2017 IEEE International Symposium on Antennas and Propagation and URSI/USNC National Radio Science Meeting

Final Program

July 9 – 14, 2017
Manchester Grand Hyatt San Diego
San Diego, California, USA
## Conference at a Glance

### Sunday, July 9
- 08:00 - 17:00: Short Courses: FD-1, FD-4, FD-6
- 08:00 - 12:00: Short Course: HD-1
- 09:00 - 10:30: Amateur Radio License Exam Session
- 13:00 - 17:00: Short Course: HD-2

### Monday, July 10
- 07:00 - 08:00: Amateur Radio Breakfast Meeting
- 07:00 - 08:00: Meeting: Standard 1502 Breakfast Meeting
- 08:00 - 11:40: Technical Sessions (Oral)
- 12:00 - 13:30: Meeting: Distinguished Lecturer Meeting and Lunch
- 12:00 - 13:30: Meeting: Transactions Associate Editors and Track Editors Lunch
- 13:20 - 17:00: Technical Sessions (Oral)
- 16:00 - 17:00: Meeting: Future Symposia Meeting
- 17:00 - 18:00: Meeting: APS 2019 Committee Meeting
- 17:00 - 18:00: Meeting: URSI Commission B Business Meeting
- 17:00 - 18:00: Meeting: URSI Commission C Business Meeting
- 17:00 - 18:00: Meeting: URSI Commission F Business Meeting
- 19:30 - 21:30: Welcome Dessert Reception

### Tuesday, July 11
- 07:00 - 08:00: Meeting: Magazine Staff Breakfast
- 08:00 - 11:40: Technical Sessions (Oral)
- 08:00 - 11:40: Student Paper Competition Presentations
- 08:00 - 08:30: Student Design Competition (Set-Up - Closed to Others)
- 08:30 - 09:30: Student Design Competition (Demo for Judges - Closed to Others)
- 09:00 - 10:00: Meeting: AP History Committee
- 09:30 - 12:00: Meeting: Student Design Competition Judges Meeting
- 10:00 - 11:00: Meeting: APS 2018 Committee Meeting
- 12:00 - 13:00: Student Design Competition (Luncheon for Judges and Teams)
- 12:00 - 13:30: Women In Engineering Lunch and Speaker
- 13:00 - 17:00: Student Design Competition (Demo for Public)
- 13:20 - 17:00: Technical Sessions (Oral)
- 16:00 - 18:00: Technical Sessions (Interactive Forum)
- 16:00 - 18:00: Interactive Forum Reception
- 18:30 - 20:30: Young Professionals’ Beach Barbecue

### Wednesday, July 12
- 07:00 - 08:00: Student Paper Judges Committee Breakfast
- 08:00 - 11:40: Technical Sessions (Oral)
- 12:00 - 13:30: Reviewers’ Lunch
- 13:00 - 14:00: Meeting: Publications Committee Meeting
- 13:20 - 17:00: Technical Sessions (Oral)
- 17:00 - 18:00: URSI Commission A Business Meeting
- 17:00 - 18:00: URSI Commission E Business Meeting
- 17:00 - 18:00: URSI Commission G Business Meeting
- 17:00 - 18:00: URSI Commission K Business Meeting
- 18:00 - 19:00: Awards Presentation
- 19:00 - 21:00: Celebratory Banquet

### Thursday, July 13
- 08:00 - 11:40: Technical Sessions (Oral)
- 12:00 - 13:00: Meeting: APS Fellows Committee Lunch
- 12:00 - 13:00: Meeting: AWPL AE Lunch
- 12:00 - 13:00: Meeting: Education Committee
- 12:00 - 13:00: Meeting: IEEE Press Liaison Lunch
- 12:00 - 14:00: Meeting: Chapter Chairs Lunch
- 12:00 - 14:00: Meeting: APS Propagation Standards Committee Lunch
- 13:20 - 17:00: Technical Sessions (Oral)
- 16:00 - 18:00: Technical Sessions (Interactive Forum)
- 16:00 - 18:00: Interactive Forum Reception
- 18:00 - 21:00: MGA, FDI and SIGHT Dinner
- 18:45 - 22:00: Dinner Sail

### Friday, July 14
- 08:00 - 11:40: Technical Sessions (Oral)
- 13:20 - 17:00: Technical Sessions (Oral)
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Chairs’ Welcome

On behalf of the Conference Organizing Committee, the Antennas and Propagation Society, and USNC-URSI, we welcome you to San Diego and the 2017 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting. This meeting is the premier international forum for the exchange of ideas on state-of-the-art research in antennas, propagation, electromagnetic engineering, and radio science. Through an exciting lineup of technical and social activities, it will provide the opportunity to interact with the world’s leading experts in antennas and propagation from academia, industry, and government.

This year’s meeting will be held at the Manchester Grand Hyatt Hotel, which is directly on the water, and minutes from downtown activities including the San Diego Zoo, Balboa Park and its numerous museums, and the Gaslamp district for dining and nightlife. San Diego is the eighth largest city in the country, and is often referred to as “America’s Finest City.” Known for its great hotels, beautiful weather, pristine beaches, friendly people and a plethora of entertainment, San Diego is a favorite destination for visitors across the globe. Our downtown airport is conveniently close to our symposium venue, so transportation to the conference will be quick and straight-forward.

We have several new features to enhance this year’s conference. In addition to the traditional technical talks, short courses, and exhibits, we will also have eight invited speakers who will present double-length talks. These distinguished experts from both academia and industry will present at the beginning of select technical sessions, allowing an in-depth discussion of timely topics chosen by our technical program committee based on emerging trends and exciting new research areas. We also offer a new format for the interactive forums, which will be presented as happy hour sessions on Tuesday and Thursday with refreshments and light snacks.

We invite you to join us on Monday at the welcome reception aboard the Midway aircraft carrier, including dessert, refreshments, and fireworks. Additional social events throughout the week include the women in engineering lunch with speaker Dr. Marta Martinez-Vázquez, and the young professionals beach blast at the Kona Kai Resort & Spa on Tuesday. We will hold the awards ceremony and celebratory dinner on Wednesday, and on Thursday we invite you to join us aboard the Hornblower Adventure for a dinner cruise, sailing the beautiful San Diego bay and enjoying the city skyline.

We hope you enjoy our exciting lineup of technical talks, short courses, and social activities, and we suggest that you consider extending your stay to enjoy the beautiful weather and the many attractions that San Diego has to offer.

Dan Sievenpiper & Gabriel Rebeiz, University of California, San Diego
## Sessions at a Glance — Monday

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<td>MO-SP.1A Additive Manufacturing in Antennas and RF Systems</td>
<td>MO-SP.1P In Memoriam of Per-Simon Kildal</td>
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<td>Grand Hall D</td>
<td>MO-SP.2A Theoretical, Methodological and Technological Advances in Electromagnetic Inverse Scattering</td>
<td>MO-SP.2P Benchmarking at the Frontiers of Computational EM</td>
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<tr>
<td>Coronado A</td>
<td>MO-A2.1A Electromagnetic Theory</td>
<td>MO-UB.1P Metamaterial Based Designs</td>
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<td>Coronado B</td>
<td>MO-A2.2A New Physics in Guiding Systems I</td>
<td>MO-A2.1P Advances in Frequency Selective Surfaces</td>
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<tr>
<td>Coronado D</td>
<td>MO-A2.3A Scattering Control through Metasurfaces and Cloaking</td>
<td>MO-A1.1P Leaky Wave Antennas</td>
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<td>MO-A1.1A Reflectarray with Novel Elements</td>
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<td>Regatta</td>
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<td>Mission Beach AB</td>
<td>MO-A3.2A Design Methodologies for Antennas</td>
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<tr>
<td>Promenade AB</td>
<td>MO-A1.3A Antenna Theory I</td>
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<td>America’s Cup CD</td>
<td>MO-A5.1A Advanced Antenna Technologies for User End</td>
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<td>Hillcrest AB</td>
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<tr>
<td>Hillcrest CD</td>
<td>MO-A5.2A Electromagnetics in Medicine and Biology</td>
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<td>Golden Hill AB</td>
<td>MO-UF.1A Propagation Based on Numerical Weather Prediction Models</td>
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<td>Torrey Hills AB</td>
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<td>MO-UB.4P EM Educational Methods and Tools</td>
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<td>Grand Hall C</td>
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<tr>
<td>Mission Beach C</td>
<td></td>
<td>TH-UB.2P 3D Printed and Planar Structures</td>
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</tbody>
</table>

### Interactive Forum — Tuesday

<table>
<thead>
<tr>
<th>Location</th>
<th>Afternoon</th>
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<tbody>
<tr>
<td>Thursday, July 13, Grand Hall C</td>
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</table>

<p>| Boards C.1-9 | TH-P.A1.4P: Planar Antennas for Mobile Applications                     |
| Boards C.11-20 | TH-P.A5.10P: Metamaterial Based mmWave Antennas                         |
| Boards C.21-24 | TH-P.A5.11P: mmWave and Subwavelength Antennas                        |
| Boards C.26-30 | TH-P.A5.12P: Wideband Antennas for High Frequency Communications       |
| Boards C.36-40 | TH-P.A5.5P: 60 GHz Radars and Communications                          |
| Boards C.41-48 | TH-P.A5.4P: 3D Printed Antennas and Structures                        |
| Boards C.51-60 | TH-P.A5.6P: Additively Manufactured Antennas                           |
| Boards C.61-68 | TH-P.A5.7P: Antennas for THz and 5G Communications                     |
| Boards C.71-80 | TH-P.A5.8P: Antennas, Applications and Relevant Issues                |
| Boards C.81-89 | TH-P.A5.9P: Arrays for mmWave Applications                            |
| Boards C.91-98 | TH-P.UA.1P: Antenna Fabrication Techniques                            |</p>
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<tr>
<th>Location</th>
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<tr>
<td>Grand Hall C</td>
<td>FR-SP.1A In-Body Devices for Wireless Biotelemetry: Implants and Ingestibles</td>
<td>FR-A4.1P Reduction of Complex Structures</td>
</tr>
<tr>
<td>Grand Hall D</td>
<td>FR-SP.2A Handset LTE Antenna Design and Challenges</td>
<td>FR-SP.1P AMTA Special Session - Advances in RF Measurement Technology</td>
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<td>Coronado A</td>
<td>FR-A2.1A Design and Analysis of Metasurfaces I</td>
<td>FR-A2.1P Metasurfaces for Antenna Applications</td>
</tr>
<tr>
<td>Coronado B</td>
<td>FR-A2.2A Metamaterial-Inspired Antennas</td>
<td>FR-A2.2P Design and Analysis of Metamaterials</td>
</tr>
<tr>
<td>Coronado D</td>
<td>FR-A5.1A Terahertz Antennas and Sources</td>
<td>FR-UB.1P Terahertz Antennas and Focal Plane Arrays</td>
</tr>
<tr>
<td>Coronado E</td>
<td>FR-A1.1A Dielectric Resonator Antennas</td>
<td>FR-A1.1P Beam Scanning Antennas and Arrays</td>
</tr>
<tr>
<td>America’s Cup AB</td>
<td>FR-A1.3A Wideband Printed Antennas</td>
<td>FR-UA.1P Microwave to Millimeter Measurements and Standards</td>
</tr>
<tr>
<td>Regatta</td>
<td>FR-UB.1A Time Domain Methods</td>
<td>FR-UB.2P Advanced Concepts in Metamaterials</td>
</tr>
<tr>
<td>America’s Cup CD</td>
<td>FR-A5.2A On-chip Antennas</td>
<td>FR-A5.1P Wireless Power Transfer and Energy Harvesting</td>
</tr>
<tr>
<td>Hillcrest AB</td>
<td>FR-A4.1A Propagation in Complex Environments</td>
<td>FR-UB.4P Propagation Phenomena and Scattering of EM Waves</td>
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<tr>
<td>Hillcrest CD</td>
<td>FR-A4.2A Scattering and Diffraction</td>
<td>FR-A3.1P High Frequency and Asymptotic Methods</td>
</tr>
<tr>
<td>Golden Hill AB</td>
<td>FR-UB.4A Electromagnetic Interaction, Propagation and Scattering</td>
<td>FR-A4.3A Millimeter Wave Propagation</td>
</tr>
<tr>
<td>Torrey Hills AB</td>
<td>FR-A5.3A MIMO System Applications</td>
<td>FR-UB.6P MIMO Antennas and Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR-UB.7P Microwave Imaging</td>
</tr>
</tbody>
</table>
Registration

The on-site Registration Desk is located at the Third Floor Landing, adjacent to the escalator and close to the Seaport Tower. 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 9 .................07:00 - 17:00
- Monday, July 10 .............07:00 - 17:00 (Badge pick-up only: 17:00 - 20:00)
- Tuesday, July 11 .............07:00 - 17:00
- Wednesday, July 12 .........07:30 - 17:00
- Thursday, July 13 ..........07:30 - 17:00
- Friday, July 14 ..............07:30 - 17:00

Devotions

The Pier Room on the Third Level of the Harbor Tower is available for devotions from 07:00 - 17:00 Sunday, July 9 through Friday, July 14.

Speaker Preparation Room

The Cove Room on the Third Level of the Harbor Tower is the Speaker Preparation Room and is available from 07:00 - 17:00 daily Sunday, July 9 - Friday, July 14. The room contains a computer identical to those used in the presentation rooms. The speakers may use his room and equipment to test presentations prior to the scheduled presentation.

Internet Access

Wireless internet access (WiFi) is provided to all participants throughout the meeting space and lobby areas at the Manchester Grand Hyatt. Attendees can connect to the IEEE network. The access password is APSURSI17.

If you are staying at the Hyatt, 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 that on Monday, July 10, morning and afternoon breaks (at 09:40 and 15:00 respectively) will be held in the Foyer Areas on the Fourth Level of the hotel – Coronado, Regatta and America’s Cup.

Tuesday through Friday, July 11-14, the breaks will be held in Grand Halls ABC, which are located on the Lobby Level. Grand Hall B is the Exhibit Hall.
Meeting and Event Schedule

Sunday, July 9
09:00 - 10:30 Amateur Radio License Exam Session................................................................. Mission AB

Monday, July 10
07:00 - 08:00 Amateur Radio Breakfast Meeting................................................................. Bayview Room
07:00 - 08:00 Standard 1502 Breakfast Meeting................................................................. Ocean Beach
10:00 - 11:00 APS 2019 Committee Meeting........................................................................ Ocean Beach
12:00 - 13:30 Distinguished Lecturer Meeting and Lunch................................................... Ocean Beach
12:00 - 13:30 Transactions Associate Editors and Track Editors Lunch................................. Bayview Room
16:00 - 17:00 Future Symposia Meeting............................................................................... Bayview Room
17:00 - 18:00 URSI Commission B Business Meeting........................................................... Regatta
17:00 - 18:00 URSI Commission C Business Meeting.......................................................... America's Cup AB
17:00 - 18:00 URSI Commission F Business Meeting........................................................... America's Cup CD
19:30 - 21:30 Welcome Dessert Reception............................................................................. The Midway

Tuesday, July 11
07:00 - 08:00 Magazine Staff Breakfast.................................................................................. Ocean Beach
08:00 - 11:40 Student Paper Competition Presentations......................................................... Coronado Foyer
08:00 - 08:30 Student Design Competition [Set-Up - Closed to Others].................................. Coronado Foyer
08:30 - 09:30 Student Design Competition [Demo for Judges - Closed to Others]................ Coronado Foyer
09:30 - 12:00 Student Design Competition [Demo for Public]................................................ Coronado Foyer
09:30 - 12:00 Student Design Competition Judges Meeting.................................................. Cortez Hill A
10:00 - 11:00 APS 2018 Committee Meeting........................................................................ Cortez Hill A
12:00 - 13:00 Student Design Competition [Luncheon for Judges and Teams]...................... Cortez Hill A
12:00 - 13:30 Women In Engineering Lunch and Speaker....................................................... Bayview Room
13:00 - 17:00 Student Design Competition [Demo for Public]................................................ Coronado Foyer
17:30 - 20:30 Young Professionals’ Beach Barbecue............................................................... Kona Kai Resort & Marina

Wednesday, July 12
07:00 - 08:00 Student Paper Judges Committee Breakfast..................................................... Ocean Beach
12:00 - 13:30 Reviewers’ Lunch........................................................................................... Grand Hall D
13:00 - 14:00 Publications Committee Meeting....................................................................... Grand Hall D
17:00 - 18:00 URSI Commission A Business Meeting.......................................................... Torrey Hills
17:00 - 18:00 URSI Commission E Business Meeting.......................................................... Golden Hill
17:00 - 18:00 URSI Commission G Business Meeting.......................................................... Hillcrest AB
17:00 - 18:00 URSI Commission K Business Meeting.......................................................... Hillcrest CD
18:00 - 19:00 Awards Presentation......................................................................................... Grand Hall C
19:00 - 21:00 Celebratory Banquet........................................................................................ Grand Hall D

Thursday, July 13
12:00 - 13:00 APS Fellows Committee Lunch....................................................................... Bankers Hill
12:00 - 14:00 APS Propagation Standards Committee Lunch................................................ Cortez Hill A
12:00 - 13:00 AWPL AE Lunch............................................................................................ Cortez Hill C
12:00 - 14:00 Chapter Chairs Lunch.................................................................................... Ocean Beach
12:00 - 13:00 Education Committee..................................................................................... Boardwalk
12:00 - 13:00 IEEE Press Liaison Lunch.............................................................................. Cortez Hill B
18:00 - 21:00 MGA, FDI and SIGHT Dinner......................................................................... Boardwalk
18:45 - 22:00 Dinner Sail..................................................................................................... The Marina at the San Diego Marriott Marquis
**Short Courses**

**FD-1 - Multibeam Antennas and Beamforming Networks**

Giovanni Toso, Piero Angeletti

Sunday, July 9, 08:00 - 17:00

Location: Hillcrest A

Multibeam Antennas are becoming more and more important in different applications requiring high performances, flexibility and reconfigurability. In particular, the topic is of interest not only for Space Applications but also for Radar Systems and Mobile Communications (including emerging MIMO for 5G). The course has been previously proposed during EUCAP and IEEE conferences with excellent participation and feedbacks. The course content is updated regularly by the two co-authors who are deeply involved since twenty years in this field.

The objective of this course consists in presenting the state of the art and the on-going developments in Multi-Beam Antennas (MBAs) and Beam-Forming Networks (BFNs). MBAs find application in several fields including communications, remote sensing (e.g. radars, radiometers, etc.), electronic surveillance and defense systems, science (e.g. multibeam radio telescopes), RF navigation systems, etc. The BFN plays an essential role in any antenna system relaying on a set of radiating elements to generate a beam. The course will cover both theoretical and practical aspects for the following topics:

**FD-4 - Base station antennas for 5G – System aspects and design**

Claes Beckman

Sunday, July 9, 08:00 - 17:00

Location: Hillcrest B

This short course gives the participants an overview of the application, implementation and design of current and future base station antennas for mobile communications from 1G to 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.

**FD-6 - Reflector Antenna Design and Analysis**

Peter Meincke

Sunday, July 9, 08:00 - 17:00

Location: Hillcrest C

The course gives an introduction to the design and analysis of single and dual reflector antennas, center-fed as well as offset. After a review of the analysis methods commonly employed for space- and Earth-station reflector antennas, the basic design principles are presented. First, single and dual spot-beam antennas are considered with the relation between size, feed illumination, directivity, and sidelobe level. Second, the influence of blockage by struts, subreflector, and feed is discussed. Third, the origin of cross polarization in offset designs is addressed and it is shown how to improve the polarization characteristics in dual reflector systems by employing the Mizuguchi compensation principle. Hands-on experience in reflector antenna design is obtained during the course by using the software package GRASP (participants must bring their own laptop).
**HALF DAY (MORNING)**

**HD-1 - Reflectarray Antennas: Theory, Designs, and Applications**

Payam Nayeri, Fan Tang, Atef Elsherbeni  
Sunday, July 9, 08:00 - 12:00  
Location: Golden A

This course will be presented in two parts. In the first part, the history of reflectarray antenna development is first reviewed and then basic theories for analysis and design of reflectarray antennas are presented in detail. This section of the course builds the fundamental knowledge one needs to have in order to understand the governing dynamics of a reflectarray antenna system, and efficiently design and analyze reflectarray antennas. The second part of the course is intended for researchers that have a good knowledge of the basic theories in reflectarray, and aim at designing reflectarray antennas for specific applications/operations. This part starts with a discussion on bandwidth limitation and solutions for broadband designs, and afterwards several advanced application oriented topics in reflectarray antennas will be presented.

**HALF DAY (AFTERNOON)**

**HD-2 - Surface Electromagnetics in Antenna Engineering: From EBG to Meta-surface and Beyond**

Yahya Rahmat-Samii, Fan Yang  
Sunday, July 9, 13:00 - 17:00  
Location: Golden A
Social Events

Amateur Radio Breakfast Meeting
The Amateur Radio Breakfast Meeting is open to all conference participants who hold an amateur radio call sign, but pre-registration is required and your call sign is requested. The intent of the gathering is to gather support for AP-S student, outreach, SIGHT and educational activities involving amateur radio.
Date: Monday, July 10
Time: 07:00 - 08:00
Location: Bayview Room, 32nd Floor, Seaport Tower
Fee: Complimentary, but advance registration is required. An amateur radio license is required for attendance.
Additional Information on Amateur Radio activities at AP-S/URSI 2017 are listed on the following pages.

Welcome Reception Aboard the USS Midway
The Steering Committee has chosen a spectacular venue for the APS 2017 Welcome Reception... USS Midway, one of America’s longest serving aircraft carriers. Just minutes away from the Manchester Grand Hyatt, the Midway sits as a majestic and historic reminder of one of the most challenging periods of time in United States history.
Please note that the reception begins at 19:30 and is a Dessert Reception. This timing allows you the flexibility of enjoying one of San Diego’s many [and varied] local restaurants: http://www.sandiegorestaurants.com/
For more information about this special venue, please visit their site - http://www.midway.org/
Date: Monday, July 10
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 USS Midway. Note, too, that there will be docent tours available and The Battle of Midway Theatre will run its movie, “Battle of Midway,” throughout the evening.
Transportation: The USS Midway is a 10-minute walk from the Manchester Grand Hyatt. There will be symposium guides along the route to assist in directing you. For guests requiring transportation, there will be limited shuttle service between the hotel and the venue.
Fee: Complimentary for AP-S 2017 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, Dr. Marta Martinez-Vázquez, as she shares with you her experience during her featured presentation “Mom Talk - An Engineer’s Bedside Story.” 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 11
Location: Manchester Grand Hyatt San Diego, Bayview Room, 32nd Floor, Seaport Tower
Fee: Advance registration is required, and there is a $20.00 fee for the two course, plated lunch.

Young Professionals’ Beach Blast at the Kona Kai Resort & Spa
The Young Professionals’ Beach Blast is open to all Graduates of the Last Decade (GOLD). Enjoy beach games (beach volleyball, corn hole and ladder ball, to name a few), live music, sitting by one of their fire pits and a barbecue buffet dinner. A limited number of passes will be available for use of the hotel’s pool.
Date: Tuesday, July 11
Time: This event begins at 18:30, with motorcoach shuttles leaving from the Manchester Grand Hyatt San Diego beginning at 18:00.
Location: Kona Kai Resort & Spa - http://www.resortkonakai.com
Fee: Advance registration is required. Complimentary for GOLD attendees; $25.00 for advisors.

Reviewers’ Lunch
The Reviewers’ Lunch is open to all reviewers of the last year for the APS Transactions and Journals.
Date: Wednesday, July 12
Time: 12:00 - 13:20
Location: Grand Hall D, Lobby Level
Fee: Complimentary for all registered attendees who participated in the APS Transactions and Journals review process during the last year. Advance registration is required.

Awards Presentation
Please join the Antennas and Propagation Society’s Awards Committee, as they honor the distinguished accomplishments of the society’s professional community, including recognition of the 2017 IEEE AP-S Fellows. NOTE the format, introduced during the 2016 event, as the awards will be presented during a special evening session at the Manchester Grand Hyatt San Diego, 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 12  
Time: 18:00 - 19:00  
Location: Grand Hall C, Lobby Level  
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 Grand Hall D at the Manchester Grand Hyatt San Diego, and it is open to all conference registrants and their guests, but requires a separate ticket purchase. A three-course plated dinner and wine will be served.

Date: Wednesday, July 12  
Time: Doors open for dinner at 19:00  
Location: Grand Hall D, Lobby Level  
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.

Dinner Sail Aboard the Hornblower Adventure

The Hornblower Adventure sets sail on Wednesday, July 12 from the Marina located at the San Diego Marriott Marquis, just steps away from the Manchester Grand Hyatt San Diego. Enjoy a buffet dinner, while taking advantage of magnificent views of the San Diego skyline either from their extensive sun deck or through the panoramic windows in the dining salons. Both alcoholic and non-alcoholic beverages will be available onboard for purchase.

Date: Thursday, July 13  
Time: Boarding time is 18:45, and the boat will sail promptly at 19:00.  
Location: The Marina at the San Diego Marriott Marquis. Specific slip location to be advised.  
Fee: $100.00 for adults and children 12 and older; $53.00 for children 4-11 years. There is no charge for children under 3 years.

Daily Tours with the Companion Program

Monday - Friday, July 10-14

Check the conference website to see the extensive offering of Companion Program tours, also available to symposium registrants. Note throughout that some of the tours have registration via the symposium site, and for others, attendees are asked to register directly through the tour operator.

Companion Program

Companion Program hosts Sue Stone, Joy Rockway, Judy Long and Joanne Wilton will be onsite in the Companion Suite to welcome registered companions for breakfast each morning. Please note that you must be a registered companion to enjoy morning breakfast in the Marina Room, located immediately adjacent to the Marina and Sally’s Restaurant, both located at the back of the Manchester Grand Hyatt San Diego.

For additional information or any questions, please contact either of the co-chairs via e-mail:
Sue Stone - suelstone@hotmail.com or  
Joy Rockway - rockway4@gmail.com.
At the AP-S/URSI 2015 symposium in Vancouver, we began to encourage Radio Amateurs to display their callsign on their conference badges and we held the first-ever Amateur Radio breakfast meeting. Given the very favourable response, we continued these initiatives in Puerto Rico in 2016. Our second Amateur Radio breakfast meeting attracted even more attendees and formal expressions of support from the Education and SIGHT committees.

Welcome to San Diego in 2017, and further expansion of this special interest group.

ARRL will be publishing stories about our Amateur Radio activities at IEEE AP-S/URSI 2017. These activities will include:

**FCC Amateur Radio License Exam Session - Sunday, July 9**

Volunteer Examiners from San Diego will be onsite to administer FCC Amateur Radio License Exams to registered attendees of the 2017 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 valuable 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-systems.

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.

**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 AP-S student, outreach, SIGHT and educational activities involving amateur radio.

**Amateur Radio special event station N6P - Tuesday, July 12 - Thursday, July 14**

Amateur Radio special event station N6P will be set up at the Amateur Radio booth in the commercial exhibits area, booth 3. Please drop by and see the station in operation!

Other Amateur Radio demonstrations will be held throughout the week in and around the conference venue.

For more information, please contact Dave Michelson, VE7TSX: davem@ece.ubc.ca or Bob Paknys, VE2JBP: robert.paknys@concordia.ca.
FEKO for Integrated Antenna Design

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Weng Cho Chew
For contributions to electromagnetic solutions of complex multiphysics problems and inverse scattering methods

Ulrich L. Rohde
For pioneering work and contribution to the field of Antennas and Propagation, leading to development of wireless communication systems for industrial, military and space applications

Yahia M. M. Antar
For dedicating his professional career to the education and training of highly qualified personnel

Kwai-Man Luk
For contributions to the invention of the L-probe fed patch antenna and the magneto-electric dipole antenna for wireless communications

Francesca Vipiana
For contributions to computational electromagnetics, and in particular to the analysis of multi-scale problems

Jian-Ming Jin
For outstanding contributions to the research and development of the finite element method for computational electromagnetics


D. J. Bisharat, S. Liao, and Q. Xue

L. Liang and S. Victor Hum

Edward E. Altschuler AP-S Magazine Prize Paper Award

Nader Behdad
Filiberto Bilotti
Debatosh Guha
Mahbub Hoque
Ronghong Jin
Kenichi Kagoshima
Cyril Luxey
Marta Martinez-Vazquez
Charles Rhoads
Zhongxiang Shen
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**URSI B - Fields and Waves**  
Commission Chair: John L. Volakis

**URSI C - Radio Communication and Signal Processing Systems**  
Commission Chair: Greg Huff

**URSI E - Electromagnetic Environment and Interference**  
Commission Chair: Charles Baylis

**URSI F - Wave Propagation and Remote Sensing**  
Commission Chair: Michael Newkirk

**URSI G - Ionospheric Radio and Propagation**  
Commission Chair: Sigrid Close

**URSI K - Electromagnetics in Biology and Medicine**  
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Special Sessions

MO-SP.1A: Additive Manufacturing in Antennas and RF Systems
Organizers: Frederic Gianesello, Cyril Luxey and Yiannis Vardaxoglou

MO-SP.2A: Theoretical, Methodological and Technological Advances in Electromagnetic Inverse Scattering
Organizers: Danilo Erricolo, Giacomo Oliveri, Aria Abubakar

MO-SP.1P: In Memoriam of Per-Simon Kildal
Organizers: Stefano Maci, Eva Rajo and Ahmed Kishk

MO-SP.2P: Benchmarking at the Frontiers of Computational EM
Organizer: Ali Yilmaz

TU-SP.1A: Physical Reconfiguration through Advances In Programmable Materials and Adaptive Mechanics
Organizers: Gregory Huff, Christos Christodoulou, Philip Buskohl and Derek Doyle

TU-SP.2A: Compressive Sensing as Applied to Electromagnetics - Advances, New Trends and Applications
Organizers: Mahta Moghaddam, Andrea Massa and Donald Migliore

TU-SP.1P: History of APS: Early Legends of the Field
Organizer: Stuart Long

TU-SP.2P: Advancement of Metasurfaces and Lenses for Beyond 4G and 5G
Organizers: Jungsuek Oh, Seungtae Ko and Nader Behdad

TU-SP.3P: Higher Symmetries for Flat Meta-lenses
Organizers: Guido Valerio and Oscar Quevedo-Teruel

WE-SP.1A: Emerging Techniques in Imaging at Microwave, mmWave and THz Frequencies
Organizers: Okan Yurduseven, David Smith, Jonah Gollub, Mohamad Imani and Thomas Fromenteze

WE-SP.2A: Automotive Antennas
Organizers: Hyok Song and Timothy Taltry

WE-SP.1P: Loaded Antennas for Next Generation Radar and Antennas
Organizers: Bart Smolders, Diego Caratelli and Ronis Maximidis

WE-SP.2P: Innovative Phased Arrays and Beamforming Technology
Organizers: Paolo Rocca, Robert Mailloux and Jeffrey Herd

TH-SP.1A: Applications of Electromagnetics and RF Techniques in Medicine and Biology
Organizers: Gianluca Lazzi and Jung-Chih Chaio

TH-SP.2A: 3D Printed Antennas and Components
Organizers: Guan-Long Huang and Chow-Yen-Desmond Sim

TH-SP.1P: Wideband Phased Arrays for 5G Wireless and Beyond
Organizers: Johnson J. H. Wang and Andrew Peterson

TH-SP.2P: Modern Longwave Antennas
Organizer: Walter Wall

FR-SP.1A: In-Body Devices for Wireless Biotelemetry: Implants and Ingestibles
Organizers: Asimini Kiourtu and Raed Shubair

FR-SP.2A: Handset LTE Antenna Design and Challenges
Organizer: Hongwei Liu

FR-SP.1P: AMTA Special Session - Advances in RF Measurement Technology
Organizer: Ivan LaHaie

FR-SP.2P: International Standards Development and Applications
Organizer: Vikass Monebhurrun
Presentations for finalists will be in the Coronado Foyer on Tuesday, July 11, 08:00–11:40.

**Finalists**

A Dual-Polarized Dual-Mode Annular Ring Microstrip Antenna for GPS Interference Suppression  
Navid Rezazadeh, Lotfollah Shafai, University of Manitoba, Canada

A Novel Feeding Structure for Second Higher Order Mode Excitation of Microstrip Leaky-Wave Antenna  
Pengfei Zhang, Sheng Sun, University of Electronic Science and Technology of China, China

Analysis of a Helmet-Based FMCW Radar for Impact Prediction  
Hossein Mehrpour Bernety, David Schurig, University of Utah, United States

Antenna Probes for Power Reception from Deep Tissues for Wearable Microwave Thermometry  
Parisa Momenroodaki, University of Colorado Boulder, United States; Mojtaba Fallahpour, Stanford University, United States; Zoya Popovic, University of Colorado Boulder, United States

Design of a C-band Beam-scanning Reflectarray Antenna for Satellite Communications  
Xiangfei Xu, Fan Yang, Shenhong Xu, Tsinghua University, Beijing, China

Diplexer Integration Into a Ka-Band High-Gain Gap Waveguide Corporate-Fed Slot Array Antenna  
Abbas Vosoogh, Chalmers University, Sweden; Milad Sharif Sorkherizi, Concordia University, Canada; Ashraf Uz Zaman, Jian Yang, Chalmers University, Sweden; Ahmed A. Kishk, Concordia University, Canada

Flexible RF Coil Array System Utilizing Electro-textiles for 3T MRI Carotid Artery Imaging  
Daisong Zhang, Yaha Rahmat-Samii, University of California, Los Angeles, United States

High-resolution Polarimetric THz Imaging for Biomedical Applications  
Nandhini Srinivasan, Cosan Caglayan, Niru Nahar, Kubilay Sertel, The Ohio State University, United States

Invisible Near-Field Probes at Infrared Frequencies based on Impedance Engineering at the Nanoscale  
Aobo Chen, Cornell University, United States; Andrea Alu, University of Texas at Austin, United States; Francesco Monticone, Cornell University, United States

Millimeter-Wave Conformal Antenna Array for 5G Wireless Applications  
Syeda Fizzah Jilani, Akram Alomainy, Queen Mary University of London, United Kingdom

Range-Dependent Evaporation Duct Height Estimation from a Versatile Ship-Mounted X-band Receiving Array  
Qi Wang, Robert Burkholder, Caglar Yardim, The Ohio State University, United States

Ray-Based Reconstruction Algorithm for Multi-Monostatic Radar in Imaging Systems  
Kurt Jaisle, Carey Rappaport, Northeastern University, United States

Single-bit Compressive Imaging System for the mmW and THz Bands  
Syed An Nazmus Saqueb, Kubilay Sertel, The Ohio State University, United States

**Honorable Mentions**

“Phasenna” based on a Metasurface System  
Guillaume Lavigne, Christophe Caloz, Polytechnique Montréal, Canada

A Self-Powered Harmonic Sensor Based on Simple Graphene Circuit and Hybrid-Fed Antenna  
Mehdi Hajizadeh, Pai-Yen Chen, Wayne State University, United States

A Single-Source Surface Integral Equation Formulation for Composite Dielectric Objects  
Utkarsh Patel, Piero Triverio, Sean Hum, University of Toronto, Canada

All Directions Through the Wall Imaging Using Omnidirectional Bi-static FMCW Transceivers  
Behzad Yektakbah, Kamal Sarabandi, University of Michigan, United States

An Accurate Combined Source Integral Equation for Perfect Electrically Conducting Bodies  
Jonas Kornprobst, Thomas F. Eibert, Technical University of Munich, Germany

An Explicit MOT Scheme for Solving the TD-EFVIE on Nonlinear and Dispersive Scatterers  
Sadeed Bin Sayed, King Abdullah University of Science and Technology (KAUST), Saudi Arabia; Hüseyin Arda Ülkü, Gebze Technical University, Turkey; Hakan Bagci, King Abdullah University of Science and Technology (KAUST), Saudi Arabia
Circuit-Board Edge-Mount Dual-Polarized Millimeter-Wave Antenna
Zunnurain Ahmad, Jan Hesselbarth, University of Stuttgart, Germany

Circularly Polarized PIFA Array for Simultaneous Transmit and Receive Applications
Andrew Kee, Dejan Filipovic, Mohamed Elmansouri, University of Colorado Boulder, United States

Design of Zero-Phase-Shift-Line (ZPSL) Loop Antennas Using Full Dispersion Characteristics
Yunjia Zeng, Institute for Infocomm Research, Singapore; Zhi Ning Chen, National University of Singapore, Singapore; Xianming Qing, Institute for Infocomm Research, Singapore; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

Dual-Band Broadside Slot Array with Corporate-Series-Feed Based on CRLH Microstrip Line
Jen-Kuei Tsai, Shih-Yuan Chen, National Taiwan University, Taiwan

High-Efficiency Microwave Graphene Antenna
Shengjian Jammy Chen, Christophe Fumeaux, Tran Thanh Tung, Dusan Losic, The University of Adelaide, Australia

Improved Design of a Low Sidelobe Pyramidal Horn Antenna Loaded with a Metasurface Lens
Xuixiang Chen, Yuehe Ge, Huaqiao University, China; Trevor Bird, Antengenuity, Australia

Multifunctional Metasurfaces Nanoantennas by Gate-Tunable Materials
Ali Forouzmand, Hossein Mosallaei, Northeastern University, United States

Multi-linear polarization reconfigurable center-fed circular patch antenna with shorting posts
Shu-Lin Chen, Pei-Yuan Qin, Jay Guo, University of Technology Sydney, Australia

Novel 3D-Printing Enabled Antenna Design for Future Wireless Intra-chip Interconnect
Junqiang Wu, Hao Xin, University of Arizona, United States

Novel Technique for Enhancing RCS Reduction Bandwidth of Checkerboard Surfaces
Anuj Y. Modi, Constantine A. Balanis, Craig R. Birtcher, Arizona State University, United States

Plasmonic Nano-Antenna Arrays for High-Sensitivity and Broadband Terahertz Detection
Nezih Tolga Yardimci, University of California - Los Angeles, United States; Mona Jarrahi, University of California, Los Angeles, United States

Printed High Gain End-fire Beam-Steerable Yagi Antenna
Parisa Lofti Poshtgol, Saber Soltani, Ross Murch, Hong Kong University of Science And Technology, Hong Kong SAR of China

Quantitative Statistical Analysis with Physics-based Surrogate Modeling for Wave Chaotic Systems
Shen Lin, Zhen Peng, University of New Mexico, United States; Thomas Antonsen, University of Maryland, United States

Scattering in Superluminal Space-time (ST) Modulated Electromagnetic Crystals
Zoé-Lise Deck-Léger, Christophe Caloz, Polytechnique Montréal, Canada

Scattering properties of parity-time symmetric nanoparticle dimers
Robert Duggan, Mohammad-Ali Miri, Andrea Alù, University of Texas at Austin, United States

Subwavelength Metamaterial-Lined Apertures as Far-Field Imaging Devices
Elham Baladi, Ashwin K. Iyer, University of Alberta, Canada

Systematic Design of Single-Layer Multi-Stop-Band Frequency Selective Surfaces
Gengyu Xu, Sean Hum, George Eleftheriades, University of Toronto, Canada

Ultrasensitive Telemetric Sensor Based on Adapted Parity-Time Symmetry
Maryam Sakhdari, Pai-Yen Chen, Wayne State University, United States

Warpage-free Antenna for Smart Contact Lens
Luyao Chen, George Shaker, Safieddin Safavi-Naeini, University of Waterloo, Canada

Wide Bandwidth Cavity-Backed Dual-Polarized Vivaldi Array Antenna
Elie Tianang, Dejan Filipovic, Mohamed Elmansouri, University of Colorado, Boulder, United States

Axial Mode-Matching Technique for Analysis of Directional Well-Logging Sensor Tools
Guilherme S. Rosa, José R. Bergmann, Pontifical Catholic University of Rio de Janeiro, Brazil; Fernando L. Teixeira, The Ohio State University, United States

Circularly-Polarized Antenna Array for Beam Steering
Bernardo Moscardiní Fabiani, Daniel Chagas do Nascimento, Technological Institute of Aeronautics, Brazil
Student Design Contest

The annual IEEE Antennas and Propagation Society (AP-S) Student Design Contest continues to be a popular event each year. This year, there were 30 entries from a diverse set of countries from IEEE regions around the world, including North America (United States and Canada), Europe (Italy, Spain, Sweden, Finland), Asia (China, Taiwan, India, Taiwan, Japan, and Malaysia), the Middle East (Turkey, Iran, and Egypt), and Latin America (Brazil).

This year’s topic was designing antennas for cubesats. The goal was to design and build a cubesat antenna for enabling high-performance communications with a ground station. Each team prepared a proposal for the Contest that was evaluated by a college of reviewers to narrow the field to six finalist teams. Each finalist team had just over four months to build their proposed antenna systems with a budget of US $1,500, as well as to write a detailed technical paper and make a YouTube video demonstration. The finalists (in random order) are:

1) GRID, from KTH Royal Institute of Technology
   Project title: A Transparent Dual-Band Cubesat Antenna Based on Stacked Patches
   Members: Fernando Franzen, Harald Hultin and Jonas Olsson
   Mentors: Oscar Quevedo-Teruel, Mykola Nickolay Ivchenko, Fatemeh Ghasemifard
   YouTube video: https://youtu.be/9nnyY0Rrvrc

2) University of Alabama
   Project title: Archimedean Spiral Antenna with a Conical Perturbation for a 3U CubeSat
   Members: Katelyn Isbell, Peyton Morris, Cristion Oliphant-Jerry, Nikolaus Lhurs, Woncheol Lee
   Mentor: Yang-Ki Hong
   YouTube video: https://youtu.be/ES6CVY68Dno

3) Michigan State University
   Project title: Genetic Algorithm-Designed Conical Helix Antenna for Wideband Communications
   Members: John Doroshewitz, Ethan Gros, Sean Ellison, Vincens Gjokaj
   Mentor: Jeffrey Nanzer
   YouTube video: https://www.youtube.com/watch?v=Al-yFeqL7sw

4) Missouri University of Science and Technology
   Members: Matthew Dvorsky, Michael Sharif, Ali Foudazi, Atieh Talebzadeh
   Mentor: Mohammad T. Ghasr
   YouTube video: http://www.youtube.com/watch?v=LkVYxcUr0vQ

5) Polarization Bears, from the Colorado School of Mines
   Members: Robert Jones, Joseph Diener
   Project title: Ku-band Isoflux Phased Array Design
   Mentor: Atef Z. Elsherbeni
   YouTube video: https://www.youtube.com/watch?v=ZJJbFUA7PXQ

6) University of Alberta
   Project title: Solar Panel Integrated Cubesat Antenna
   Members: John Grey, Thomas Jones
   Mentor: Mojgan Daneshmand
   YouTube video: https://youtu.be/iU6eM7ozXQs

The submitted reports and YouTube videos were evaluated based on the criteria of creativity, justification of achieved link performance, completeness of the description in the report, functionality of the system as determined by the video, and quality of written materials.

Each finalist team will receive stipends of up to US $2,500 for team representative(s) to attend this Symposium and demonstrate their working designs. Based on the on-site demo and the finalist evaluation results, the first-, second-, and third-prize winners will be selected to receive cash prizes of US $1,500, $750 and $250, respectively. The winners will be announced at the Symposium’s Awards Presentation. In addition, the finalist teams may be invited to submit their final reports for publication in the IEEE Antennas and Propagation Magazine, under the Education Column. I highly encourage attendees of the conference to check out the demonstrations in person:

Date: Tuesday, July 11, 2017
Time: 09:30-12:00; 13:00–17:00
Location: Coronado Foyer

Many thanks are due to those who have worked hard to provide careful evaluation of the entries. In particular, I would like to acknowledge the evaluators and judges for the finalists:

Jacob Adams [North Carolina State University, USA], Dimitris
Anagnostou (Heriot-Watt University, UK), Marco Antoniades (University of Cyprus), Jorge Costa (University Institute of Lisbon, Portugal), Maria Garcia Vigueras (INSA de Rennes, France), and Albert Lysko (Council for Scientific and Industrial Research, South Africa). My thanks also go to the IEEE AP-S Education Committee, whose members evaluated the preliminary designs. I also acknowledge the help and support of Karl Warnick and David Kelley, the co-chairs of the AP-S Education Committee.

Sean Victor Hum
IEEE AP-S Student Design Contest Coordinator
University of Toronto, Canada
sean.hum@utoronto.ca

Patrons

AP-S/URSI 2017 is pleased to welcome our Gold patrons: Altair, Huawei and Qualcomm, and Silver patrons: IMST, MVG and NSI-MI. Thank you for your support of AP-S/URSI 2017!

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

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Exhibitors

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**Exhibition Location and Hours**

Exhibits are located in Grand Hall B on the Lobby level of the Manchester Grand Hyatt San Diego, and are open to all attendees according to the following schedule:

- Tuesday, July 11.....................09:00–18:00
- Wednesday, July 12.............09:00–18:00
- Thursday, July 13...............09:00–18:00
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https://americas.kyocera.com/kai-semiparts/

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http://www.emcs.org

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http://www.mtt.org

IMST GmbH

IMST GmbH 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 the publicly sponsored research sector. The new 3D EM solver EMPIRE XPU 7.6 will be presented which covers nearly all today’s design challenges for RF designers, like antennas, passive circuits, packages, waveguides or EMC/EMI problems. Due to its efficient implementation it is possible to model large scale problems with up to, e.g. 1000 million FDTD Cells using EMPIRE XPU on a 24 GByte PC* with a performance of up to 14000 MCells/s. A new 3D design mode allows easy and intuitive 3D modeling. Please visit our booth No. 37 and have a discussion with our experts.

http://www.imst.de

Kyocera International Inc.

Kyocera International, Inc., Semiconductor Components Group (KII-SCG), formerly known as Kyocera America, has been manufacturing ceramic packages in San Diego, CA since 1971. KII-SCG offers electronic packages and complex modules for the vast majority of semiconductor devices including RF, mmW, EO / silicon photonics, FPGAs / ASICs, power semiconductor (GaAs, SiC), and MEMS. Applications include high-rel, phased array radar, automotive, DNA sequencing / bio-sensors, space, medical equipment, undersea cable, and telecom / datacom. Packages manufactured in San Diego are available in HTCC, LTCC-Au, LTCC-Cu, post-fired Al2O3, and BeO. Packages and modules are available with brazed metal heat sinks and high-frequency connectors such as GPPO, G3PO, etc, and seal rings for hermetic sealing with Kyocera metal or ceramic lids. KII-SCG has advanced package engineering and design capability, which includes electrical (analog, high-speed digital), thermo-mechanical, interconnect / filter / transitions library, modeling / simulation and CFD. KII-SCG Assembly Technology Division accepts prototype to volume production orders for flip chip, wirebond, wafer dicing and vacuum soldering. Additional Kyocera products and services available through KII-SCG in San Diego are high-density PCBs, organic packages, assembly materials (epoxies, Ag sinter, resins), wafer bumping, column grid array (CGA), and electrolytic / electroless metal plating.

https://americas.kyocera.com/kai-semiparts/

MiCIAN

MICIAN design software has been instrumental in the success of space missions ranging from commercial C-band TV broadcast to Terahertz scientific research. Our pWave Wizard™ hybrid EM solver is known for fast yet accurate simulation and optimization of passive microwave systems, feed networks and antennas. Please stop by and let us demonstrate our synthesis tools for horn and reflector antennas, complemented by design tools for feed clusters, OMTs, polarizers, filters, multiplexers, couplers, tapers and more. Our latest release offers 3D drafting capability for modeling complex components. An integrated COM/VBA interface allows for external control and third party add-ons.

http://www.mician.com

MVG (Microwave Vision Group)

MVG (Microwave Vision Group) is an industry leader in antenna measurements and EMC testing solutions. Our broad product portfolio offers full turnkey systems with speed, accuracy, multiple techniques and geometry capabilities. Our systems can be tailored to your industry specific testing requirements. Ask us about our 5G testing capabilities!

http://www.mvg-world.com
MI\-Mi\-NET

WASP-\NET

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.

http://www.nsi-mi.com

PPG Aerospace / Cuming Microwave Corp

Cuming Microwave, now part of PPG, is a worldwide leader in the design, construction and installation of RF anechoic chambers. Since 1980, we have been providing solutions for the most demanding requirements for EMC, antenna, RCS and PIM chambers. We manufacture CRA\AM\®, advanced RF absorbing materials for a variety of military and commercial applications, including consumer electronics, telecom, military & aerospace electronics, automotive and medical. Cuming Microwave is ISO9001 and AS9100 certified.

www.cumingmicrowave.com  cmcsales@ppg.com

http://www.ppg.com

Qualcomm, Inc.

http://qualcomm.com

REMC\ON INC

Now! Remcom now offers a unique ray tracing capability for simulating MIMO antennas for 5G, WiFi, and other applications relevant to today’s rapidly advancing technologies. Wireless InSite MIMO predicts accurate path data between each transmitting and receiving element with precision and reveals key channel characteristics in a timely manner. With optimizations that minimize runtime and memory constraints, Wireless InSite efficiently simulates even large Massive MIMO arrays. Visit Remcom’s booth for a demonstration. Remcom’s Electromagnetic Simulation Software simplifies the analysis of complex EM problems and leads the market in FDTD-based modeling and simulation. Applications include antenna design and antenna placement, 5G/MIMO, mobile device, biomedical/MRI, EMI/EMC, microwave, radar and scattering, wireless propagation, military and defense, automotive radar, and more.

http://www.remcom.com/

Space\X

http://spacex.com

TICRA

TICRA provides highly accurate EM simulation software for reflector antennas and related feed systems, as well as near-field to far-field transformation software for spherical test ranges. The GRASP software is recognized as an industry standard and used worldwide by antenna industries, including spacecraft manufacturers, earth-station antenna suppliers, defence industries and research institutions. The substantial experience available at TICRA, partly gained through numerous development contracts with the European Space Agency, is available to our customers through our software support and consultancy services.

http://www.ticra.com

Virtual EM Inc.

Founded in 2002 by engineers who hungered to solve the most complex problems, Virtual EM develops disruptive technologies in the areas of computational electromagnetics, embedded wireless sensors, conformal antennas, and machine learning. Virtual EM strives to create a nurturing and rewarding environment for its employees and it has a strong record for creating products and licensing its technologies to OEMs. At Virtual EM, we relish the challenge to solve difficult problems with scientifically-sound, reliable, innovative solutions. We listen to your challenges, then provide candid input on the feasibility of project aims, keeping your best interests in mind. Our customers rely on our input and trust our guidance to successfully accomplish their goals. As a small research and development firm, we can flex our size as needed. We bring together academics, researchers, and commercial partners to create a team perfectly suited to tackle your challenge. Our flexibility can also help modify solutions to be more applicable for commercial markets. We deliver what is promised on time and on budget. You can be confident that our budgets and timelines are realistic. Let Virtual EM be your problem-solver when you need a trusted, flexible and reliable partner on tough research challenges. To learn more, contact Virtual EM, Inc. at 734-222-4558 or sales@virtualem.com, or find us online at www.virtualem.com.

http://www.virtualem.com

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, learned societies, businesses, governments, and individuals increase the academic and professional impact of their work.

http://www.wiley.com

WIP\LD d.o.o.

WIP\LD offers cutting-edge software for fast and accurate electromagnetic and circuit modeling and simulation, based on MoM/SIE, modeling metallic and dielectric surfaces by quadrilateral patches. Various application areas (Antennas, Microwaves, Scattering, EMC), prompt support, professional consulting service, custom-made solutions and full dedication to every client makes WIP\LD favorite partner.

http://www.wipl-d.com
The exhibit hall will feature a new program this year: “Interactive Exhibition”. 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 IIC conducted a survey of the attendees of the 2016 APS Symposium/URSI Meeting in Puerto Rico. The survey results indicated an interest in increased participation from industry in the symposium and exhibition. A majority indicated “increased number of exhibitors” and “hardware demonstrations” as desired features followed by “software demos and tutorials” as a means to improve the exhibition. In response to these suggestions, this year’s symposium organizing committee and the IIC are pleased to bring you the “Interactive Exhibition”. You will find hardware and software demonstrations in special stations as well as in participating exhibitor booths in the exhibit hall during exhibit hours. Following is the list to date of participating exhibitors. Please check the symposium website and mobile app for schedule information!

**DEMONSTRATIONS — GRAND HALL A**

Please check the symposium website and mobile app for schedule information!

**ALTAIR**

**Design of High Gain Patch Antennas using Topology Optimization using FEKO and HyperStudy**

Patch antennas are still an ongoing topic of interest due to their advantages: low profile, low cost and ease of fabrication. One of the disadvantages of patch antenna is low directivity, which results in low range performance. In this demonstration, we will introduce an efficient and novel way to improve the directivity of patch antenna using topology optimization and design of experiments (DoE). Numerical simulations are done using Method of Moments (MoM) technique in product, FEKO. We use global response surface method (GRSM) for double objectives topology optimization using the product HyperStudy. This product demonstration will show use of topology optimization and DoE techniques for the systematic design of high directivity of low profile single element patch antennas. This demonstration will show the pertinent steps for design of a patch antenna for V2V applications at 5.9GHz using FEKO in conjunction with HyperStudy.

*Presenter: Dr. Aseim Elfrgani, Altair*

**EMSCAN**

**Antenna Measurements in Seconds with Chambers on Your Desktop**

This demonstration will show how very-near-field (VNF) systems can accurately evaluate antenna performance in seconds. VNF measurements of radiated emissions are fast and easy to make. VNF test systems invented by EMSCAN are able to accurately measure radiated power and efficiency for antennas. This allows designers to easily and quickly check antenna and wireless device performance without always needing to resort to chambers and helping them to avoid the delays and set-up needed for far-field measurements in a chamber. When working on small devices like mobile phones or smart meters, a designer can get radiation patterns in "real-time". This speed makes it valuable in all stages of the design cycle including new product integration and quality assurance. The same hardware and technique can also be extended to larger antenna like base station antenna or radar arrays and provide measurements in the lab in minutes. You can bring your antennas for us to test.

*Presenter: Eduardo Lopez, EMSCAN*

**ETS-LINDGREN**

**5G Performance Measurements**

This demonstration shows a simple 2-dimensional antenna pattern measurement for a 5G/millimeter wave (mmWave) antenna. In this demonstration, the antenna under test (AUT) is four (4) element patch antenna array working at 28 GHz. The patch antenna is fed with the 28GHz signal from a signal source and while the device is rotated in azimuth plane, the radiation pattern of the antenna array is measured with measurement antenna. The demonstration presents the challenges in millimeter wave communications and further emphasizes the tasks that lie ahead in order to perform accurate and confident measurements for 5G/mmWave antennas. Note this demonstration provides an example of this measurement technique in a 2-dimensional test system, but this approach may also be used to measure 3-dimensional antenna performance.

*Presenter: Jari Vikstedt, ETS-Lindgren*
MICROWAVE INNOVATION GROUP

Efficient Design of Antennas and Arrays including Feeds by Hybrid Multi-Solver Domain Decomposition Methods

The demonstration shows the efficiency of hybrid multi-solver domain decomposition methods using WASP-NET software for the fast design and optimization of antennas and arrays together with feed-networks by live simulations of typical examples on a standard notebook: Corrugated horn together with dual-band/dual-polarization Boifot-OMT, shaped ADE dual-reflector antenna with OMT, shaped offset dual-reflector antenna with OMT, slot-array with feed-network for sum and difference patterns, and a phased Vivaldi-array fed by coax-to-slot-line transitions. Calculation speeds range from a couple of seconds up to a couple of minutes. Design wizards enable the convenient design of these antenna types. An efficient characteristic mode (CM) solver allows pre-investigating exploitable design potentials of antenna structures including feed-point and platform placement effects. CM demonstration examples are a patch array with microstrip feed-network and a mobile phone antenna including housing effects.

Presenter: Fritz Arndt, University of Bremen and MiG – Microwave Innovation Group

MICROWAVE VISION GROUP

Measured Antenna Models for Numerical Simulations in Antenna Placement Scenarios

Electromagnetics solvers are important engineering tools in the characterization and optimization of antenna placement on large and complex platforms. The accuracy of the source representation has a strong influence on the simulation accuracy of the overall system. It is customary to use domain decomposition techniques based on the near-field description of the local domain in such cases. This allows a separate modeling of the antenna with a high level of detail. The source is subsequently used in the numerical simulation of the entire system. Due to the conclusiveness and high data reliability, measured antennas are attractive as accurate antenna models in numerical simulations.

The MVG commercial software INSIGHT, implementing the inverse source method, provides an accurate near-field representation of any radiating device in terms of equivalent electric and magnetic currents. The equivalent model of the measured device can be imported into commercial electromagnetics solvers in the form of a Huygens Box. This demonstration will show the pertinent steps for using real antennas in numerical simulations, and give practical application examples.

Presenter: Lars Jacob Foged, Microwave Vision Group

NSI-MI TECHNOLOGIES

Using a Portable Near-Field System to Measure High Frequency Antennas

The 1x1 Spherical and Planar Near-Field System is beneficial for measuring high frequency, medium and high gain antennas (>15 dBi) with small apertures. This simple design is portable and easy to align. It can be quickly reconfigured to use both mm-Wave modules or traditional coaxially connected antennas, supporting payloads of up to 10 lb. (4.5 kg). The 5-axis test system interfaces with a wide variety of RF equipment and is ideal for characterizing small aperture antennas from 8.2 - 500 GHz. The system software runs on a measurement workstation and provides automatic setup of scans based on measurement parameters and desired output. Measured data can be processed for far-field or holographic back projected patterns, yielding complete characterization of the antenna’s performance. A single data set provides complete characterization of the antenna’s gain, side lobe structure, beam pointing and cross polarization. The 1x1 Portable Near-Field System can also be integrated with an mm-Wave VNA, providing a compact mm-Wave planar near-field test package. This demonstration will show how a Portable Near-Field System measures a slot array antenna easily, quickly and accurately.

Presenter: Jesus Aguilar, NSI-MI Technologies

WIPL-D

WIPL-D Advanced Higher Order EM Modeling: From Low Frequency to Multiscale Problems and Composite Scenarios

The aim of the presentation is to demonstrate simulation of huge variety of different applications, multiscale problems and composite scenarios in WIPL-D software package. Usage of advanced sophisticated techniques, such as: max-ortho (higher order) basis function over quadrangle patches, independent selection of expansion orders along two major axes of these patches, adaptive choice of expansion orders depending on electrical size of patches (showing for the first time results for polynomial expansion orders from 1 to 128), and advanced matrix equilibration, together with CPU and GPU parallelization of all phases of simulation, enables WIPL-D to solve these problems without any solver hybridization, only by using MoM SIE based solver. Full wave analysis of electrically very large antenna placement and RCS problems of platforms up to 1000 λ long will be demonstrated using standard MoM augmented by Domain Decomposition technique.

Presenter: Branko Mrdakovic, WIPL-D
Please check the symposium website and mobile app for schedule information!

**DATA QUARRY**

**Automating OTA Compliance Reports**

In this demonstration, we will show a live example of automating an LTE OTA Compliance Report using Quarry ReportsTM. The report will contain sections for TRP, TIS, ICRS, and 3D Radiation patterns using data automatically extracted from a folder full of raw far field chamber data. This method provides fast, accurate, repeatable results while allowing you to track your data within the report for ease of validation or auditing of report results.

*Presenter: Amy Brown, Data Quarry Inc.*

**IMST**

**24 GHz Radar Module: Live Simulation, Virtual Reality Experience and Radar Demonstration**

The demonstration starts with a live simulation of an antenna system for a 24 GHz radar module using the EMPIRE XPU simulation software. The radar module contains one Tx and two Rx antenna arrays as well as all associated RF electronics. The simulation is followed by a virtual reality experience where the 24 GHz radar module and other 3D EM designs can be inspected using a VR headset. The last part of the demonstration will feature a live demonstration of the functional radar module showing multiple target detection with distance and angular information.

*Presenters: Winfried Simon and Marta Martinez Vazquez, IMST GmbH*

**VIRTUAL EM**

**Tunable Antenna for LTE (4G) Handsets (Live Demonstration of Recovering from Detuning)**

The demonstration features a tunable antenna operating in the 2.43-2.47GHz global roaming band. Antenna uses bare-die SPST solid-state relays controlled by DC voltages and has a total of 16 tuning states. The first act demonstrates how the antenna is tuned by combination of switch states. The second act is a live demonstration of how the antenna recovers from detuning through measurement of VSWR and the control algorithm.

*Presenter: Tayfun Özdemir, Virtual EM Inc.*

**WIPL-D**

**Title: WIPL-D Advanced Higher Order EM Modeling: From Low Frequency to Multiscale Problems and Composite Scenarios**

Abstract: The aim of the presentation is to demonstrate simulation of huge variety of different applications, multiscale problems and composite scenarios in WIPL-D software package. Usage of advanced sophisticated techniques, such as: max-ortho (higher order) basis function over quadrangle patches, independent selection of expansion orders along two major axes of these patches, adaptive choice of expansion orders depending on electrical size of patches (showing for the first time results for polynomial expansion orders from 1 to 128), and advanced matrix equilibration, together with CPU and GPU parallelization of all phases of simulation, enables WIPL-D to solve these problems without any solver hybridization, only by using MoM SIE based solver. Full wave analysis of electrically very large antenna placement and RCS problems of platforms up to 1000 λ long will be demonstrated using standard MoM augmented by Domain Decomposition technique.

*Presenter: Branko Mrdakovic, WIPL-D*
As a leading global information and communications technology (ICT) solutions provider, Huawei is dedicated to customer-centric innovation and strong partnerships. We have established end-to-end advantages in telecom networks, devices and cloud computing, and we have experienced rapid growth in the global smartphone market as well as increased brand recognition. Huawei was ranked third in global smartphone shipments in 2016 with over 29.6% growth worldwide representing 140 million shipments.

WE WANT YOU

Chief RF Systems Architect

Description:
As our Chief RF Systems Architect, you will lead the development of novel RF system architecture to meet the challenges of next generation wireless products. You are expected to work on all stages of product development cycle from concept development/spec drafting, component level development/validation, and system optimization/validation to factory production optimization.

Job Specifications:
Lead the development of novel RF system architecture to meet the challenges of next generation wireless products.
Draft concept design and specifications while working with the platform architect.
Collaborate with RF design/test team and suppliers on component-level development and validation.
Work closely with Antenna/RF design team on system optimization and validation.
Oversee factory test team on production optimization.

Staff/Principal Engineer - RF/Antenna

Description:
The Staff/Principal Engineer (Antenna/RF) will lead and/or participate in the research, design and development of mobile device antenna and RF activities at Huawei Device USA. The ideal candidate will have a combination of 6 years' experience developing mobile device hardware. Five years of experience at a globally recognized mobile device company is preferred.

Job Specifications:
Participate and/or lead in the research, design and development of mobile device antenna and RF activities.
Debug and optimize OTA system performance to meet customer requirements and ensure compliance with FCC SAR/HAC regulations.
Perform pre-research activities in new antenna and RF subsystem technologies.
Improve and develop antenna/RF R&D tools, software, and testing methods.
Conduct antenna/RF simulation with commercial tools (XFDTD and ADS preferred).
Communicate with engineers globally on R&D projects as needed.
Global travel required (less than 15%).
Invited Speakers

Gennady Shvets, Cornell University
Topological Photonics and its Applications To Microwave Devices
Monday, July 10, 08:00 - 08:40, Coronado B
This talk opens Session MO-A2.2A: New Physics in Guiding Systems I

The 2016 Nobel Prize in Physics was awarded for the pioneering work on counter-intuitive topological states of matter. Half a century later, the area of topological photonics is emerging. I will provide an overview of the field, with special emphasis on how topological approaches can be applied to novel microwave devices such as broadband circulators, reflectionless waveguides, and delay lines.

Gennady Shvets is a Professor of Applied and Engineering Physics at Cornell University. He received his PhD in Physics from MIT in 1995. His research interests include optical and microwave metamaterials and their applications, optoelectronic devices, and topological photonics. He is a Fellow of the American Physical Society (APS) and Optical Society of America (OSA).

J.-C. Chiao, University of Texas at Arlington
Endoscopically-Implantable Wireless Devices for Endoluminal Applications
Monday, July 10, 13:20 - 14:00, Hillcrest CD
This talk opens Session MO-A5.1P: Implantable Antennas and Sensors

This presentation reviews batteryless wireless implants for endoluminal applications in physiological symptom diagnosis and management. Overall system constraints, antenna and hardware design consideration, implementation configurations and experimental results in animal models will be discussed. Esophagus sensors to detect reflux occurrence and pH, and gastric stimulators to sustain stomach motility are exemplified for their wireless operation by electromagnetic energy transfer.

J.-C. Chiao is Greene endowed professor of Electrical Engineering at University of Texas – Arlington. He received his PhD at Caltech. Dr. Chiao received the 2011 O’Donnell Award by The Academy of Medicine, Engineering and Science of Texas; Tech Titan Technology Innovator award; and IEEE R5 Outstanding Engineering Educator award. His webpage is at http://www.uta.edu/faculty/jcchiao/

Andrea Alù, University of Texas at Austin
Non-Reciprocal Electromagnetics in Time-Varying Systems
Tuesday, July 11, 08:00 - 08:40, Coronado B
This talk opens Session TU-A2.1A: New Physics in Guiding Systems II

Time-varying systems have recently gained significant attention for the realization of nonreciprocal and active devices. In this tutorial, we provide an overview of the recent progress in this area, including different approaches to time-varying systems that break reciprocity and an outlook on their applications for antenna systems, including isolators, circulators, nonreciprocal antennas, metasurfaces and topological insulators for radio-waves and light.

Andrea Alù is the Temple Foundation Endowed Professor at the University of Texas at Austin. He received his Laurea (2001) and PhD (2007) from the University of Roma Tre, Italy. His research focuses on metamaterials and plasmonics, electromagnetics, nanophotonics and acoustics. Dr. Alù is a Fellow of IEEE, OSA, SPIE and APS, and received the NSF Alan T. Waterman award (2015), the URSI Issac Koga Gold Medal (2011), and several other relevant awards and recognitions.

John Smee, Qualcomm Technologies Inc.
The Advent of 5G Mobile
Wednesday, July 12, 08:00 - 09:40, America's Cup AB
This talk opens Session WE-A1.2A: Wideband Antennas for 5G, Full-Duplex, MIMO and AoA

The 5G New Radio is moving closer to commercial reality across design, standardization and implementation. Now that the 3GPP 5G NR Release 14 Study Item has been completed, the Release 15 Work Item is now underway at an accelerated pace to enable 5G NR
enhanced mobile broadband deployments in spectrum bands below 6 GHz and in higher frequency mmWave bands. Key 5G design aspects and performance improvements include low latency frame structures, LDPC and Polar channel coding, massive MIMO, mmWave beam tracking, and improved network architectures. We are now embarking on large scale 5G NR trials with operators worldwide as commercial rollouts in 2019/2020 will set the stage for the next decade of 5G growth.

Dr. John E. Smee is a Vice President of Engineering at Qualcomm Technologies Inc. He joined Qualcomm in 2000, holds 61 US Patents, and has been involved in the system design for a variety of projects focused on the innovation of wireless communications systems such as CDMA EVDO, IEEE 802.11, 4G LTE, and 5G. His work involves taking advanced system designs and signal processing techniques from theory through design, standardization, implementation, and productization. He is currently a 5G project engineering lead in Qualcomm’s research and development group. John was chosen to participate in the National Academy of Engineering Frontiers of Engineering program and is a recipient of the Qualcomm Distinguished Contributor Award for Project Leadership. He received his Ph.D. in electrical engineering from Princeton University, and also holds an M.A. from Princeton and an M.Sc. and B.Sc. from Queen’s University.

Jian-ming Jin, University of Illinois at Urbana-Champaign

Multiphysics Modeling in Computational Electromagnetics: Technical Challenges and Potential Solutions

Wednesday, July 12, 13:20 - 14:00, Regatta

This talk opens Session WE-A3.1P: Multiphysics Methods and Applications

Electromagnetics-based multiphysics modeling has a wide range of application in science and engineering. However, its development faces a number of technical challenges. By using four examples, which involve electromagnetic, heat, fluid, mechanical, circuit, and plasma analyses, we will illustrate the nature and modeling of multiphysics problems and discuss some of the technical challenges and potential solutions in multiphysics modeling.

Jian-Ming Jin is the Y. T. Lo Chair Professor of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. He has authored and co-authored six books, 265 journal papers, 22 book chapters, and 362 conference papers, and presented 142 invited talks. He was elected an ISI most cited author in 2002 and a Fellow of IEEE in 2001. He appeared 23 times in the university’s List of Excellent Instructors, and was awarded various professorship by 14 institutions around the world.

Peter Siegel, California Institute of Technology

Millimeter and Submillimeter Wave Applications in Biology Potential and Challenges

Thursday, July 13, 13:20 - 14:00, Coronado D

This talk opens Session TH-A5.1P: Terahertz IR and Optical Applications

The millimeter and submillimeter wave regimes have moved to the forefront of recent expansion and innovative use of the RF spectrum. As we depart the “Space Age” and enter the “Age of Biology” it is appropriate to take a closer look at what we can already do with millimeter and submillimeter-wave technology, by simply refocusing some existing circuits and techniques.

Peter H. Siegel has held appointments as Faculty Associate in Electrical Engineering and Senior Scientist in Biology at the California Institute of Technology, and Senior Research Scientist at the NASA Jet Propulsion Laboratory, both in Pasadena, California. At JPL, he founded and led for 25 years, the Submillimeter Wave Advanced Technology (SWAT) team, a group of 20+ scientists and engineers developing THz technology for NASA’s near and long term space missions. This included delivering key components for four major satellite missions and leading more than 75 smaller R&D programs for NASA and the US department of defence. At Caltech, Dr. Siegel has been involved in new biological and medical applications of THz, especially low power effects on neurons and most recently, millimeter-wave monitoring of blood chemistry. Among many other functions, he served as founding Editor-in-Chief of the IEEE Transactions on Terahertz Science and Technology (2010-2015) and founder, and now the General Secretary, of the International Society of Infrared, Millimeter, and Terahertz Waves, the world’s largest society devoted exclusively to THz science and technology. He is also an IEEE Fellow, and has served as an IEEE Distinguished lecturer, vice-chair and chair of IEEE MTTS Committee 4 - THz Technology,
Stefano Maci, University of Siena

Design of Modulated Metasurface Antennas

Friday, July 14, 13:20 - 14:00, Coronado A

This talk opens Session FR-A2.1P: Metasurfaces for Antenna Applications

In the recent years, metasurfaces (MTSs), i.e. the two-dimensional equivalent of metamaterials, have captured the attention of the AP-S community. In this talk, the recent achievement of the research in MTS will be reviewed with emphasis on antenna design, synthesis and applications in the microwave and millimeter wave range. A roadmap on the future perspectives of such antennas will be presented.

Stefano Maci is Professor at Univ. of Siena, Italy. He is expert in EM theory, high-frequency methods, integral equations, antennas, metamaterials. He is a IEEE Fellow since 2004. He was the founder in 2005 and presently the Director of the “European school of antennas” (35 Universities and 200 instructors, including 20 IEEE Fellow). He was AP-S AdCom member in 2010-12, former member of the Board of Director of EurAAP, IEEE Distinguish Lecturer, Chair of the Award Committee of IEEE AP-S. He was recipient of the EurAAP Career Award 2014, IEEE Chen-To Tai distinguished educator award 2016, and of the Schelkunoff Transaction prize in 2016. He is author of 150 papers in international journals, 10 Book Chapters. His paper got more than 5000 citations.

John L. Volakis, The Ohio State University

Ultra Wideband Phased Arrays and Low-cost Beamforming

Friday, July 14, 08:00 - 08:40, Promenade AB

This talk opens Session FR-A1.4A: Phased Array Antenna Designs

UWB arrays with low-power and low-cost beam forming hardware are presented. Key features include: 1) 10:1 bandwidth with high isolation dual-pol antenna arrays, 2) on-site coding to reduce analog to digital and digital to analog converters by more than an order of magnitude, 3) signal spreading to achieve over 25dB of additional gain, and 4) 500MHz bandwidth simultaneous transmit/receive capability.

John L. Volakis has 35 years of experience in all aspects of Electromagnetics and sensing. He is the Roy & Lois Chope Chair Professor of Engineering at The Ohio State Univ. His publications include 8 books, 400 journal papers and ~800 conference papers. He mentored nearly 90 Ph.Ds/PostDocs with 37 of them having won awards at international conferences.
### Session Code Legend

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### Session Track Icon Legend

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<td>AP-S Track 5: Antenna Applications and Emerging Technologies</td>
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<td>URSI Commission K: Electromagnetics in Biology and Medicine</td>
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<td>🧪SP</td>
<td>AP-S/URSI Joint Special Special Sessions</td>
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</table>
Additive Manufacturing in Antennas and RF Systems
Session Co-Chairs: Cyril Luxey, EpOC, Université Nice-Sophia; Yiannis Vardaxoglou, Loughborough University

MO-SP.1A.1 08:00
3D Printed Feed-Chain and Antenna Components
Esteban Menargues, LEMAP-EPL, Switzerland; Mario Garcia-Vigueras, INSA-ETR, France; Tomislav Dlugogorski, SWISSSTI2, Switzerland; Santiago Capdevila, LEMAP-EPL, Switzerland; Alexandru Dimitriu, Emile de Krij, SWISSSTI2, Switzerland; Juen R. Masiq, LEMAP-EPL, Switzerland

MO-SP.1A.2 08:20
Challenges 3D Printing Microwave Components
Karina Hoel, Stein Kristoffersen, FF, Norway

MO-SP.1A.3 08:40
Low-Cost 3D-Printed 240 GHz Plastic Lens fed by Integrated Antenna in Organic Substrate

MO-SP.1A.4 09:00
Metasurface Antennas and Packaging at Terahertz Frequencies
Goutam Chattopadhyay, Jet Propulsion Laboratory, California Institute of Technology, United States; David Gonzalez Ovejero, Université de Rennes, France; Cecile Jung-Kubiak, Maria Alonso-Goutam, Jet Propulsion Laboratory, California Institute of Technology, United States; Carlos A. Fernandes, Instituto Superior Técnico - Universidade Técnica de Lisboa, Portugal

MO-SP.1A.5 09:20
3D-Printed Lens Antenna
Ravi Kumar Ayya, EMC Laboratory, The Pennsylvania State University, USA; United States; Shiyu Zhang, Jun-Readback, University of Central Florida, USA and KAU, Saudi Arabia, United States

Break 09:40

MO-SP.1A.6 10:00
Development and Electromagnetic Characterization of 3D Printable Material with High Dielectric Constant
Jungiang Wu, Min Liang, University of Arizona, Arizona; United States; Kevin Schirr, Adriana Ramirez, David Roberson, The University of Texas at El Paso, United States; Eric MacDonald, Youngstown State University, United States; Ryan Wicker, The University of Texas at El Paso, United States; Hao Xin, University of Arizona, Arizona; United States

MO-SP.1A.7 10:20
Microwave Performance of Composite Conductors for Fused Filament Fabrication of Electronics
Christopher Stevens, Ekatarina Shamonina, San Chu, Andrea Vallecchi, Oxford University, United Kingdom

MO-SP.1A.8 10:40
On-Package mm-Wave FSS Integration with 3D-Printed Encapsulation
Bijan Tahani, Syed Abdulrahman Nouri, Ryan Bahr, Manas M. Tentzers, Georgia Institute of Technology, United States

MO-SP.1A.9 11:00
Bowtie Antennas Inkjet Printed on Cylindrical Surfaces
Adam Kaye, Loughborough University, United Kingdom; Svatrasad Rodyk Kunduru, Neil Chilton, Printed Electronics Ltd, United Kingdom; Yiannis Vardaxoglou, William Whittow, Loughborough University, United Kingdom

MO-SP.1A.10 11:20
3D Printed 77 GHz Planar Yagi-Uda Antenna
Lee Han, Yu Xiaoh, John Papapolymerou, Michigan State University, United States
Electromagnetic Theory
Session Co-Chairs: Yakir Hadad, Tel Aviv University; Guido Lombardi, Politecnico di Torino

MO-A2.1A.1 08:00
Finding ‘at-once’ all dominantly excited modes in a layered medium by Fourier-Pade approximation of the Green’s function
Yakir Hadad, Tel Aviv University, Israel

MO-A2.1A.2 08:20
Re-expressing the Solution of Maxwell Equations Using Two New Auxiliary Scalar Potentials
Arman Afsari, Amin Abbosh, The University of Queensland, Australia; Yahya Rahmat-Samii, University of California, Los Angeles, United States

MO-A2.1A.3 08:40
Photo-induced Force vs Power in Chiral Scatterers
Mohammad Albooyeh, Mina Hanifeh, Mohammad Kamandi, Mohsen Rajaei, Jinwei Zeng, H. Kumar Wickramasinghe, Filippo Capolina, University of California, Irvine, United States

MO-A2.1A.4 09:00
Uniqueness Theorem for Lossy Anisotropic Inhomogeneous Structures with Diagonal Material Tensors
Razza Dehbash, Konstanty S. Bialkowski, Amin Abbosh, University of Queensland, Australia

MO-A2.1A.5 09:20
On Circuit Modelling of Diffraction Problems in Spectral Domain
Vito Daniele, Guido Lombardi, Rodolfo S. Zich, Politecnico di Torino - ISMB, Italy

Break 09:40

MO-A2.1A.6 10:00
Minimum Energy Storage in Dissipative Electromagnetic Systems
Lucas Jelinek, Czech Technical University in Prague, Czech Republic; Kurt Schab, North Carolina State University, United States; Miroslav Capak, Czech Technical University in Prague, Czech Republic

MO-A2.1A.7 10:20
Restoring Characteristic Eigenvalues as Reactive Powers for Simple and Complex Media in Surface Integral Formulations
Zachary Alios, Boon Kong Lau, Lund University, Sweden

MO-A2.1A.8 10:40
Analytical study of the TE-waveguide modes in time-domain
Fatih Erden, Turkish Naval Academy, Turkey; Oleg Tretyakov, Gebze Technical University, Turkey

MO-A2.1A.9 11:00
Pedagogical Construction of a Green’s Function from Physical Consideration
Thomas Wong, Zhijing Hu, Yanlin Li, Illinois Institute of Technology, United States

MO-A2.1A.10 11:20
Nondiffracting Waves: Criteria for Designing X-wave Launchers
Walter Fucalodo, Sapienza University of Rome, Italy; Sant Concetto Pavone, University of Siena, Italy; Davide Camile, Sapienza University of Rome, Italy; Guido Valeria, Sorbonne Universités, UPMC Univ Paris 06, France; Matteo Albani, University of Siena, Italy; Mauro Ettorre, Université de Rennes 1, UMR CNRS 6164, France; Alessandro Galli, Sapienza University of Rome, Italy
Scattering Control through Metasurfaces and Cloaking
Session Co-Chairs: Alexander B. Yakovlev, University of Mississippi; Filiberto Bilotti, Roma Tre University

MO-A2.3A.1 08:00
Waveform-Selective Scattering Control through Circuit-Based Metasurfaces at the Same Frequency
Hiroki Wakatsuchi, Nagoya Institute of Technology, Japan; Daniel F. Sievenpiper, University of California, San Diego, United States

MO-A2.3A.2 08:20
Wideband Elliptical Metasurface Cloaks in Antenna Technology
Gabriel Moreno, Hossein Mehrpour Bernety, Alexander Yakovlev, University of Mississippi, United States

Van Atta arrays for realizing angular and frequency wideband carpet cloaks
Antonino Tobia, Davide Ramaccia, Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy

MO-A2.3A.4 09:00
Spatio-temporal modulated Doppler cloak restores invisibility of moving cloaked objects
Davide Ramaccia, Filiberto Bilotti, Alessandro Toscano, Roma Tre University, Italy; Dimitrios Sounas, Andrea Alù, The University of Texas at Austin, United States

MO-A2.3A.5 09:20
A Concept for Cloaking using Electrically-Thin Dielectric Surfaces
Miguel Ruphuy, University of Costa Rica, Costa Rica; Omar Ramahi, University of Waterloo, Canada

Break 09:40

MO-A2.3A.6 10:00
Miniaturizing Electromagnetic Invisibility Cloaks Using Double Near Zero Slabs
Reza Dehbashi, Konstanty S. Bialkowski, Amin Abbosh, University of Queensland, Australia

MO-A2.3A.7 10:20
Concealment with Near-Zero Materials and Their Sensitivity to Non-Zero Material Parameters
Reza Dehbashi, Konstanty S. Bialkowski, Amin Abbosh, University of Queensland, Australia

MO-A2.3A.8 10:40
Ultra Wideband Epsilon-Near-Zero Metamaterial
Reza Dehbashi, Konstanty S. Bialkowski, Amin Abbosh, University of Queensland, Australia

MO-A2.3A.9 11:00
Tai-Chi-Inspired Pancharatnam-Berry Phase Metasurface for Dual-band RCS Reduction
Xia Luo, Qingfeng Zhang, South University of Science and Technology of China, China; Yaqiang Zhuang, Air Force Engineering University, China

MO-A2.3A.10 11:20
Radar Cross Section Reduction of Dipole Antenna Using Checkerboard Surface
Longjian Zhou, Min Gao, Xuewu Cui, Feng Yang, Zhipeng Liang, University of Electronic Science and Technology of China, China

MO-A1.1A 08:00
Reflectarray with Novel Elements
Session Co-Chairs: Yehuda Leviatan, Technion - Israel Institute of Technology; Adam Mehrabani, Johns Hopkins University

MO-A1.1A.1 08:00
C-Band Flexible and Portable Circularly Polarized Textile-Reflectarray (TRA)
Muhammad Mustafa Tahseen, Ahmed A. Kishk, Concordia University, Canada

MO-A1.1A.2 08:20
Perfect Reflectarrays Elements Based on Non-local Metasurfaces
Ana Diaz-Rubio, Viktor Asadchy, Do-Hoon Kwon, Sergei Tretyakov, Aalto University, Finland

MO-A1.1A.3 08:40
Extending Power-handling of High-power Metamaterial Phase-shifters using Three-dimensional Counter-rotated End-loaded Dipoles
Sawyer D. Campbell, Jeremy A. Bassard, Micah D. Gregory, The Pennsylvania State University, United States; Clintan P. Scarborough, E x H, Inc., United States; Pingjian L. Warner, Douglas H. Werner, The Pennsylvania State University, United States; Joshua Papmert, Scott Griffiths, Joint Non-Lethal Weapons Directorate, United States

MO-A1.1A.4 09:00
Offset-fed Dielectric Reflectarray Antenna Designs
Ravi Kumar Arora, The Pennsylvania State University, United States; Raj NKtra, University of Central Florida, USA and KAU, Saudi Arabia, United States

MO-A1.1A.5 09:20
A Novel Single-Layer Reflectarray Antenna Using Square Spiral Element
Yang Liu, Hongjian Wang, Fei Xue, Xingchao Dong, National Space Science Center, Chinese Academy of Sciences, China

Break 09:40

MO-A1.1A.6 10:00
The Shape Synthesis of Unit Elements for Transmittarray Antennas
Abdullah Aljunah, Derek McNamara, University of Ottawa, Canada

MO-A1.1A.7 10:20
GA-Optimized Reflectarray Elements for Broadband Orthogonal-Polarization Conversion
Daichi Higashi, Hiroyuki Deguchi, Mikio Tsuji, Doshisha University, Japan

MO-A1.1A.8 10:40
Parametric Analysis of Double-Split Ring Resonator as a Reflectarray Unit Cell
Gülay Özşahin, Tuğba Simşek, Mehmet Ünlü, Ankara Yıldırım Beyazıt University, Turkey; Orçun Kırış, Süleyman Köse, Halid Mustaçoğlu, Fahri Öztürk, Volkan Akan, TÜBİTAK Space Technologies Research Institute, Turkey
Wideband Slot Antennas
Session Co-Chairs: Saeed Latif, University of South Alabama; Hsi-Tseng Chou, National Taiwan University

Wideband, Circularly Polarized Slot Antenna
Zabed Iqbal, Sogkyun Lim, Georgia Southern University, United States
08:00

The Performance of an Ultra-wideband Elliptical Ring Monopole Antenna with a Humanoid Breast Phantom
F. Mansoor, T. Tan, Saeed Latif, University of South Alabama, United States
08:20

A Compact Circularly-Polarized Square Slot Antenna with Enhanced Axial-Ratio Bandwidth Using Metasurface
Mehrdad Nosrati, Negar Tavassolian, Stevens Institute of Technology, United States
08:40

Design of Wideband Circular Polarization for The Open-Slot Antenna
Kuan-Wei Li, Chia-Wei Hsu, Jun-Yu Lai, Wen-Bin Tsai, Chien-Jen Wang, National University of Tainan, Taiwan
09:00

QLR Based Reconfigurable Two/Four-States UWB Notch Antenna
Ahmed Abdelaal, Purdue University, Egypt; Mahmoud A. Abdalla, Military Technical College, Egypt
09:20

A Wideband Circularly Polarized Slot-Antenna Array
Sing Wai Cheung, Changfei Zhou, Di Wu, Qinlong Li, Min Li, The University of Hong Kong, China
10:00

Octagonal Band Notched Superwideband Fractal Antenna
Sarthak Singh, Amity School of Engineering & Technology, India; Amit Kumar Singh, Indian Institute of Technology (BHU), India
10:20

Broadband Circularly Polarized Square Slot Antenna with a G-Shaped Feedline
Kwame Oteng Gyasi, Yongjun Huang, Guangjun Wen, Jian Li, Affum Emmanuel Ampoma, University of Electronic Science and Technology of China, China
10:40

A Printed UWB Slot Antenna with Bluetooth and Dual Notched-Bands
Guodong Zhao, Peng Gao, University of Electronic Science and Technology of China, China
11:00

Integral Equation Applications
Session Co-Chairs: Branislav Notaros, Colorado State University; Kristof Cools, University of Nottingham

Using Subdivision Surface Technique to Solve Generalized Debye Sources based EFIE
Xi Fu, University of Hong Kong, Hong Kong SAR of China; Jie Li, Balasubramaniam Shanker, Michigan State University, United States; Lijun Jiang, University of Hong Kong, Hong Kong SAR of China
08:00

Investigation of Alternative Array Configurations of Nanowires for Maximum Power Transmission at Optical Frequencies
Barisan Kanoosan, Hasan Aykut Sahana, Middle East Technical University, Turkey; Fatih Dakmen, Gebze Technical University, Turkey; Özgür Ergül, Middle East Technical University, Turkey
08:20

Domain Decomposition Method for Solving Scattering from PEC objects
Kai Han, Zaiping Nie, Dongdong Wen, University of Electronic Science and Technology of China, China
08:40

Wideband Frequency Analysis Using Volume Surface Integral Equation and Taylor Series Expansion
Qiang-Ming Cai, Yan-Wen Zhao, Zhi-Peng Zhang, Li Gu, Yu-Teng Zheng, Zaiping Nie, University of Electronic Science and Technology of China, China; Qing Huo Liu, Duke University, United States
09:00

Efficient Numerical model to analyze the conformal capacitive frequency selective surfaces
Yiling Wang, Zaiping Nie, Dongdong Wen, University of Electronic Science and Technology of China, China
09:20
Monday, July 10 08:00 - 11:40
MO-A3.2A
Mission Beach AB

**Design Methodologies for Antennas**

**Session Co-Chairs:** Daniel Weile, University of Delaware; Miguel Navarro-Cia, University of Birmingham

MO-A3.2A.1 08:00
From Optimization of Near-Field WPT Systems to Far-Field Antenna Arrays
Hans-Dieter Lang, Costas D. Saris, University of Toronto, Canada

MO-A3.2A.2 08:20
Suppression of Sidelobe Level and Sideband of Time-Modulated Linear Antenna Arrays by Using NSDE
Anyong Qing, Cheng Zhang, School of Physical Electronics, University of Electronic Science and Technology of China, China

MO-A3.2A.3 08:40
Comparison of Crossover Recombination Operators in GA-Optimized Sparse Linear Array Design
Sean Ellison, Jeffrey Nanzer, Michigan State University, United States

MO-A3.2A.4 09:00
Leadership-Based Algorithm for Planar Array Optimization
Francesco Grimaccia, Marco Mussata, Alessandro Nicolai, Politecnico di Milano, Italy; Paolo Prinari, Politecnico di Torino, Italy; Riccardo Zich, Politecnico di Milano, Italy

MO-A3.2A.5 09:20
The Design of Two-fold Redundancy Linear Arrays in Aperture Synthesis Radiometers
Peiwen Tang, Liang Lang, Fei Hu, Dong Zhu, Huazhong University of Science and Technology, China

Break 09:40

MO-A3.2A.6 10:00
On Q-Factor Bounds for a Given Front-to-Back Ratio
Shuai Shi, Lei Wang, B.L.G. Jonsson, KTH Royal Institute of Technology, Sweden

MO-A3.2A.7 10:20
An Improved Procedure for Simulation-Driven Miniaturization of Antenna Structures
David Johansson, Slawomir Kaziel, Adrian Bekasiewicz, Reykjavik University, Iceland

MO-A3.2A.8 10:40
Statistical Investigation of a Dual-Band Wearable Patch Antenna
Hulusi Acikgoz, KTO Karatay University, Turkey; Raj Mittra, University of Central Florida, United States

MO-A3.2A.9 11:00
Optimization of the Spiral Inductor With EBG Via FDTD and GA
Hongjian Wang, NSSC, CAS, China

MO-A3.2A.10 11:20
Artificial Neural Network with Data Mining Techniques for Antenna Design
Li-Ya Xiao, Wei Shao, Tu-Lu Liang, Bing-Zhong Wang, School of Physical Electronics, China

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Monday, July 10 08:00 - 11:20
MO-A1.3A
Promenade AB

**Antenna Theory I**

**Session Co-Chairs:** Constantine Balanis, Arizona State University; Andrea Neto, Delft University of Technology

MO-A1.3A.1 08:00
Measurement Sample Reduction for Efficient Antenna Gain Determination in the Near-Field
Ole Neitz, Thomas F. Eibert, Technical University of Munich, Germany

MO-A1.3A.2 08:20
On the Evaluation of the Available Power for Antennas in Reception
Andrea Neto, Nuria Llombart, TU Delft, Netherlands; Angela Freni, University of Florence, Italy; Arturo Fiorellini Bernardis, TU Delft, Netherlands

MO-A1.3A.3 08:40
Printed High Gain End-fire Beam-steerable Yagi Antenna
Panisz Lotfi Poshtgol, Saber Saltani, Ross D. Murch, Hong Kong University of Science and Technology, Hong Kong SAR of China

MO-A1.3A.4 09:00
Excitation Shape and Placement Effects on Natural Radiating Modes
Asim Ghalib, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia

MO-A1.3A.5 09:20
Characteristic Modes of Circular Slot Antennas Etched on a Finite Ground Plane
Asim Ghalib, Rifaqat Hussain, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia

Break 09:40

MO-A1.3A.6 10:00
Investigations on Effects of Finite Ground Plane on Slot Antennas using Characteristic Modes
Arka Bhattacharyya, Bhaskar Gupta, Jadavpur University, India

MO-A1.3A.7 10:20
Influence of Amplitude and Phase Errors on Near-Field to Far-Field Transformation
Weijun Chen, Chufeng Hu, Nanjing Li, Shuoxia Guo, Lifang Guo, Kai Zheng, Northwestern Polytechnical University, China

MO-A1.3A.8 10:40
A Novel Dual-Band Dual-Sense Circularly Polarized Antenna Based on Simple Printed Dipole Structure
Rui Xu, Jianying Li, Guangwei Yang, Northwestern Polytechnical University, China

MO-A1.3A.9 11:00
The Vertical Radio Waves Realized by Helical Antennas
Du-Juan Wei, Jianying Li, Jang-Jun Yang, Northwestern Polytechnical University, China
Advanced Antenna Technologies for User End
Session Co-Chairs: Magdy Iskander, University of Hawaii at Manoa; Thomas Liu, Intel Corp.

MO-A5.1A.1 08:00
RF EMF Exposure of Beam-Steering Slot Array in 5G User Equipment at 15 GHz
Bo Xu, Kun Zhao, Sailing He, KTH Royal Institute of Technology, Sweden; Zhinong Ying, Sony Communication AB, Sweden

MO-A5.1A.2 08:20
Internal Pattern-Switchable 1.0 Wavelength Loop Antenna Array for Satellite Smartphone Applications
Wei-Yu Li, Wei Chung, Industrial Technology Research Institute (ITRI), Taiwan; Amane Miura, Hiroyuki Tsuji, National Institute of Information and Communications Technology (NICT), Japan; Jui-Hung Chen, Chin-Yu Yi, Industrial Technology Research Institute (ITRI), Taiwan

MO-A5.1A.3 08:40
Disc-Slot Antenna With Dielectric Loading and Thick Metal Ground for Wrist-Worn Devices
Huan-sheng Hwang, Aycan Erentok, Rodrigo. Camacho, Thomas Liu, Paul Beaucourt, Intel Corp., United States

MO-A5.1A.4 09:00
Design of Broadband Dual-Polarized Oval-Shaped Base Station Antennas for Mobile Systems
Ahmad Alidin, Yi Huang, University of Liverpool, United Kingdom

A Self-Resonant Reconfigurable Diversity Antenna for Mobile Phone with Full Metal Housing
Yuan Li, Xiaojun Tang, Yumei Yu, Lijia Zhu, Guangli Yang, Shanghai University, China

Break 09:40

MO-A5.1A.6 10:00
Doppler Radar Phenomenology in Small Commercial Unmanned Aerial Systems
Traian Dogaru, Kyle Gallagher, Calvin Le, U.S. Army Research Laboratory, United States

MO-A5.1A.7 10:20
Advanced Directional Networking: LTE vs WiFi Radios
Shekh Md Mahmudul Islam, Farhan A. Qazi, Magdy F. Iskander, Zhengqing Yun, Galen Sasaki, University of Hawaii at Manoa, United States

MO-A5.1A.8 10:40
A Novel technique for RF voltage measurement for Aperture Tuned Antennas.
Abolghasem Zamani, Roberto Gaddi, Paul Yamatra, Cavendish Kinetics, Netherlands

MO-A5.1A.9 11:00
A Compact Monopole Antenna for Smartphones
Min Li, Song Wai Cheung, Chang He Cheung, Qinlong Li, Di Wu, The University of Hong Kong, China

MO-A5.1A.10 11:20
Low-profile and Dual-polarized Distributed Patch Antenna with Wide beamwidth
Xi Chen, Guang Fu, Dan Wu, Xidian University, China

Remote Sensing I
Session Co-Chairs: Matthys Botha; Robert Burkholder, The Ohio State University

MO-A4.1A.1 08:00
MASCRAD Events: Observations and Analyses of Cases with Contrasting Hydrometeor Forms
Branislav Notaros, V. N. Bringi, Merhala Thurai, Patrick Kennedy, Gwo-Jong Huang, Colorado State University, United States; Gyuwon Lee, Wondae Dong, Kwonil Kim, Kyungpook National University, Republic of Korea; Andrew Newman, National Center for Atmospheric Research, United States

MO-A4.1A.2 08:20
Range-Dependent Evaporation Duct Height Estimation from a Versatile Ship-Mounted X-band Receiving Array
Qi Wang, Robert Burkholder, Caglar Yardim, The Ohio State University, United States

MO-A4.1A.3 08:40
Investigation of spatial resolution enhancement for GCOM-W AMSR2 follow-on mission
Takashi Maeda, Japan Aerospace Exploration Agency, Japan

MO-A4.1A.4 09:00
Experimental Verification of a MoM-Based Efficient Design Approach to Direction Finding Antenna Arrays
Luca Scorrano, Libero Dinoi, Elettronica S.p.A., Italy; Lorenzo Bartolucci, Giuseppe Polosi, Stefano Selleri, University of Florence, Italy

MO-A4.1A.5 09:20
Chirp Scaling Algorithms for SAR Imaging under High Squint Angles
Po-Chih Chen, Jean-Fu Kang, National Taiwan University, Taiwan

Break 09:40

MO-A4.1A.6 10:00
Doppler Radar Phenomenology in Small Commercial Unmanned Aerial Systems
Traian Dogaru, Kyle Gallagher, Calvin Le, U.S. Army Research Laboratory, United States

MO-A4.1A.7 10:20
HF Noise Trends in Coastal Southern California
Daniel Gaytan, David Hilton, Kris Buchanan, Lu Xu, Vincent Dinh, Gregory Larson, Chris Diley, SPAWAR Systems Center Pacific, United States

MO-A4.1A.8 10:40
Experimental Study of Antenna Characteristic Effects on Doppler Radar Performance
Mahboud Nosrat, Negar Tavassolian, Stevens Institute of Technology, United States

MO-A4.1A.9 11:00
A 60-Channels ADC Board for Space Borne DBF-SAR Applications
Emilio Ariniero, Luigi Boccia, Giandomenico Amendola, University of Calabria, Italy; Chunwu Mao, Steven Gao, University of Kent, United Kingdom; Fabio Rommel, Microwaves and Radar Institute, German Aerospace Center (DLR), Germany; Srdjan Gligic, Silicon Radar GmbH, Germany; Puneetkumar Patel, Avantronics, Poland; Milos Krstic, Evatronix, Germany; Anselm Ho, Innovative Solutions In Space BV, Netherlands; Eusatani Yoshidai, Silicon Radar GmbH, Germany; Oliver Schrappe, HHI, Germany; Marwan Younis, Microwaves and Radar Institute, German Aerospace Center (DLR), Germany

MO-A4.1A.10 11:20
Fast back projection algorithm for circular SAR processing
Yi Xiao, Wen-Qin Wang, Huazhuang Shao, UESTC, China
Propagation Based on Numerical Weather Prediction Models
Session Co-Chairs: Tracy Haack, Naval Research Laboratory; Katherine Horgan, Naval Surface Warfare Center

MO-UF.1A.1  08:00
Making Numerical Weather Predictions Portable, Compression of Weather Data for Use in Radar Propagation Modeling
Vincent van Leijen, Marjau Boemeke, Defence Material Organisation, Netherlands; Katherine Horgan, Naval Surface Warfare Center, United States

MO-UF.1A.2  08:20
Sensitivity of RF Propagation Loss to Variations of Environmental Refractivity along the Path
Qing Weng, Kyle Franklin, Ryon Yamaguchi, Naval Postgraduate School, United States; Denyo Alappattu, Moss Landing Marine Laboratory, United States; Robert Burkholder, Caglar Yardim, The Ohio State University, United States; Adam Christman, Hanindra Joseph S. Fernando, University of Notre Dame, United States

MO-UF.1A.3  08:40
A Review of Refractivity Structure Matching as a Pre-Processing Component When Considering its Use with Numerical Weather Prediction
Katherine Horgan, Edward Burgess, William Thornton, Victor Wiss, Naval Surface Warfare Center Dahlgren Division, United States

MO-UF.1A.4  09:00
A Technique to Evaluate Numerical Weather Prediction Performance During CASPER-East: An Engineering Perspective
Matt Willbanks, Stephanie Billingsley, Kate Horgan, William Thornton, Naval Surface Warfare Center Dahlgren Division, United States; Qing Weng, Naval Postgraduate School, United States; Tracy Haack, Naval Research Laboratory, United States

MO-UF.1A.5  09:20
Validation of the Navy Atmospheric Vertical Surface Layer Model (NAVSLaM) Using LATPROP-UWB 2-40 GHz Data from CASPER East
Paul Fredericks, Naval Postgraduate School, United States; Caglar Yardim, Luyao Xu, The Ohio State University, United States

Break 09:40

MO-UF.1A.6  10:00
Validation of Simulated Propagation using Measured and Modeled Refractivity Profiles from CASPER-East with LATPROP-UWB EM Propagation Data
Luyao Xu, Caglar Yardim, Robert Burkholder, The Ohio State University, United States; Qing Weng, Naval Postgraduate School, United States; Tracy Haack, Naval Research Laboratory, United States; Hanindra Joseph S. Fernando, University of Notre Dame, United States; Ojaselle Kheil, University of California, Irvine, United States

MO-UF.1A.7  10:20
Evaporation duct profiles from the Tropical Air-Sea Propagation Study
George Ford, Martin Vosrey, Helen Rance, Met Office, United Kingdom; Sally Garrett, Defence Technology Agency, New Zealand; Jacques Cleaver, CREC STC & IETR, France

MO-UF.1A.8  10:40
Assessment of Evaporation Duct Model Performance in a Tropical Littoral Environment
Helen Rance, George Ford, Met Office, United Kingdom; Andy Kulesa, Airborne Research Australia, Australia; Helmoed Hansen, Defence Science and Technology Organisation, Australia; Martin Vosrey, Met Office, United Kingdom

MO-UF.1A.9  11:00
All Directions Through the Wall Imaging Using Omnidirectional Bi-static FMCW Transceivers
Behzad Yektakia, Kornal Sarabandi, University of Michigan, United States

MO-UF.1A.10  11:20
Investigation of Simulated Ground Penetrating Radar Data for Buried Objects Using Quadratic Time-Frequency Transformations
Mesut Dogan, Gunal Turhan-Sayan, Middle East Technical University, Turkey

Electromagnetics in Medicine and Biology
Session Co-Chairs: Amin Abbosh, University of Queensland; Susan Hagness, University of Wisconsin-Madison

MO-AS.2A.1  08:00
Power Harvesting for Wearable Electronics Using Fabric Electrochemistry
Ramandeep Vikho, Brook DeLong, Pnya Das Ghatak, Shamita Mathew-Steiner, Chandan Sen, Asimina Kouri, The Ohio State University, United States

MO-AS.2A.2  08:20
Examination of the Sensing Radius of Open-ended Coaxial Probes in Dielectric Measurements of Biological Tissues
Alessandra La Gioia, Emily Porter, Martin O’Halloran, National University of Ireland, Galway, Ireland

MO-AS.2A.3  08:40
Skin Tissue Characterization of Canine at Microwave and Millimeter-Wave Frequencies
Syed Akber Raza Naqi, Mohamed Manoufali, Noor Al-Badri, Beadad Mohammed, Konstanty S. Bialkowski, Amin Abbosh, The University of Queensland, Australia

MO-AS.2A.4  09:00
Study of Microwave Energy Localization in Human Tissue
Jang-Youl Kim, Soon-Il Jeon, Seong-Ho Son, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea

MO-AS.2A.5  09:20
A High-Order SAR Model for Multiple Transmitters in Portable Devices
Jian Li, Su Yan, Yayan Liu, Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States; Bertrand M. Hochwald, University of Notre Dame, United States

MO-AS.2A.6  10:00
Virtual Humans for Antenna/Implant Modeling
Gregory M Noortzcher, NEVA Electromagnetics, LLC, United States; Janukinath Yanamadalla, Worcester Polytechnic Inst., United States; Harshil V Tankara, Worcester Polytechnic Inst., United States; Sergey V Makarov, NEVA Electromagnetics, LLC, United States; Sara Louie, ANSYS, Inc., United States; Alexander Prokop, CST AG, Germany, Ara Nazarian, Harvard Medical School, United States

MO-AS.2A.7  10:20
Intelligent Sensing using a System of Multiple Microwave Resonators
Ali Abadi, Omar Khamis, University of Waterloo, Canada

MO-AS.2A.8  10:40
Metamaterial Isolator for RFID Based Biomedical Repeater System
Elham Moradi, Mohammad Waqs Ahmad Khan, Louis Syedinho, Tampere University of Technology, Finland; G. Steven Bova, University of Tampere, Finland; Leena Ukkonen, Tampere University of Technology, Finland

MO-AS.2A.9  11:00
Unintended RF Energy Coupling during Endoscopy
Satheesh Bujia Venkatkrishnan, The Ohio State University, United States; Edward Jones, The University of Colorado and the Denver VAMC, United States; Asimina Kouri, The Ohio State University, United States

MO-AS.2A.10  11:20
Shaping Transient Fields at Microwave Frequencies by Time Reversal Focusing Method
Desthuang Zhao, Fei Guo, University of Electronic Science and Technology of China, China

MO-AS.2A  Hillcrest CD

Thursday, July 10 08:00 - 11:40

MO-UF  Golden Hill AB
Innovative Application and Methods for Detection and Estimation
Session Co-Chairs: Gregory Huff, Texas A&M University; Jonah Gollub, Duke University

MO-UC.A1.1 08:00
Enhancing Machine Learning Techniques for Occupancy Estimation and Socio-Physical Graph Reconstruction Using Reconfigurable Antennas
Pranay Edanta, Hai Li, Nagaraj Janakiraman, N. R. Anudeep Tungala Tungala, Jean-Francois Chamberland, Gregory Huff, Texas A&M University, United States

MO-UC.A1.2 08:20
Single-Frequency Imaging from Dynamic Metasurface Antennas
Timothy Sleasman, Mohammadreza F. Imani, Michael Boyarsky, Thomas Fromenteze, Jonah N. Gollub, David R. Smith, Duke University, United States

MO-UC.A1.3 08:40
How to locate precisely and efficiently the scatterers of a target contributing to its RCS
Jerome Simon, Juan Carlos Castelli, ONERA, France

MO-UC.A1.4 09:00
Clock Synchronization Challenges for On-Site Coding Digital Beamformer
Sathheeh Bojaka Venkatakrishnan, Alin Alman, John L. Volakis, The Ohio State University, United States

MO-UC.A1.5 09:20
Impact of UAV Swarm Density and Heterogeneity on Synthetic Aperture DoA Convergence
Zhong Chen, Jean-Francois Chamberland, Gregory Huff, Texas A&M University, United States

Break 09:40

MO-UC.A1.6 10:00
Full-wave Analysis of Time of Arrival Based Localization with Polarization Diversity
Fikadu Dagefu, Gunjan Verma, Brian Sadler, U.S. Army Research Laboratory, United States; Richard Kazick, Bucknell University, United States; Kamal Sarabandi, University of Michigan, United States

MO-UC.A1.7 10:20
Localization via the Received Signal Strength Gradient at Lower VHF
Gunjan Verma, Fikadu Dagefu, Brian Sadler, U.S. Army Research Laboratory, United States; Kamal Sarabandi, University of Michigan, United States

MO-UC.A1.8 10:40
Backscattering Assessment of Small Targets in the Radiative Near-Field for Automotive Collision Avoidance Radar
Wen-Jiao Liao, Yuan-Chang Hou, Tai-Heng Hsieh, Hao-Ju Hsieh, National Taiwan University of Science and Technology, Taiwan

In Memoriam of Per-Simon Kildal
Session Co-Chairs: Stefano Maci, University of Siena; Eva Rajo-Iglesias, University Carlos III of Madrid; Ahmed Kishk, Concordia University

MO-SP.1P.1 13:20
Per-Simon Kildal - Thoughts From Our 15 Years As Colleagues in Trondheim
Erik Lie, Lockheed Martin, United States

MO-SP.1P.2 13:40
Per-Simon Kildal and Design of Electromagnetic Structures: Outstanding Combination of Scientific Concepts and Engineering Intuition
Zvonimir Sipus, Juraj Bartolic, Silvio Hrabar, University of Zagreb, Croatia

MO-SP.1P.3 14:00
Reverberating Dreams - the Story of an OTA Chamber
Andres Aloyan Glazunov, Chalmers University of Technology, Sweden; Jan Carlsson, Proven AB, Sweden; Christian Patané Lätböck, Bluetest AB, Sweden

MO-SP.1P.4 14:20
Obtaining Total Isotropic Sensitivity from Average Fading Sensitivity in Reverberation Chamber
Jun Luo, Edwin Mendiviel, Michael Christopher, ETS-Lindgren, United States

MO-SP.1P.5 14:40
State of the Art and Development of High Gain Planar Gap Waveguide Antennas at Chalmers University of Technology
Jan Yang, Ashraf Zayed, Abbas Vosough, Jinlin Liu, Chalmers University of Technology, Sweden; Stefan Carlsson, Lars-Ingve Sjöqvist, Gapwaves AB, Sweden

Break 15:00

MO-SP.1P.6 15:20
Continuous Beam Steering Antenna with Large 2D Coverage for 5G Applications
Karim Tekkouk, Jiro Hirokawa, Tokyo Institute of Technology, Japan; Ronan Sauleau, IETR (Institut d’Electronique et de Télécommunications de Rennes) UMR CNRS 6164, France; Makoto Ando, Tokyo Institute of Technology, Japan

MO-SP.1P.7 15:40
One Meter Deployable Reflectarray Antenna for Earth Science Radars
Nacer Chahat, Gregory Agnes, Jonathan Sauder, Thomas A Cwik, NASA Jet Propulsion Laboratory / Caltech, United States

MO-SP.1P.8 16:00
Analysis of Antenna and Scattering Problems Using a Spectrum of Two-Dimensional Solutions: a Review
Sembiam Renganjan, California State University, United States

MO-SP.1P.9 16:20
Groove Gap Waveguide in metallized 3D-printed plastic and in mechanized aluminium in Ka band
Adrian Tamayo-Dominguez, José-Manuel Fernández-González, Manuel Sierra-Pérez, Technical University of Madrid, Spain

MO-SP.1P.10 16:40
Synthesis of 3D-Printed Dielectric Lens Antennas Via Optimization of Geometrical Optics
Ray Tracing
Jordan Badhu, Yahya Rahmat-Samii, University of California, Los Angeles, United States
Benchmarking at the Frontiers of Computational EM
Session Chair: Ali Yilmaz, University of Texas at Austin

MO-SP.2P.1 13:20
Advancing Computational Electromagnetics Research though Benchmarking
Ali E. Yilmaz, The University of Texas at Austin, United States

MO-SP.2P.2 13:40
The benefit of simple benchmarks to highlight problems in CEM codes
Renier Marchand, Johannes van Tonder, Marianne Bingle, Danie le Roux, Mel van Rooyen, Ulrich Jakobus, Altair Development S.A., South Africa

MO-SP.2P.3 14:00
Benchmarking Full Wave Analysis of Periodic Structures: Non Perpendicularity at Periodic Boundaries
Vignesh Manohar, Yahya Rahmat-Samii, University of California, Los Angeles, United States

MO-SP.2P.4 14:20
Benchmarking computational electromagnetics with exact analytical solutions of canonical electromagnetic scattering problems
Danilo Erricolo, University of Illinois at Chicago, United States

MO-SP.2P.5 14:40
On Higher Order Imperative in Computational Electromagnetics Through Benchmarking of Boundary Element Methods for Canonical Scattering Problems
Mohammad Shoafi,y, Manitoba HVDC Center, Canada; Jonatan Aronsson, CEMWorks Inc., Canada; Vladimir Okhmatovski, University of Manitoba, Canada

Break 15:00

MO-SP.2P.6 15:20
Benchmarking the Solutions of Billion-Unknown Problems
Levent Gürel, ABAKUS Computing Technologies, Turkey

MO-SP.2P.7 15:40
Accurate and Efficient Simulation of Bioelectromagnetic Models
Apra Pandey, Nivedita Parthasarathy, Darryl Kostka, CST of America, United States; Alexander Prokop, Tilmann Wittig, CST AG, Germany

MO-SP.2P.8 16:00
On Computational Electromagnetic Code Testing and Benchmarking
Andrew D Greenwood, Air Force Research Laboratory, United States

MO-SP.2P.9 16:20
Figure of Merit for Computational Electromagnetics Solvers
Tayfun Ozturk, Virtual EM Inc., United States; Robert Burkholder, The Ohio State University, United States

MO-SP.2P.10 16:40
Austin Benchmark Suite for Computational Bioelectromagnetics: AIM Performance Data
Jackson W. Massey, Ali E. Yilmaz, The University of Texas at Austin, United States

Metamaterial Based Designs
Session Co-Chairs: Shah Nawaz Burokur, Université Paris Nanterre; Ana Diaz-Rubio, Aalto University

MO-UB.1P.1 13:20
Metaplatforms for Solving Integral Equations with Waves
Nasim Mohammadi Estakhri, Brian Edwards, Wader Engheta, University of Pennsylvania, United States

MO-UB.1P.2 13:40
Metamaterial Absorber for Oblique Incidence of Parallel and Perpendicular Polarization
Toan Trung Nguyen, Sungjoon Lim, Chung-Ang University, Republic of Korea

MO-UB.1P.3 14:00
Polarizability Extraction of Meta-Atoms Embedded in Waveguides
Laura Pulido-Mancera, Patrick Bowes, Mohammadreza F. Imani, David R. Smith, Duke University, United States

MO-UB.1P.4 14:20
Novel Metamaterial Polarizer
David Mahoney, Akim Akuruth, University of Massachusetts at Lowell, United States

MO-UB.1P.5 14:40
Transition metamaterials for local-field enhancement
Yang Li, Philip Gambrel-Muzar, Daryl Wood, Peter So, Yu Peng, Orad Rechel, Olivia Mello, Hooning Tang, Marka Lancer, Eric Mazur, Harvard University, United States

Break 15:00

MO-UB.1P.6 15:20
K-Space Signatures of Negative-Index Metamaterials
Imran Aghanejad, Kenneth J. Chau, Loïc Markley, The University of British Columbia, Canada

MO-UB.1P.7 15:40
Integrated topology optimization of volumetric antenna substrates and conductor surfaces for broadband microstrip patch antennas
Osman Seyginer, Gullu Kizilbas, Sabanci University, Turkey

MO-UB.1P.8 16:00
Surface-Wave Tracing by Flat Optics
Cristian Della Giovampaola, Mario Jr. Mencagli, Enrico Martinelli, Matteo Albani, Stefano Maci, University of Siena, Italy

MO-UB.1P.9 16:20
Tailoring Stability Properties of One-dimensional Non-Foster Electromagnetic Structures
Silvio Hrabar, Josip Loncar, Borna Vukadinovic, University of Zagreb, Croatia

MO-UB.1P.10 16:40
Split-Ring Resonators (SRR)-based antenna for WLAN applications
Fernan Paredes, Pau Aguilà, Simone Zuffanelli, Gerard Zama, Ferran Martin, Jordi Bonoche, Universitat Autonoma de Barcelona, Spain
Advances in Frequency Selective Surfaces
Session Co-Chairs: Chien-Hao Liu, National Taiwan University; Sean Hum, University of Toronto

MO-A2.1P.1 13:20
Plasma-Tunable Electronic Protection for Microwave Applications
Kamran Payne, Syracuse University, United States; Edwin Peters, Daniel Wedding, Carol Wedding, Imaging Systems Technology (IST) Inc., United States; Jun H. Cho, Syracuse University, United States

MO-A2.1P.2 13:40
Systematic Design of Single-Layer Multi-Stop-Band Frequency Selective Surfaces
Gengyu Xu, Sean V. Hum, George Eleftheriades, University of Toronto, Canada

MO-A2.1P.3 14:00
An Equivalent-Circuit Model of Miniaturized Split-Ring Resonator
Yih-Dar Chen, Chien-Hao Liu, National Taiwan University, Taiwan

MO-A2.1P.4 14:20
Rotationally Tunable Frequency Selective Surfaces for Large Areas via Linkage Mechanisms
Sultan Can, Asim Egemen Yilmaz, Ankara University, Turkey; Kamil Yavuz Kapusuz, Ghent University, Belgium

Break 15:00

MO-A2.1P.6 15:20
A Miniaturized Frequency Selective Surface by Using Vias to Connect Spiral Lines and Square Patches
Muaad Hussein, Jiafeng Zhou, Yi Huang, The University of Liverpool, United Republic of Tanzania

MO-A2.1P.7 15:40
Linkage Mechanism for Large-Area Reconfigurable Periodic Structures
Yi-Chia Hwang, Chien-Hao Liu, National Taiwan University, Taiwan

Break 15:00

MO-A2.1P.8 16:00
A Bandpass Circular Polarization Frequency Selective Surface with Wideband Rejection Properties
Yuheng Liu, Longjian Zhou, Jun Ouyang, University of Electronic Science and Technology of China, China

Leaky Wave Antennas
Session Co-Chairs: David R. Jackson, University of Houston; Ladislau Matekovits, Politecnico di Torino

MO-A1.1P.1 13:20
A Planar Leaky-Wave Antenna Offering Well Designed Leakage on the 2D Aperture Using Printed Width Modulated Microstrip Lines
Pasquale Maria Gallo, Politecnico di Torino, Italy; Symon K. Podilchak, Heriot-Watt University, United Kingdom; Ladislau Matekovits, Politecnico di Torino, Italy

MO-A1.1P.2 13:40
Axial and Circumferential Modulation on Cylindrical Metasurfaces
Subramanian Ramalingam, Swaseetharaman Pandi, Constantine A. Balanis, Craig R. Birtcher, Arizona State University, United States

MO-A1.1P.3 14:00
Analysis of the Radiating Properties of Endfire 1-D Leaky-Wave Antennas
Walid Fussaldo, Sapienza University of Rome, Italy; David R. Jackson, University of Houston, United States; Alessandro Galli, Sapienza University of Rome, Italy

MO-A1.1P.4 14:20
The Cause of Beam Squint in Planar Holographic Antennas
E'qab Almajali, Postdoctoral Fellow/Carleton University, Canada; Derek McNamara, Professor/University of Ottawa, Canada; Jim Wight, Professor/Carleton University, Canada

MO-A1.1P.5 14:40
Dispersive Analysis of a Dual-Layer Planar Structure for Leaky-Wave Antenna Applications
Davide Comite, Sapienza University of Rome, Italy; Symon K. Podilchak, Heriot-Watt University, United Kingdom; Paolo Baccarelli, Paolo Burghignoli, Alessandro Galli, Sapienza University of Rome, Italy; Al P. Freundorfer, Yahia M. M. Antar, Queen’s University, Canada

Break 15:00

MO-A1.1P.6 15:20
Bandwidth Analysis of Phase Crossover and Non-phase Crossover Frequency Operations of HAIS
Swaseetharaman Pandi, Subramanian Ramalingam, Constantine A. Balanis, Craig R. Birtcher, Arizona State University, United States

MO-A1.1P.7 15:40
A High Impedance Surface Based Leaky-Wave Antenna Excited by Collimated Surface-Wave
Zi Long Ma, Chi Hou Chan, Kong Bo Ng, City University of Hong Kong, Hong Kong SAR of China; Li Jun Jiang, The University of Hong Kong, Hong Kong SAR of China

MO-A1.1P.8 16:00
A Novel Feeding Structure for Second Higher Order Mode Excitation of Microstrip Leaky-Wave Antenna
Pengfei Zhang, Sheng Sun, University of Electronic Science and Technology of China, China

MO-A1.1P.9 16:20
Millimeter-Wave Periodic Dielectric Waveguide for Application of Radio-Wave Coverage in Confined Space
Xingying Huo, Junhong Wang, Beijing Jiaotong University, Institute of Lightwave Technology, China

MO-A1.1P.10 16:40
A Novel Seamless Scanning Leaky Wave Antenna in Ridge Gap Waveguide Technology
Xingchao Dong, Chinese Academy of Sciences, China; Hongjian Wang, National Space Science Center, China; Fei Xue, Yang Liu, Chinese Academy of Sciences, China; Guang Liu, National Space Science Center, China
**Phased Array Antennas: Special Topics I**

**Session Co-Chairs:** Davide Ramaccia, Roma Tre University; Jingeni Zhang, Ohio State University

**MO-A1.2P.1** 13:20  
**Design of Low-cost Phase-Shifters for Circularly Polarized Antenna elements using Partially Transmitting Surfaces**  
Raj Mittra, Ashwani Kumar, University of Central Florida, United States

**MO-A1.2P.2** 13:40  
**Interwoven Feeding Networks for Limited-Scan Phased Array Systems**  
Bilgehan Azer, Gabriel M. Rebeiz, University of California, San Diego, United States

**MO-A1.2P.3** 14:00  
**Beam sparse SMILE Array for Digital Beamforming with a Single RF Receiver**  
Yikun Huang, Lindsay Light, Yuanxun Ethan Wang, University of California, Los Angeles, United States

**MO-A1.2P.4** 14:20  
**Design of a Terahertz Beam-Steering Photomixer Array**  
Suleyman Burak Celik, Kazim Demir, Asaf Behzat Sahin, Mehmet Unlu, Ankara Yildirim Beyazit University, Turkey

**Break 15:00**

**MO-A1.2P.5** 15:20  
**A Compact Two-Dimensional Multibeam Antenna Fed by Two-Layer SIW Butler Matrix**  
Xiaojing Li, Ming Cai, Huafeng Shen, Guangli Yang, Shanghai University, China

**MO-A1.2P.6** 15:40  
**Cavity-Backed Slot ESPAR Cross Array with Two-Dimensional Beam Steering Control**  
Wei Ouyang, Xin Gong, University of Central Florida, United States

**MO-A1.2P.7** 16:00  
**A Dual Polarized All Metal Wideband Vivaldi Array with Wide Scan Ability**  
Burak Alptug Yilmaz, Doganay Dogan, Aselsan A.S., Turkey

**MO-A1.2P.8** 16:20  
**Wide-Angle Scanning Microstrip Phased Array Using Wide-Beam Element**  
Jun Wang, Zengliang Li, Song Wu, Huadong Zhang, Ruofan Li, Kang An, Beijing Electro-Mechanical Engineering Institute, China; Changrong Liu, Xueguan Liu, Lingfeng Mao, Soochow University, China

**MO-A1.2P.9** 16:40  
**Unequally Spaced Linear Antenna Array Synthesis using Multi-Objective Cauchy Mutated Cat Swarm Optimization**  
Lakshman Pappula, Debjani Ghosh, Indian Institute of Technology Bombay Bhubaneswar, India

**MO-A1.2P.10** 17:00  
**Direction Finding by Time Modulated Linear Array**  
Chong He, Xianling Liang, Weiren Zha, Guangjun Wen, Ruofan Li, Shanghai Jiao Tong University, China; Anjie Cao, Hui Di, Shanghai Institute of Satellite Engineering, China

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**Wideband Omni-directional Antennas**

**Session Co-Chairs:** Nobid Rahman, University of Colorado Boulder; Yilong Lu, Nanyang Technological University

**MO-A1.3P.1** 13:20  
**High-Efficiency Microwave Graphene Antenna**  
Shengjian Jammy Chen, Christophe Fumeaux, Tran Thanh Tung, Dusan Losic, The University of Adelaide, Australia

**MO-A1.3P.2** 13:40  
**Novel Ultra-Wideband “Robe” Antenna on High-Loss Paper Substrate**  
Hong Phuong Phan, Tran Phuoc Ngoc, Philippe Benich, Pascal Xavier, University Grenoble Alpes, IMEP – LTM, CNRS, France; Pascal Borel, Anastasia Delattre, Technical Center of Paper (CTP), France

**MO-A1.3P.3** 14:00  
**Multi-Objective Optimization for Assessment of Topological Modification in UWB Antennas**  
Adrian Bekasiewicz, Slawomir Kuziel, Reykjavik University, Iceland

**MO-A1.3P.4** 14:20  
**A Low Profile Stepped Wideband Monocone Antenna**  
Ankang Liu, Yilong Lu, Nanyang Technological University, Singapore

**MO-A1.3P.5** 14:40  
**Tunable UHF Origami Spring Antenna with Actuation System**  
Shan You, Kun Bao, Xueli Liu, Stavros V. Georgakopoulos, Florida International University, United States

**Break 15:00**

**MO-A1.3P.6** 15:20  
**A Wideband CPW-Fed Monopole Antenna with Linear and Circular Polarizations**  
Jun-Yu Lai, Wei Hsu Chia, Chien-Ten Wang, Department of Electrical Engineering/National University of Taiwan, Taiwan

**MO-A1.3P.7** 15:40  
**Broadband Omnidirectional Antenna for GSM900, GSM1800, 3G, 4G and Wi-Fi Applications**  
Mahima Arora, Indian Institute of Technology Jodhpur, India; Maryam Shajoei Baghini, Girish Kumar, Indian Institute of Technology Bombay, India

**MO-A1.3P.8** 16:00  
**Monopole of Decade Bandwidth Realized from A New Metal-Dielectric Hybrid Structure**  
Debatash Guha, University of Calcutta, India; Debarati Ganguly, Lourdes Matha College of Science and Technology, India; Sumeet George, St. George’s College, India; Yahia M. M. Antar, Royal Military College of Canada, Canada

**MO-A1.3P.9** 16:20  
**A Planar Dipole Antenna with Parasitic Elements for Beamwidth Enhancement across a Wide Frequency Band**  
Wenbin Qiu, Chang Chen, WaiKong Chan, University of Science and Technology of China, China; Huailiang Zhang, University of Massachusetts Lowell, United States

**MO-A1.3P.10** 16:40  
**A Compact and Broadband CPW-Fed Folded-Slot Antenna for C-Band Application**  
Taochuan Fang, Yangjian Huang, Guangjun Wen, University of Electronic Science and Technology of China, China
Materials and Packaging
Session Co-Chairs: Kubilay Sertel, Ohio State University; Alkim Akyurtlu, University of Massachusetts Lowell

MO-UA.1P.1 13:20
Dielectric Properties of Low-loss Polymers for mmW and THz Applications
Seckin Sahin, Nilu K. Nahar, Kubilay Sertel, The Ohio State University, United States

MO-UA.1P.2 13:40
Fabrication of Functionally Graded Ceramic-Polymer Dielectrics via Freeze Casting for RF Applications
Osman Sayginer, Gullu Kiziltas, Sabanci University, Turkey

MO-UA.1P.3 14:00
A Study for RCS Broadband Reduction due to Dielectric Constant of Radar Absorbent Material
Yuka Ishii, Naobumi Michishita, Hisashi Morishita, National Defense Academy, Japan

MO-UA.1P.4 14:20
Printed Interconnects between Components for Microwave Applications
Elicia Harper, Craig Armiento, University of Massachusetts Lowell, United States; Susan Trulli, Raytheon IDS, United States; Alkim Akyurtlu, University of Massachusetts Lowell, United States; Christopher Laighton, Raytheon IDS, United States

MO-UA.1P.5 14:40
Practical Guidelines for PWB Circuits Using Reactive Field Theory
Carolyn Reistad, University of Massachusetts Lowell, United States; Thomas Sikina, Raytheon-UMass Lowell Research Institute, United States; Alkim Akyurtlu, University of Massachusetts Lowell, United States

Optimization Methods in EM Design
Session Co-Chairs: Douglas Warner, Pennsylvania State University; Daniel Weile, University of Delaware

MO-A3.1P.1 13:20
The Shape Optimization of Closely-Spaced Electrically-Small Antennas
Anas Alakhras, Derek McMamara, University of Ottawa, Canada

MO-A3.1P.2 13:40
Multi-objective Surrogate-Assisted Optimization Applied to Patch Antenna Design
John Essam, Jogender Nagar, Douglas H. Werner, The Pennsylvania State University, United States

MO-A3.1P.3 14:00
Metamaterial-based Composite Reflector Antenna Optimization
Richard Obermeier, Jose A. Martinez Lorenzo, Northeastern University, United States

MO-A3.1P.4 14:20
A Direct Synthesis Algorithm Having a Broad Range of Validity for Electromagnetic Design
Peng Li, Dan Jiao, Purdue University, United States

MO-A3.1P.5 14:40
Efficient Optimization of a Simple Compact Resonant Cavity Antenna
Mania Kavaleva, David Bulger, Karu P. Esselle, Macquarie University, Australia

Break 15:00

MO-A3.1P.6 15:20
Sparse Linear Regression for Optimizing Design Parameters of Double-T-Shaped Monopole Antennas
Yashika Sharma, Junqiang Wu, Hao Xin, Hao Helen Zhang, University of Arizona, United States

MO-A3.1P.7 15:40
Implicit Space Mapping with Substrate Segmentation for Reliable Antenna Optimization
Slawomir Krasil, Adrian Bakiszewicz, Reykjavik University, Iceland

MO-A3.1P.8 16:00
Optimization of 2.45-GHz Pixel Rectenna for Wireless Power Transmission using Mixed Integer Linear Programming
Shanpu Shen, Chi-Yuk Chiu, Ross D. Murch, The Hong Kong University of Science and Technology, Hong Kong SAR of China

MO-A3.1P.9 16:20
Bioinspired symbiosis algorithm Another focus in multiobjective optimization.
Nierenberg Ramos, Glaucia Fontgalland, Federal University of Campina Grande - UFCG, Brazil

MO-A3.1P.10 16:40
Analysis and Synthesis of Sierpinski Gasket Fractal Antenna using ANFIS
Aarti Gehani, Prashasti Agnihotri, Dhaowal Pujara, Nirma University, India
Antenna Theory II
Session Co-Chairs: Ted Simpson, University of South Carolina; Jeffrey Young, Oklahoma State University

MO-A1.4P.1 13:20
Application of Autocorrelation Principles for Evaluating the Performance of Radiating Structures Comprised of Line Source Radiators
Christopher Wilson, Jeffrey Young, Oklahoma State University, United States

MO-A1.4P.2 13:40
On the Admitting Area of Slender Antennas
Hamid Shannan, Raphael Kastner, Tel Aviv University, Israel

Radiation Pattern Synthesis For A Prolate Spheroidal Antenna
Marco Poort, Piergiorgio L. E. Uslenghi, University of Illinois at Chicago, United States

MO-A1.4P.5 14:40
The Far Field of Antennas in Practical Scenarios
Mohammad Abdallah, Tapan Sarkar, Syracuse University, United States; Magdalena Salazar-Palma, Universidad Carlos III de Madrid, Spain

Break 15:00

MO-A1.4P.6 15:20
Analysis of the Degree of Practically Achievable Superdirectivity using Poynting Streamline Method
Junming Diao, Karl F. Warnick, Brigham Young University, United States

Closed Form Expressions for the Realistic Modeling of Weakly Directive Antenna Patterns
Stefano Marulà, Stefano Mazza, Giuseppe Peluso, Monica Righini, Stefano Selleri, University of Florence, Italy

Realizing Orbital Angular Momentum (OAM) Beam with Small Divergence Angle by Luneberg Lens
Yu Yao, Xiaoqin Liang, Weiren Zhu, Jianping Li, Zhiqiang Sun, Shanghai Jiao Tong University, China

On Massive MIMO Antenna Topologies using Total Power in the Azimuth and Zenith Domains
Affum Emmanuel Appama, HaoBin Zhang, Yongjun Huang, Wen Guangjun, Oteng Gyasi Kwame, University of Electronic Science and Technology of China, China

Frequency Selective Surfaces and Filters
Session Co-Chairs: Ryan Adams, University of North Carolina at Charlotte; David R. Jackson, University of Houston

MO-UB.2P.1 13:20
Sleeve Monopole Antenna with Integrated Filter for Base Station Applications
Joshua Stefan, Anmphonal Antenna Solutions, United States; Ryan Adams, University of North Carolina at Charlotte, United States

Leaky-mode Analysis of Wideband Fabry-Pérot Cavity Antennas
Ahmad Almutawa, Alistar Hosseini, Filippo Capolino, University of California, Irvine, United States; David R. Jackson, University of Houston, United States

Tunable Dual-band Bandpass Filter Using Piezoelectric Transducer (PET)
Dongjin Jung, Skyworks Solutions, United States; Kai Chang, Texas A&M University, United States

Improving Absorption Using Time-Variant Electromagnetic Systems
Hamidreza Kazemi, Mahdi Vaeysi, Mohamed A. K. Othman, Filippo Capolino, University of California, Irvine, United States

Screen Printed Electromagnetic Metamaterial Absorber
Heijun Jeong, Sungjoon Lim, Chung - Ang University, Republic of Korea

Reconfigurable Band Rejection and Band-Pass Frequency Selective Structures
Jeffrey Kula, John L. Volakis, The Ohio State University, United States

Single-Layer Multiband FSS for Wi-Fi Applications
Te-Kao Wu, FSS and Antenna Consulting, United States

Frequency Selective Surfaces for Microwave Frequency Band Applications
Khem Poudel, Vijay Koju, William Robertson, Middle Tennessee State University, United States

Conformal Dual-Band Frequency Selective Surface on Textile: Design, Prototyping and Experiment
Sultan Can, Asım E Gamze Yılmaz, Emnelluk Karakaya, Ankara University, Turkey

An Empirical Formula for Resonant Frequency Shift due to Jerusalem-Cross FSS with Substrate on One Side
Hsing-Yi Chen, Shu-Huan Wen, Yuan Ze University, Taiwan
Remote Sensing II
Session Co-Chairs: Susan Hagness, University of Wisconsin-Madison; Natalia Nikolaou, McMaster University

MO-A4.1P.1 13:20
Complex Permittivity Characterization Based on the Matrix-Pencil Method for Objects on the Human Body
Hipolito Gomez-Sousa, Jose A. Martinez-Lorenzo, Northeastern University, United States

MO-A4.1P.2 13:40
Effective Noise Antenna Factor FA Estimate at Depth
Nicholas Lumsden, Jack Dao, Sali Serna, Israel Perez, Sara Wheeland, John D. Rockway, SPAWAR Systems Center Pacific, United States

MO-A4.1P.3 14:00
Feasibility of Efficient and Accurate Estimation of Cranberry Crop Yield using Microwave Sensing
Alex Hautler, John Booske, Susan Hagness, University of Wisconsin-Madison, United States; Benjamin Tilberg, Lindsay Wells-Hansen, Rodney Serres, Ocean Spray Cranberries Inc., United States

MO-A4.1P.4 14:20
Air Core Loop Antenna Calibration Methods
Drew Overturf, Nicholas Lumsden, Jack Dao, Doeg Rodriguez, John D. Rockway, SPAWAR Systems Center Pacific, United States

MO-A4.1P.5 14:40
Low Complexity RF Sensor for Multiphase Oil Flow Estimation in Pipelines
Muhammad Tayyab, Mohammad Said Sharawi, Abdelsalam Al-Sarkhi, King Fahd University of Petroleum and Minerals, Saudi Arabia

Break 15:00

MO-A4.1P.6 15:20
Sensitivity of Synthetic Aperture Radar Imaging to Ship Generated Internal Wave Field
Jiakun Wang, Min Zhang, Xidian University, China

MO-A4.1P.7 15:40
A Novel Energy Detection Algorithm Based on power distribution difference
Ning Liu, Shaoia Guo, Northwestern Polytechnical University, China

MO-A4.1P.8 16:00
3D Image Reconstruction Using a Scanning Configuration and Focused SAR Technique
Saeed Rahimi, Parsa Dehkhoz, Abad Tavakoli, Amir Hossein Ahamdi, Amirkabir University of Technology, Iran

Implantable Antennas and Sensors
Session Co-Chairs: William Scanlon, Queen’s University of Belfast; William Scanlon, Queen’s University of Belfast

MO-A5.1P.1 13:20
Endoscopically-Implantable Wireless Devices for Endoluminal Applications
J.-C. Chiao, The University of Texas at Arlington, United States

MO-A5.1P.3 14:00
Effect of Implant Coating on Wireless Powering for Intracranial Pressure Monitoring System
Muhammad Waqas Ahmad Khan, Muhammad Razwan, Mohammad H. Behfar, Lauri Sydanheimo, Toni Björninen, Leena Ukkonen, Tampere University of Technology, Finland

MO-A5.1P.4 14:20
2.4GHz Monopole Antenna on Flexible Substrate for Implanting Sensor
Haruchii Kanaya, Kyohshi Yamaguchi, Yasuyuki Matsuishi, Kyushu University, Japan; Takahiro Kudo, Tokuya Furuichi, Fuji Electric Co., Ltd, Japan

MO-A5.1P.5 14:40
Efficiency Comparison of Inductive and Microwave Power Transfer for Biomedical Applications
Reem Shadid, University of North Dakota, United States; Sayeed Sajal, Minot State University, United States; Sima Noghanian, University of North Dakota, United States

Break 15:00

MO-A5.1P.6 15:20
Performance Analysis of Ultra Small Antenna in Body-Air Channel
Joo-seong Kang, Jae-chun Lee, Junyeob Soh, Sang Jooh Kim, Samsung Advanced Institute of Technology, Republic of Korea; Seang-cheol Kim, Seoul National University, Republic of Korea

MO-A5.1P.7 15:40
Effect Of Tumor Tissue On Implant Antenna Performance At 2.38 GHz
Matthew Magill, Gareth Conway, William Scanlon, Queens University Belfast, United Kingdom

MO-A5.1P.8 16:00
The Importance of Antenna Near-Field Losses in Intro-Body UHF Communication Applications
Yomna El-Saboni, Gareth Conway, William Scanlon, Queens University Belfast, United Kingdom

MO-A5.1P.9 16:20
Implantable Neurostimulator Lead Transfer Function Based on the Transmission Line Model
Sattar Atash-Bahar, Hjalti Sigmarsson, University of Oklahoma, United States; David Thompson, LivNova, United States

MO-A5.1P.10 16:40
Compact Implantable MIMO Antenna with Electro-Magnetic Band Gaps
Jin-hong Huang, Tianhai Chang, Xiangying Liu, South China University of Technology, China
**RF Propagation in Complex Environments**

Session Chair: David Michelson, University of British Columbia

**MO-UF.1P.1** 13:20
A Comparative Study of Radiowave Propagation Models for Urban and Suburban Paths
Ozlem Ozgun, Hacettepe University, Turkey

**MO-UF.1P.2** 13:40
Exploitation of LTE Channel Measurements at 450 MHz and Channel Modeling Implementation in a Suburban and Rural Deployment
Chonis Stournas, Democritus University of Thrace, Greece; Dimitris Anagnostou, Heriot-Watt University, United Kingdom; Michael Chryssomallis, Democritus University of Thrace, Greece

**MO-UF.1P.3** 14:00
Near Earth Propagation Loss Model in Forest for Low Power Wireless Sensor Network
Tatsuki Tokunou, Kyushu University, Japan

**MO-UF.1P.4** 14:20
Development of Path Loss Models for Low-power and Lossy Wireless Networks in Urban Environments using Data Analytics
Sol Lancashire, BC Hydro, Canada; Panham Zarei, David Michelson, University of British Columbia, Canada

**MO-UF.1P.5** 14:40
Comparison of Propagation Factor in Wireless Mobile Environment in Korea
Soon-Soo Oh, Joo-Won Choi, Chosun University, Republic of Korea; Hwa-Choon Lee, Chosun University, Republic of Korea; Young-Chul Lee, Donggeun Choi, Sung Won Park, Mokpo National Maritime University, Republic of Korea

**MO-UF.1P.6** 15:20
Simulation of the Received Power for V2V and V2I Communication Within Radius of 500m
Dong Woo Kim, Chosun University, Republic of Korea; Wook Ki Park, Incheon Technopark, Republic of Korea; Jin Dae Kim, Jong Wook Kim, Se Woong Na, Carnavicom, Republic of Korea; Soon-Soo Oh, Chosun University, Republic of Korea

**MO-UF.1P.7** 15:40
A new propagation prediction approach based on Ray Launching and Diffusion Equation techniques for complex environments
Leyre Azpilicueta, Tecnologico de Monterrey, Mexico; Francisco Falcone, Public University of Navarra, Spain; Ramakrishna Janaswamy, University of Massachusetts, United States

**MO-UF.1P.8** 16:00
Investigation of 60 GHz Wireless Propagation in an Indoor Environment
Zahed Jalaal, Sungkyun Lim, Georgia Southern University, United States; Carol Ansley, ARRIS Group Inc., United States

**MO-UF.1P.9** 16:20
Ray-Based Reconstruction Algorithm for Multi-Monostatic Radar in Imaging Systems
Kurt Jaisle, Carey Rappaport, Northeastern University, United States

**MO-UF.1P.10** 16:40
Computational Polarimetric Localization with a Radiating Metasurface
Thomas Fromentere, Xlim Research Institute & CNIP - Duke University, France; Michael Bayarsky, Okan Yurduseven, Jonah N. Gollub, Daniel L. Marks; David R. Smith, CNIP - Duke University, United States

**RFID and RF Measurements**

Session Co-Chairs: Ronald Pogorzelski, California State University, Northridge; Jianming Jin, University of Illinois at Urbana-Champaign

**MO-UB.3P.1** 13:20
A Low-Profile Directional UHF Near-field RFID Reader Antenna
Yunxia Zeng, Institute for Infocomm Research, Singapore; Zhi Ning Chen, National University of Singapore, Singapore; Raining Qing, Institute for Infocomm Research, Singapore; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

**MO-UB.3P.2** 13:40
Optimal impedance matching for power and data transmission in wearable devices
Janghyun Lee, Se Woong Kim, Jong Jin Baek, Youn Tae Kim, Chosun University, Republic of Korea

**MO-UB.3P.3** 14:00
A Mapping for Spectral Filtering in Planar Near-Field Aperture Antenna Measurement
Ronald J. Pogorzelski, California State University, Northridge, United States

**MO-UB.3P.4** 14:20
Analysis of Wireless Power Transfer (WPT) Scheme with Connected Ground Planes
Saeed Khan, Kansas State University, United States

**MO-UB.3P.5** 14:40
Computing the Far Field of an Aperture Antenna in the Plane of the Aperture from its Near Field
Ronald J. Pogorzelski, California State University, Northridge, United States

**EM Educational Methods and Tools**

Session Co-Chairs: Adam Mehrabani, Johns Hopkins University; Jeffery Williams, Sandia National Laboratories

**MO-UB.4P.1** 15:20
Preliminary results on students’ study habits and their grades in STEM courses
Saeed Khan, Kansas State University, United States; Mohammad Abdollah, Tapan Sarkar, Syracuse University, United States; Magdalena Salazar-Palma, Universidad Carlos III de Madrid, Spain

**MO-UB.4P.2** 15:40
Electromagnetics at Sandia National Laboratories
Lorenzo Basilio, Jeffery Williams, Lucas Feldner, Sandia National Laboratories, United States

**MO-UB.4P.3** 16:00
THE DISTINCTION BETWEEN ZENNECK WAVES AND SURFACE PLASMON POLARITONS
Mohammad Abdollah, Tapan Sarkar, Syracuse University, United States; Magdalena Salazar-Palma, Universidad Carlos III de Madrid, Spain

**MO-UB.4P.4** 16:20
System normalization of the Taeduk Radio Astronomy Observatory and application plan to the National Youth Space Center in Korea
Janghyun Lee, Se Woong Kim, Jong Jin Baek, Youn Tae Kim, Chosun University, Republic of Korea; Jin Dae Kim, Jong Hoong Jung, Il-Gyo Jeong, Young Sik Kim, Korea Astronomy and Space Science Institute, Republic of Korea

**MO-UB.4P.5** 16:40
Application of Single Layer Reduction Technique in Multilayer Transmission Lines
Payal Majumdar, University of Delhi South Campus, United States
Physical Reconfiguration through Advances In Programmable Materials and Adaptive Mechanics
Session Co-Chairs: Gregory Huff, Texas A&M University; Derek Doyle, Air Force Research Laboratory

TU-SP.1A.1 08:00
Materials for liquid RF electronics
Christopher Tabor, Michelle Champman, United States Air Force Research Laboratory, United States; Brad Comby, UES, Inc., United States

TU-SP.1A.2 08:20
Frequency Tuning through Physical Reconfiguration of a Corrugated Origami Frequency Selective Surface
Kazuko Fuchi, University of Dayton Research Institute, United States; Giorgio Bazzan, Andrew Gillman, UES, Inc., United States; Gregory Huff, Texas A&M University, United States; Philip Buskohl, Edward Aljanik, Air Force Research Laboratory, United States

TU-SP.1A.3 08:40
Mode Reconfigurable Bistable Spiral Antenna Based on Kresling Origami
Xueli Liu, Shun Yao, Stavros V. Georganakopoulos, Florida International University, United States

TU-SP.1A.4 09:00
An Inkjet-printed Tunable Origami Frequency Selective Surface on Cellulose Paper
Syed Abdulbaset Naouraz, Bijan Tahmani, Wenjing Su, Ryan Bahr, Manas M. Tontzeris, Georgia Institute of Technology, United States

TU-SP.1A.5 09:20
Polarization Reconfigurable Antennas Using a Liquid Metal Switching Mechanism
Michelle Champian, Air Force Research Laboratory, United States; Brad Comby, UES, Inc., United States; Emily Belovich, University of Cincinnati, United States; Daniel Jackson, Riverside Research Institute, United States

Break 09:40

TU-SP.1A.6 10:00
Beamforming and Reconfiguration of a Structurally Embedded Vascular Antenna Array (SEVA2) in a Complex Curved Composite
Jeffrey Baer, Air Force Research Laboratory, United States; Darren Hartl, Texas A&M University, United States; Geoffrey Frank, Rhynl Bradford, Air Force Research Laboratory, United States; David Phillips, University of Dayton, United States; Thao Gibson, Daniel Rapking, Air Force Research Laboratory, United States; Amita Bol, Hong Pan, Gregory Huff, Texas A&M University, United States

TU-SP.1A.7 10:20
Reconfigurable and Time-Varying Metamaterials
Dimitrios Sounas, Younes Radi, Giuseppe D’Aguanno, Andrea Alu, The University of Texas at Austin, United States

TU-SP.1A.8 10:40
Soft-Matter Electronics and Multifunctional Materials with Polydisperse Liquid Metal Suspensions
Khaliid Javed, Navid Kazem, Carmel Majidi, Carnegie Mellon University, United States

TU-SP.1A.9 11:00
Physically Reconfigurable Antennas: Concepts and Automation
Youssef Jaww, Joseph Costantine, Firas Ayoub, Christine Christodoulou, University of New Mexico, United States; Derek Doyle, Steven Lane, Air Force Research Laboratory, United States

TU-SP.1A.10 11:20
Electrically-Shaped Liquid Metals in 1- and 2-D for Reconfigurable Apertures
Meng Wang, Michael Dickey, Jacob Adams, North Carolina State University, United States

Compressive Sensing as Applied to Electromagnetics - Advances, New Trends and Applications
Session Co-Chairs: Mahlia Moghaddam, University of Southern California; Michael Marco Donald, University of Cassino and Southern Lazio

TU-SP.2A.1 08:00
Radar target recognition using compressive backscatter
Ismail Jouini, Lafayette College, United States

TU-SP.2A.2 08:20
The Minimum Trace Regularization Approach in Electromagnetics: Theory and Perspectives
Marco Donald Migliore, University of Cassino and Southern Lazio, Italy

TU-SP.2A.3 08:40
Synthesis of Sparse Linear Array with Multiple Patterns Based on Joint Sparse Recovery
Xiaowen Zhao, Qinghuan Yang, Yunhua Zhang, CAS Key Laboratory of Microwave Remote Sensing, China

TU-SP.2A.4 09:00
Fast Antenna Testing via Regularization Procedures based on Compressive Sensing
Benjamin Fuchs, Laurent Le Coq, Université de Rennes 1, France

TU-SP.2A.5 09:20
Sparse Conformal Array Design for Multiple Patterns Generation through Multi-task Bayesian Compressive Sensing
Giorgio Gottardi, Luca Turinna, Nicola Anselmi, Giacomo Oliveri, Paolo Rocco, University of Trento, Italy

TU-SP.2A.6 09:40
Sparse Multilayered Subsurface Imaging in MIMO Radar Using Total Variation Minimization
Ahmad Hoorfar, Wenji Zhang, Villanova University, United States

TU-SP.2A.7 10:00
Microwave Imaging of Dielectric Targets Using Higher-Order Sparse Processing
Manja Nikolic, Nebojsha Vojnovic, Antonije Djojojevic, Dragom Olican, University of Belgrade, Yugoslavia; Ayse Neharini, Washington University in St. Louis, United States

TU-SP.2A.8 10:20
Inverse Scattering and Collaborative Sensing as advanced e.m. design tools
Tommaso Isamna, Roberto Palmeri, Andrea Francesco Morabito, University Mediterranea of Reggio Calabria, Italy; Lareto Di Donato, University of Catania, Italy

TU-SP.2A.9 10:40
Matrix Norm Based Method For Recovery of High Contrast and Sparse Objects in Microwave Imaging
Pratik Shah, Mahlia Moghaddam, University of Southern California, United States

TU-SP.2A.10 11:00
Compressive sensing using approximated total variant transform to reduce the required number of antennas in radar-based medical imaging
Lei Guo, Konstanty S. Bialkowski, Amin Abbosh, The University of Queensland, Australia.
New Physics in Guiding Systems II
Session Co-Chairs: Majid Manteghi, Virginia Tech; Fatih Erden, Turkish Naval Academy

TU-A2.1A 08:00
Non-Reciprocal Electromagnetics in Time-Varying Systems
Dimitrios Sounas, Andrea Alù, The University of Texas at Austin, United States

TU-A2.1A.3 08:40
Simulation of Space-Time Varying Metasurface Using Finite-Difference Time-Domain Technique
Yousef Vahabzadeh, Nima Chamanara, Christophe Caloz, École Polytechnique de Montréal, Canada

TU-A2.1A.4 09:00
Electromagnetic Nonreciprocity and Perfect Mixing in Space-time Engineered Asymmetric Bandgaps
Nima Chamanara, Sajjad Taravati, Zoé-Lise Deck-Léger, Christophe Caloz, Polytechnique Montréal, Canada

TU-A2.1A.5 09:20
Semi-Analytical Finite-Difference Technique for Steady-State Field Characterization of Space-Time Modulated Huygens’ Metasurfaces
Scott A. Stewart, Tom J. Simy, Shuklabh Gupta, Carleton University, Canada

Break 09:40

TU-A2.1A.6 10:00
Experimental Verification of Degenerate Band Edge Dispersion in Metallic Waveguides
Mohamed A. K. Othman, University of California, Irvine, United States; Xuyuan Pan, Georgios Atmatzakis, Christos Christodoulou, University of New Mexico, United States; Filippo Capolino, University of California, Irvine, United States

TU-A2.1A.7 10:20
Dispersion Engineering and Mode Control using Multiple Pairs of Non-Identical Coupled Transmission Lines
Muhammed Zubori, The Ohio State University, United States; John L. Volakis, ElectroScience Laboratory, United States

TU-A2.1A.8 10:40
Non-reciprocal Topologically Protected Meta-waveguide for Routing Circularly Polarized Signals with Opposite Handedness
Davide Ramacca, Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy

TU-A2.1A.9 11:00
A Wide Band Polarization Independent Metamaterial Based Electromagnetic Absorber
M. Ismail Khan, Farooq Ahmad Tahir, National University of Sciences & Technology, Pakistan

Guided and Radiating Structures with Metasurfaces and Metamaterials
Session Co-Chairs: Edward Kuester, University of Colorado Boulder; Davide Ramacca, Roma Tre University

TU-A2.2A 08:00
Guiding and Radiating Microwave Components with Enhanced Functionalities Enabled by Metamaterials
Miroko Barbuto, Niccolò Cusano university, Italy; Fabrizio Tratto, Elettronica S.p.A., Italy; Davide Ramacca, Antonina Fadia, Filiberto Bilotti, Alessandro Toscano, Roma Tre University, Italy

TU-A2.2A.3 08:40
Effect of Higher-Order Modes on Extraordinary Transmission Through a Dielectric-Loaded Slot in a Thick Metallic Shield
Abdulrazzak Haddad, Edward Kuester, University of Colorado Boulder, United States

TU-A2.2A.4 09:00
Miniaturized Tunable Artificial Magnetic Conductor for Low LTE Band
Nabil Ksaitou, Jean-François Pintos, CEA-LETI, France; Kouroch Mahdjoubi, IETR, France

TU-A2.2A.5 09:20
Dual-Polarized, Binary-State Metamaterial with Integrated Bias Lines
Scott Rudolph, US Naval Research Laboratory, United States

Break 09:40

TU-A2.2A.6 10:00
A Novel Ultra Compact Four-way Power Divider with Integrated Filtering Function for WLAN Applications
Ahmed M. Hussien, Yasser S. Farag, Ahmed F. Dow, MSA University, Egypt; Mahmoud A. Abdalla, MIT College, Egypt

TU-A2.2A.7 10:20
Sharp Fano Resonances in Bi-Layered Symmetric ZStructures
Elena Bachkova, André de Lustrac, Anatole Lopu, Université Paris-Saclay, France; Thomas Lepetit, ONERA - The French Aerospace Lab, France; Shah Nawaz Burokur, Université Paris Ouest, France

TU-A2.2A.8 10:40
A bilayer ELC Metamaterial for Multi-resonant Spectral Coding at mm-Wave Frequencies
Ali Molaei, Juan Hernandez Juecas, Northeastern University, United States; Andrew Westwood, Keysight Technologies, United States; Sivasubramanian Somu, Jose A. Martinez-Lorenzo, Northeastern University, United States

TU-A2.2A.9 11:00
Wideband Low-Profile Circular Polarization Slot Antenna Based on Metasurface
Yongjun Huang, Jian Li, Guangjun Wen, University of Electronic Science and Technology of China, China

TU-A2.2A.10 11:20
Spoof Surface Plasmon (SSP) Transmission Line Transition Design Using Slow-wave Coplanar Waveguide (S-CPW)
Xiao-Lan Tang, Southern University of Science and Technology and Southeast University, China; Qingfeng Zhang, Southern University of Science and Technology, China; Samming Hu, Southeast University, China; Yifan Chen, Southern University of Science and Technology, China
**Phased Array Antennas: Special Topics II**

**Session Co-Chairs:** Paola Pirinoli, Politecnica di Torino; Navid Barani, University of Michigan

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

**A Generalized Technique for Conformal Antenna Array Synthesis**

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

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

**Bandwidth Performance of an Antenna Array with Tapped Delay-Line and Compressive Sensing**

Ismail Jouny, Lafayette College, United States

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

**Wideband Phased Arrays Synthesis with Maximum Bandwidth through Iterative Convex Optimization**

Le Trong Phuoc Bui, Nicola Anselmi, Giorgio Guttardi, Lorenzo Poli, Paolo Rocca, University of Trento, Italy

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

**Hierarchical Beamforming Networks for Phased Array of Antennas by Subarray Modularization**

Hao-Ju Huang, Yuan Ze University, Taiwan; Hsi-Tseng Chou, National Taiwan University, Taiwan

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

**Fabrication and Measurements of a Low-Cost, Dual-Polarized Advanced Planar Array with Wide Scanning Coverage**

Matilda Livadaru, John L. Volakis, The Ohio State University, United States

**Break** 09:40

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

**Analytical Far-field Calculation of Arbitrarily Oriented Antenna Arrays**

Hassan Mehrpour Bernetry, Suvesh Venkatesh, David Schurig, University of Utah, United States

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

**Wideband Scanning Array of Spiral Antennas for Simultaneous Transmit and Receive (STAR)**

Alexander Hasepeian, Elias Alwan, John L. Volakis, The Ohio State University, United States

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

**Coordinately Distributed Smart Antenna Network for WLAN Applications via the Cloud Database Management and Radiation Pattern Reconfiguration**

Hsi-Tseng Chou, Jun-Yuan Cheng, Yao-Chiang Kan, Kuang-Min Lin, Yuan-Ze University, Taiwan

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

**Study on Wide-Angle Scanning Linear Phased Array**

Guangwei Yang, Jianying Li, Northwestern Polytechnical University, China

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

**Error Analysis for Time Modulated Arrays**

Mohammadreza Amjadi, Mohammad Fakharzadeh, Sharif University of Technology, Iran

**Wideband Directional Antennas I**

**Session Co-Chairs:** Muhammad AlTarifi, University of Colorado Boulder; Yahia Antar, Royal Military College of Canada

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

**A Compact Cavity-Backed Monopole Antenna For UWB Applications**

Eric Merkley, Queen’s University, Canada; Brad Jackson, Defence Research and Development Canada, Canada; Carlos Saavedra, Queen’s University, Canada; Yahia M. Antar, Royal Military College of Canada, Canada

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

**Electro-Mechanical Analysis of Flat Radomes for Airborne Antennas at K/Ka/V-band**

Ljubodrag Boskovic, Maxim Ignatenko, Conrad Andrews, Roger Hasse, Dejan Filipovic, University of Colorado Boulder, United States

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

**Wide-Band Circularly Polarized Antenna using Partially Transmitting Surface**

Ashwani Kumar, Raj Mittra, University of Central Florida, United States

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

**A Miniaturized UWB Bi-Planar Yagi-Like Antenna**

Syed Shahabul Islam, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia

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

**Loop Antennas with Wideband Circular Polarization**

Kazuhide Hinose, Kyosuke Okiyama, Shibaura Institute of Technology, Japan; Hisamatsu Nakana, Hosei University, Japan

**Break** 09:40

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

**Multi-Layer Dielectric Rod Antenna With Stable Patterns Over Decade Bandwidth**

Muhammad AlTarifi, Dejan Filipovic, University of Colorado Boulder, United States

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

**Wide Band Multi-Beam Cylindrical Lens**

Amin Darvazehbani, Ahmad Emadeddin, Amirkabir University, Iran; Omid Manoochehri, Danilo Erricolo, University of Illinois at Chicago, United States

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

**Broadband Partially Reflective Surface Antenna With Tapered Corrugated Ground**

Lu-Yang Ji, Hai-Liang Zhu, Northwestern Polytechnical University, China; Pei-Yuan Qin, Y. Jay Guo, University of Technology Sydney, Australia

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

**Broad-Band Cavity-backed and Probe-Fed Microstrip Phased Array Antenna in X-Band**

Sen Feng, Mou-jing Jin, East China Research Institute of Electronic Engineering, China
Advances in Integral Equation Methods I
Session Co-Chairs: Roberto Graglia, Politecnico di Torino; Raj Mittra, University of Central Florida

TU-UB.1A.1 08:00
Div-Conforming Entire-Domain Basis Functions for the Analysis of Modulated Metasurface Antennas on Circular Domains
Matteo Alessandro Franzoi, Valentina Sazio, Istituto Superiore Mario Boella, Italy; Giuseppe Vecchi, Politecnico di Torino, Italy

TU-UB.1A.2 08:20
Numerical Study of Scalar and Vector Potential Integral Equations for Electromagnetic Scattering
Jie Li, Michigan State University, United States; Xin Fu, Li Jun Jiang, The University of Hong Kong, China; Balasubramaniam Shanker, Michigan State University, United States

TU-UB.1A.3 08:40
Application of high-order singular hierarchical divergence-conforming bases functions for quadrilateral elements to solve the flat plate problem
Roberto D Graglia, Politecnico di Torino, Italy; Andrew F Peterson, Georgia Institute of Technology, United States; Paolo Petmini, Politecnico di Torino, Italy

TU-UB.1A.4 09:00
Alternative Constraints for Divergence-Conforming Constrained Basis Functions
John Young, Robert Pfeiffer, Robert Adams, University of Kentucky, United States

TU-UB.1A.5 09:20
Surface Integral Equation Methods with Reverse Operation Self-consistent Evaluation (ROSE)
Jinva Lee, Xuezhe Tian, Yangjin Chen, Kheng Huee Lim, The Ohio State University, United States

Break 09:40

TU-UB.1A.6 10:00
Numerical Green’s Function Based Augmented Electric Field Integral Equation for Inhomogeneous Media
Hui Gan, Qi Dai, Tian Xia, University of Illinois at Urbana-Champaign, United States; Yanlin Li, The University of Hong Kong, China; Weng Cho Chew, University of Illinois at Urbana-Champaign, United States

TU-UB.1A.7 10:20
A Source-Model Technique for Analysis of Scattering by, and Waveguiding across, Chains of Cylinders Partially Buried in a Half-Space Medium
Dana Szafrańek, Yehuda Leviatan, Technion, Israel

TU-UB.1A.8 10:40
Boundary Integral Spectral Element Method with Periodic Layered Medium Green’s Function
Jun Niu, Duke University, United States; Yi Ren, Changing University of Posts and Telecommunications, United States; Qing Hua Liu, Duke University, United States

TU-UB.1A.9 11:00
A Fast Uniform 3D Near-Field Microwave Imaging Method for Layered Media
Kai Ren, Robert Burkholder, The Ohio State University, United States

Acceleration Techniques for Integral Equations
Session Co-Chairs: Ali Yilmaz, University of Texas at Austin; Yang Liu, University of Michigan

TU-UB.2A.1 08:00
A Butterfly-Based Domain Decomposition SIE Simulator for EM Analysis of Wireless Communication Systems in Mine Environments
Weitian Sheng, Han Guo, Yang Liu, University of Michigan, United States; Abdulkadir Yücel, Massachusetts Institute of Technology, United States; Eric Michielssen, University of Michigan, United States

TU-UB.2A.2 08:20
A Linear-Complexity Randomized Butterfly Scheme for Direct Integral Equation Solvers
Yang Liu, Han Guo, Eric Michielssen, University of Michigan, United States

TU-UB.2A.3 08:40
Sparse Solution of Integral Equation Formulations of Multiple Scattering Problems in a Directional Plane Wave Basis
Robert Adams, Robert Thomas, John Young, University of Kentucky, United States

TU-UB.2A.4 09:00
An H-Matrix Accelerated Solution of a New Single-Source Integral Equation for Scattering on Penetrable Objects
Raza Gholami, Jamil Majdalgieh, University of Manitoba, Canada; Anton Menshov, The University of Texas at Austin, United States; Farhad Sheikh Hosseini Lari, Vladimir Okhmatovski, University of Manitoba, Canada

TU-UB.2A.5 09:20
Matrix Compression in the Method of Moments Code EIGER - Iterative Solver Accuracy and Parallel Efficiency
Joseph Kotulski, Sandia National Laboratories, United States

Break 09:40

TU-UB.2A.6 10:00
Tucker Compressed Muller-SIE for EM Analysis of Mine Communication Systems
Weitian Sheng, University of Michigan, United States; Abdulkadir Yücel, Massachusetts Institute of Technology, United States; Eric Michielssen, University of Michigan, United States

TU-UB.2A.7 10:20
A HSS-Type Butterfly-Based Direct Integral Equation Solver for 3D Perfect Electrically Conducting Objects
Yang Liu, Han Guo, Eric Michielssen, University of Michigan, United States

TU-UB.2A.8 10:40
Diagonal Localization-based Direct Solver for Volume Integral Equations and Capacitive Extraction
Choe Chang, Tanner Wilkerson, Robert Adams, John Young, University of Kentucky, United States

TU-UB.2A.9 11:00
A Direct Domain Decomposition Method (D3M) for Modeling Large Finite Antenna Arrays and FSS
Javad Moshfegh, Marinos N. Vouvakis, University of Massachusetts Amherst, United States

TU-UB.2A.10 11:20
A Modified Admissibility Criterion for H-Matrix Based Integral Equation Solvers
Anton Menshov, The University of Texas at Austin, United States; Vladimir Okhmatovski, University of Manitoba, Canada; Ali E. Yilmaz, The University of Texas at Austin, United States
Antenna Theory III

Session Co-Chairs: Andrea Alu, University of Texas at Austin; Jaehoon Choi, Hanyang University; Leonardo Lizzi, Università Côte d’Azur

TU-A1.3A.1 08:00
Applications of Magneto-Dielectric Materials in Wearable Antenna Design
Ala Alemaryeen, Sima Neghanian, University of North Dakota, United States

TU-A1.3A.2 08:20
Conformal monopolar antenna for UAV applications
Sungjoon Yoon, Jinpil Tak, Jaehoon Choi, Hanyang University, Republic of Korea; Youngmi Park, Agency for Defense Development, Republic of Korea

TU-A1.3A.3 08:40
Design of Circular Array of Circular Subarrays for Scannable Pattern using Rotational Symmetry
Omar Elizarraras, Universidad Autónoma de Tamaulipas, Mexico; Marco A. Panduro, CICESE Research Center, Mexico; Aldo Mendez, Alberto Reyna, Universidad Autónoma de Tamaulipas, Mexico; David Covarrubias, CICESE Research Center, Mexico

TU-A1.3A.4 09:00
Calculation of radiation transients in direct antenna modulation systems
Kurt Schab, Jacob Adams, North Carolina State University, United States

TU-A1.3A.5 09:20
A High Gain Printed Antenna with Parabolic Metal Grid Reflector Based on SIW Technology
Jun Wang, Shu Lin, Alexander Denisov, Lu Liu, Harbin Institute of Technology, China

Theory of Electromagnetic Intelligent Agents with Applications to MIMO and DoA Systems
Said Mikki, University of New Haven, United States; Abdalrahman Alzahed, Royal Military College of Canada, Canada; Ahmed Hanoun, John Persano, University of New Haven, United States; Jocelyn Aulin, Huawei Technologies Sweden, Sweden; Yahiya M. M. Antar, Royal Military College of Canada, Canada

Break 09:40

TU-A1.4A.1 10:00
Compact Antenna Using Split-Ring Resonator Integrated with Bent Dipole-Like Metal Pattern
Keshki Kasaka, Hiroshi Toyoo, Eiji Hantou, NEC Corporation, Japan

TU-A1.4A.2 10:00
Bandwidth and F-B Ratio Enhancements of an Electrically-Small Crossed-Dipole Antenna Using an NFRP Reflector
Son Xuat Ta, Ikmo Park, Ajou University, Republic of Korea; Richard W. Ziolkowski, University of Arizona, United States

TU-A1.4A.3 10:40
A SIW-Based Vivaldi Array Antenna for 5G Wireless Communication Systems
Pengfei Liu, Xiaowei Zhu, Xiang Wang, Ling Tian, Southeast University, China

TU-A1.4A.4 11:00
Super-Directive, Efficient, Electrically Small, Low-Profile Antenna based on Compact Metamaterial
Nebil Kristou, Jean-François Pintos, CEA-LETI, France; Kouroch Mahdjoubi, IETR, France

Break 11:20

TU-A1.4A.5 11:20
A modified Antennas Based on Fractal Split Ring Resonators
Meng Cao, Zhenghui Xue, Wu Ren, Weiming Li, Beijing Institute of Technology, China
**Reflector Feed and Applications**

Session Co-Chairs: Satish Sharma, San Diego State University; Mohamed Elmansouri, University of Lorraine, Boulder

**TU-A1.5A.1**

**Broadband Monostatic Simultaneous Transmit and Receive Reflector Antenna System**
Prathap Valale Prasannakumar, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder, United States

**TU-A1.5A.2**

**Initial Study of a Pyramidal Sinuous Antenna as a Feed for the SKA Reflector System in Band-1**
Dirk de Villiers, Stellenbosch University, South Africa

**TU-A1.5A.3**

**W-Band Feed Horn with Polarizer Structure for an Offset Reflector Antenna for CubeSat Applications**
Ghanshyam Mishra, Alejandro Castro, Satish Kumar Sharma, San Diego State University, United States; Jia-Chi S. Chieh, SPAWAR Systems Center Pacific, United States

**TU-A1.5A.4**

**Structural and Electromagnetic Design Considerations for Very Large Space Antennas**
Derek Hesser, Lawrence Lee, Lee Burchett, Ronald Marhefka, IEEE, United States; Andrew Terzuoli, institute of Electrical & Electronics Engineers (IEEE), USA, United States; Ray Wasky, IEEE, United States

**TU-A1.5A.5**

**Design of a 94/340GHz Horn Antenna Loaded with Dielectric for Dual-band Operation**
Xiannan Wang, Changjiang Deng, Weidong Hu, Yong Liu, Xin Lv, Beijing Institute of Technology, China

**TU-A1.5A.6**

**Break**

**TU-A1.5A.7**

**Considerations in the Synthesis of Elevation Patterns in Cylindrical Parallel Plate Antennas**
Naftali Herscovici, Air Force Research Laboratory, United States; Anatoliy Boryssenko, A&E Partnership, United States; Carl Carl Pfeiffer, Defense Engineering Corporation, United States

**TU-A1.5A.8**

**A novel method of direction of arrival estimation for large parabolic reflector antenna**
Hailin Cao, Zhoujian Chen, Lu Tao, Jing Liu, Chengzhao Zhu, Yantao Yu, Chongqing University, China; Jin Fan, The National Astronomy Observatory of China, China

**TU-A1.5A.9**

**Gain and Sidelobe Improved Circularly-Polarized Array Using HIS Bowl-Shaped Reflector**
Jie Ren, Shanghai Jiao Tong University, China; Lina Zhang, Shanghai Aerospace Electronic Technology Institute, China; Xuekai Hang, Weihua Yuan, Shanghai Jiao Tong University, China; Qiaoyuan Qian, Shanghai Aerospace Electronic Technology Institute, China; Junping Geng, Weiren Zhu, Ronghong Jin, Shanghai Jiao Tong University, China

**TU-A1.5A.10**

**Full Reconstruction of Focal-Field Distribution Using Compressed Sensing**
Dechang Wu, Hailin Cao, Zhoujian Chen, Lu Tao, Jing Liu, Chengzhao Zhu, Yantao Yu, Chongqing University, China; Jin Fan, Chinese Academy of Sciences, China

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**Biomedical Applications of Antennas**

Session Co-Chairs: Jennifer Bernhard, University of Illinois at Urbana-Champaign; Pai-Yen Chen, Wayne State University

**TU-A5.1A.1**

**Antenna Probes for Power Reception from Deep Tissues for Wearable Microwave Thermometry**
Pansia Momennoooodaki, University of Colorado Boulder, United States; Mojtaba Fallahpour, Stanford University, United States; Zoya Popovic, University of Colorado Boulder, United States

**TU-A5.1A.2**

**A Wearable and Reconfigurable Folded Slot Antenna for Body-Worn Devices**
Soud M. Saeed, Arizona State University and Prince Sattam bin Abdulaziz University, United States; Constantine A. Balanis, Craig R. Birchler, Arizona State University, United States

**TU-A5.1A.3**

**Antenna System for Radio Wave Type Laparoscope**
Takahumi Fujimoto, Naoto Masuda, Takuya Matori, Toshiyuki Tanaka, Nagasaki University, Japan

**TU-A5.1A.4**

**Accuracy Investigation of SFCW Radar in Human Vital Signs Detection for Subject’s Relative Position**
Tuan Phan, Ozlem Kilic, The Catholic University of America, United States; Sabikun Nahar, Lingyun Ren, Aly E. Fathy, University of Tennessee, United States

**TU-A5.1A.5**

**Ultrasonic Telemetric Sensor Based on Adapted Parity-Time Symmetry**
Maryam Sakhdari, Pai-Yen Chen, Wayne State University, United States

**TU-A5.1A.6**

**A Self-Powered Harmonic Sensor Based on Simple Graphene Circuit and Hybrid-Fed Antenna**
Mehdi Hajizadeh, Pai-Yen Chen, Wayne State University, United States

**TU-A5.1A.7**

**Design of Wide Band High Gain Unidirectional Antenna with Low Profile**
Shi Xiang, Yi-Zhi Wu, Sheng Ye, Ming-De Zhu, Donghua University, China

**TU-A5.1A.8**

**An On-body Watchband Antenna for the Applications of Wearable Systems**
Naifeng Lü, Gui Gao, Wei Liu, Jian Su, Yang Bai, National University of Defense Technology, China

**TU-A5.1A.9**

**Flexible and Compact AMC Based Antenna for WBAN Applications**
Huan Liu, Junjun Wang, Xiling Luo, Beihang University, China

**TU-A5.1A.10**

**CPW Ring Wearable Antenna on Leather Material for BAN Applications**
M. I. Ahmed, Electronics Research Institute, Egypt; M. F. Ahmed, A. A. Shaalan, Zagazig University, Egypt
Wave Propagation in Outdoor and Urban Environments
Session Co-Chairs: Robert Watson, University of Bath; Miguel Navarro-Cia

TU-A4.1A 11:00 - 11:20
Golden Hill AB

TU-A4.1A.1 11:00
Outdoor-indoor angular power spectrum prediction
Dimitry Chizhik, Reinaldo Valenzuela, Nokia, United States

TU-A4.1A.2 11:20
Beamforming Gain Degradation of Array Antenna at 20-GHz Band in Urban Street Canyon
Ngoc Hieu Tran, Tetseo Imai, Koshio Kitao, Yukihiko Okumura, NTT DOCOMO, INC., Japan

TU-A4.1A.3 11:40
UAV-Aided Source Localization in Urban Environments Based on Ray Launching Simulation
Zhuangzhuang Dai, Peter Shepherd, Robert Watson, University of Bath, United Kingdom

TU-A4.1A.4 10:00
Physical Layer Security based on Time Reversal Technique for Outdoor Radio Channels
Abdulaziz Aldosari, Hassan AlSalhi, QAF, Qatar

TU-A4.1A.5 10:20
A Comparison of Satellite Signal Simulation in Street Canyon in 2D and 3D Deterministic Methods
Hossein Hadadian Moghadam, École de Technologie Superieure (ETS), Canada; Ali Foudazi, Missouri University of Science and Technology, United States; Amir Kooi, École de Technologie Superieure (ETS), Canada

TU-A4.1A.6 10:40
Path Loss Frequency Dependence at 2-26 GHz in an Urban Macro Cell Environment
Mot teruhi Saeki, Mitsuki Nakamura, Minoru Inamata, Yasushi Takatori, NTT Corporation, Japan; Koshio Kitao, Tetseo Imai, NTT DOCOMO, INC., Japan

TU-A4.1A.7 11:00
Assessment of ISM 2.4GHz Wireless Sensor Networks Performance in Urban Infrastructure Scenarios
Leyla Azpilicueta, Tecnologico de Monterrey, Mexico; Peio Lopez-Iburi, Erik Aguirre, Carlos Martinez, Francisco Falcone, Public University of Navarre, Spain

TU-A4.1A.8 10:40
Impact of Propagation Impairments on Outdoor and Indoor Optical Wireless Communications
Kapil Dev, Dario Tagliaferri, Politecnico di Milano, Italy; Roberto Nebuloni, IEIIT, Consiglio Nazionale delle Ricerche (CNR), Italy; Carlo Capsoni, Politecnico di Milano, Italy

TU-A4.1A.9 11:00
Selection and Adjustment of Propagation Models to Compute the Electric Field Strength for Exposure Assessment Purposes in Urban Environment
Marlon Patino, Alejandro Rangel, Universidad Nacional de Colombia, Colombia; Juan V Balbastre, Universitat Politècnica de València, Spain; Daniela Alfonsi, Zulma Lopez, Felix Vega, John J. Pantoya, Universidad Nacional de Colombia, Colombia
Slot-Array Antennas
Session Co-Chairs: Miao Zhang, Xiamen University; Christos Christodoulou, University of New Mexico

TU-A1.6A.1 08:00
Wideband Design of Sub-arrays in a Q-band Partially-Corporate Fed Waveguide Slot Array
Miao Zhang, Dan Chen, Longfang Ye, Xiamen University, China; Qing Hua Liu, Duke University, United States

TU-A1.6A.2 08:20
A Spiral Radial Line Slot Array Antenna with Metallic Standoffs for Deep Space Missions
Matthew Bray, Johns Hopkins Applied Physics Laboratory, United States

TU-A1.6A.3 08:40
Compact Center-Fed Ridged Waveguide Slot Array for SAR Applications
Ying Chen, Rodney G Vaughan, Simon Fraser University, Canada

TU-A1.6A.4 09:00
A High Gain Dual Polarized Omni Antenna
John Sanford, Ubiquiti Networks, United States

TU-A1.6A.5 09:20
Cold & Hot Tests of an S-band Antenna for High Power Microwave Systems
Xuyuan Pan, University of New Mexico, United States; Julie Lawrence, Jeremy McConaha, Matthew Landavazo, Air Force Research Laboratory, United States; Christos Christodoulou, University of New Mexico, United States

Break 09:40

TU-A1.6A.6 10:00
Considerations for Resonant Slot Arrays for Microwave Food Drying and Heating
Maryam Razzmhosseini, Ying Chen, Rodney G Vaughan, Simon Fraser University, Canada

TU-A1.6A.7 10:20
Dual-Polarized Fixed-Beam High-gain Array Antenna for Microwave and mm-Wave Applications
Abhijit Bhattacharya, Rodney G Vaughan, Simon Fraser University, Canada

TU-A1.6A.8 10:40
A Novel Dual-Polarized Waveguide Array Antenna for Ku Band Satellite Communications
Hongqiang Zhang, Wei Wang, Mouping Jin, Yongming Zou, The 38th Research Institute of China Electronics Technology Group Corporation, China; Xianling Liang, Shanghai Jiao Tong University, China

TU-A1.6A.9 11:00
Ku-Band Wideband Space-borne Waveguide Slot Array Antenna
Hongqiang Wang, National Space Science Center, Chinese Academy of Sciences, China; Yang Liu, Xingchao Dong, Xingwei Zhang, University of Chinese Academy of Sciences, China; Min Yi, NSSC, China

History of APS: Early Legends of the Field
Session Co-Chairs: Stuart Long, University of Houston; Kathleen Melde, University of Arizona

TU-SP.1P.1 13:20
A Historical Perspective on the IEEE Antennas and Propagation Society Awards for Individual Achievement and Outstanding Papers
Stuart Long, University of Houston, United States

TU-SP.1P.2 13:40
A Tribute to John Kraus: A Pioneer in Electromagnetics, Antennas, and Radio Astronomy
Warren Stutzman, Virginia Tech, United States

TU-SP.1P.3 14:00
Chen-To Tai: His Life and Contributions to Electromagnetics
Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

TU-SP.1P.4 14:20
1987 IEEE AP Distinguished Achievement Award Recipient, Prof. Georges A. Deschamps, A True Gentleman and Distinguished Scholar
Richard W. Ziolkowski, University of Arizona, United States

TU-SP.1P.5 14:40
Professor Robert S. Elliott: A Role-Model Educator, Writer and Researcher
Yahya Rahmat-Samii, University of California, Los Angeles, United States

TU-SP.1P.6 15:00
Break

TU-SP.1P.7 15:20
Roger F. Harrington, 1989 IEEE AP-S Distinguished Achievement Awardee
Donald Wilton, University of Houston (retired), United States; Ercument Arvas, Istanbul Medipol University, Turkey; Chalmers M. Butler, Clemson University (retired), United States; Joseph R. Mautz, Syracuse University (retired), United States

TU-SP.1P.8 15:40
James R. Wait: An Electromagnetics Scholar, A Gentleman, and A Man of Many Quests
Jeffrey Williams, Sandia National Laboratories, United States; Dowd Hill, NIST, United States; Jeffrey Young, Oklahoma State University, United States

TU-SP.1P.9 16:00
Professor R.W.P. King: A Tribute to his Life and Technical Accomplishments
Stuart Long, University of Houston, United States; Glenn S. Smith, Georgia Institute of Technology, United States; D. V. Govil, Pro-Tech, United States; Ted Simpson, University of South Carolina, United States; Robert J. Mailloux, Consultant, United States

TU-SP.1P.10 16:20
A Tribute to Harold A. Wheeler: The Ultimate Bridge between Theory and Application
Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

TU-SP.1P.11 16:40
Robert E. Collin: A Tribute to his Professional Accomplishments
Ioannis Besiatis, Virginia Tech, United States
**Advancement of Metasurfaces and Lenses for Beyond 4G and 5G**

Session Co-Chairs: Jungsuek Oh, Inha University; Seungtae Ko, Samsung Electronics

**TU-SP.2P.1** 13:20
A Study on Design Methodology for Flexible Beam Shaping Lens with Phased Array Antenna and its Application
Seungtae Ko, Yoongeon Kim, Seungku Han, Byungchul Kim, Jungyub Lee, Yeongju Lee, Samsung Electronics, Republic of Korea

**TU-SP.2P.2** 13:40
Spatial Beam Shaping Flat Lens using Phased Array Antenna for 5G Mobile Communication
Seungtae Ko, Yoongeon Kim, Seungku Han, Byungchul Kim, Jungyub Lee, Yeongju Lee, Samsung Electronics, Republic of Korea

**TU-SP.2P.3** 14:00
Design of a Novel 2.5-Dimensional Wideband Frequency Selective Surface with Stable Performance for Fifth Generation Communications
Da Li, Tian-Wu Li, Er-Ping Li, Zhejiang University, China

**TU-SP.2P.4** 14:20
Efficiency Optimization of Millimeter Wave FR4-Based Metasurface Using Lossy Spatial Filter Modeling
Yangseop Yoon, Jungsuek Oh, Inha University, Republic of Korea

**TU-SP.2P.5** 14:40
Millimeter Wave Thin Metasurface Enabling Polarization-Controlled Beam Shaping
Inseop Yoon, Jungsuek Oh, Inha University, Republic of Korea

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**Higher Symmetries for Flat Meta-lenses**

Session Co-Chairs: Guido Valerio, Sorbonne Universités, UPMC Univ Paris 06; Oscar Quevedo-Teruel, KTH Royal Institute of Technology

**TU-SP.3P.1** 15:20
Higher Symmetries in Periodic Surfaces for Graded-Index and Band-Gap Components
Guido Valerio, Université Pierre et Marie Curie - Sorbonne Universités, France; Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden

**TU-SP.3P.2** 15:40
Application of glide-symmetric holey structures to the design of gap waveguide technology components
Eva Rajo-Iglesias, University Carlos III of Madrid, Spain; Mahsa Ebrahimpouri, KTH Royal Institute of Technology, Sweden; Astrid Algaba-Brazalez, Ericsson Research, Sweden

**TU-SP.3P.3** 16:00
Predicting PT transitions and protected points in 2D periodic materials using an antiunitary group theory
Adam Mack, Central Michigan University, United States

**TU-SP.3P.4** 16:20
Analysis of glide-symmetric metasurface waveguides using Floquet-mode representation
Zvonimir Sipus, Silvio Hrabar, University of Zagreb, Croatia

**TU-SP.3P.5** 16:40
Hexagonal Symmetry Metasurfaces for Broadband Antenna Applications
J.D. de Pineda, R.C. Mitchell-Thomas, Alastair P. Hibbins, J. Roy Sambles, University of Exeter, United Kingdom

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**Frequency Selective Surface Applications**

Session Co-Chairs: Zhongxiang Shen, Nanyang Technological University; Douglas Werner, Pennsylvania State University

**TU-A2.1P.1** 13:20
A 30GHz Linear-to-Circular Polarization Conversion Using Two-Layer FSS
Hamdan Abo Ghalyon, Mohammad Akerion, Abdul Razik Sebak, Concordia University, Canada

**TU-A2.1P.2** 13:40
Multi-Octave Linear-to-Circular Polarizers
Carl Pfeiffer, Defense Engineering Corporation, United States; Boris Tomasic, Air Force Research Laboratory, United States

**TU-A2.1P.3** 14:00
Active Frequency Selective Surface for Strain Sensing
Matthijs Mahmoodi, Kristen M. Donnell, Missouri University of Science and Technology, United States

**TU-A2.1P.4** 14:20
A Frequency Selective Surface with Nano Square Ring Resonators for Enhancing Banknote Security
Asbit Sripradit, Thoain Theeradejvanichkul, King Mongkut’s University of Technology Thonburi, Thailand

**TU-A2.1P.5** 14:40
Novel FSS-Based Sensor for Concurrent Temperature and Strain Sensing
Matthijs Mahmoodi, Kristen M. Donnell, Missouri University of Science and Technology, United States

**TU-A2.1P.6** 15:20
Wideband 3D Frequency Selective Rasorber Based on Ferrite Absorber
Yufeng Yu, Tianwei Deng, Tasmaks Laboratories, National University of Singapore, Singapore; Zhongxiang Shen, Nanyang Technological University, Singapore

**TU-A2.1P.7** 15:40
Donovan Brocker, Anastasios Panaretos, Douglas H. Werner, The Pennsylvania State University, United States

**TU-A2.1P.8** 16:00
An Absorptive Frequency Selective Surface with Wideband Transmission above Absorption Band
Qiang Chen, Yunqi Fu, National University of Defense Technology, China

**TU-A2.1P.9** 16:20
Broadband Window-type Circular Polariser Based on Frequency Selective Surfaces
Wei Zhang, Jianying Li, Guangwei Yang, Jian Xie, Northwestern Polytechnical University, China

**TU-A2.1P.10** 16:40
An Efficient FSS Absorber For WLAN Security
Sohaib Habib, CIIT Islamabad, Pakistan; Pakistan; Ghaffar Iqbal Kiani, King Abdulaziz University, Saudi Arabia; Muhammad Fasih Uddin Butt, CIIT Islamabad, Pakistan
Nanooptics and Nano-structures
Session Co-Chairs: Andrea Alu, University of Texas at Austin; Ahmed Hassan, University of Missouri-Kansas City

TU-UB.1P.1 13:20
PT-symmetric epsilon-near-zero plasmonic waveguides
Ying Li, Christos Argyropoulos, University of Nebraska-Lincoln, United States

TU-UB.1P.2 13:40
Understanding Bowtie Nanoantennas Excited by a Localized Emitter
Víctor Péche-Peña, Miguel Beruete, Universidad Pública de Navarra, Spain; Antonio I. Fernández-Domínguez, Universidad Autónoma de Madrid, Spain; Yu Luo, Nanyang Technological University, Singapore; Miguel Navarro-Cía, University of Birmingham, United Kingdom

TU-UB.1P.3 14:00
Free Carriers Photoexcitation as a Platform for Ultrafast Tunable Dielectric and Hybrid Nanoantennas
Alexander Krasnok, The University of Texas at Austin, United States; Denis Baranov, Chalmers University of Technology, Sweden; Román Saveliev, Pavel Belov, ITMO University, Russian Federation; Andrea Alù, The University of Texas at Austin, United States

TU-UB.1P.4 14:20
Quantifying the Scattering Characteristics of Plasmonic Nanowires and Microwires using Characteristic Mode Analysis
Daniel S. Kidale, Ethan Wilcox, Ahmed Hassan, University of Missouri-Kansas City, United States; Edward Gabouci, National Institute of Standards and Technology, United States

TU-UB.1P.5 14:40
Electromagnetic Scattering and Characteristic Mode Analysis of Nanowires in Layered Media
Kalyan C. Durbhakula, Daniel S. Kidale, Deb Chatterjee, Ahmed Hassan, University of Missouri-Kansas City, United States; Edward Gabouci, National Institute of Standards and Technology, United States

Break 15:00

TU-UB.1P.6 15:20
Electromagnetic Analysis of Composites with Realistic Carbon Nanotube Distributions as Determined by 3D Quantitative Electron Tomography
Spencer On, Marjorie Castro, Douglas Heller, Ahmed Hassan, University of Missouri-Kansas City, United States; Pranay Natarajan, National Institute of Standards and Technology, United States; Itai Stein, Estelle Cohen, Brian Wardle, Massachusetts Institute of Technology, United States; Renu Sharma, J. Alexander Liddle, Edward Gabouci, National Institute of Standards and Technology, United States

TU-UB.1P.7 15:40
Acceleration of numerical methods for Coherent X-ray Diffractive Imaging
Kueyang Wang, University of California, San Diego, United States; Ami Silvinski, Ben-Gurion University, Israel; André Singer, Oleg Shpyrko, Vitaliy Lomakin, University of California, San Diego, United States

TU-UB.1P.8 16:00
Green’s function formalism for near field analysis of planar layered media in nanophotonics
Faezeh Tork Ladani, Eric Potma, University of California, Irvine, United States

TU-UB.1P.9 16:20
Polarization Enhancement in a Particle with a Core-Shell Structure
Yanlin Li, Zhiqing Hu, Thomas Wong, Illinois Institute of Technology, United States

TU-UB.1P.10 16:40
Power deposition of multiple nano-scale multilayer particles excited by plane wave
Yuka Li, Jun Hu, University of Electronic Science and Technology of China, China; Wei-Feng Huang, Duke University, United States; Zaiqing Nie, University of Electronic Science and Technology of China, China; Qing Hua Liu, Duke University, United States

Small Antennas
Session Co-Chairs: John Rockway, SPAWAR Systems Center Pacific; Lale Alatan, Middle East Technical University

TU-UB.2P.1 13:20
Fundamental limitations on the quality factor and related problems for small antennas
Mats Gustafsson, Lund University, Sweden; Miloslav Capek, Czech Technical University in Prague, Czech Republic; Kurt Schab, North Carolina State University, United States

TU-UB.2P.2 13:40
Physical bounds on the MIMO capacity for small antennas
Mats Gustafsson, Lund University, Sweden

TU-UB.2P.3 14:00
On Maximum Absorption by a Lossy Antenna – to Conjugate-Match or not to Conjugate-Match?
Ofer Marks, Silvio Hrabar, Mihael Grbic, University of Zagreb, Croatia

TU-UB.2P.4 14:20
What Actually Limits the Sensitivity of NMR Antenna–Receiver Chain?
Peter Kolar, Silvio Hrabar, Mihael Grbic, University of Zagreb, Croatia

TU-UB.2P.5 14:40
Compact Null-steering Antenna System for GPS
Cara Yang Kataria, Grace X. Gao, Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

Break 15:00

TU-UB.2P.6 15:20
A Novel Technique to Tilt Radiation Beams in Bowtie Antennas
William Ake, Mana Pour, University of Alabama in Huntsville, United States

TU-UB.2P.7 15:40
A Compact Multi-antenna System with Low Mutual Coupling
Wei Huang, Hongwei Liu, Huawei Device USA, Inc., United States

TU-UB.2P.8 16:00
Design of Camera-integrated 2.4-GHz Loop Antenna for Wireless Endoscope
Se Woong Kim, Jonghyun Lee, Jong Jun Baek, Youn Tae Kim, Chosun University, Republic of Korea

TU-UB.2P.9 16:20
Optimal Receiver for Polarization Based Estimation of Angle of Arrival at HF band
Mani Kashanianfard, Kamal Sarabandi, University of Michigan - Radlab, United States

TU-UB.2P.10 16:40
A New Embedded NFC Antenna for Full Metal Mobile Devices
Olivier Pojona, Jaakka Kylonen, Laurent Descols, Ethertronics, France
Wideband Directional Antennas II
Session Co-Chairs: Jiro Hirokawa, Tokyo Institute of Technology; Sungkyun Lim, Georgia Southern University

**TU-A1.1P.1**
Wideband Axial-Mode Helical Antenna with 3D Printed Proliferated Radome
Jiukun Che, Chi-Chih Chen, The Ohio State University, United States
13:20

**TU-A1.1P.2**
HIBiscus, a broadband antenna with matching impedance and uniform radiation pattern
Jose Miguel Javegui-Garcia, Jeffrey B. Peterson, Carnegie Mellon University, United States; Edgar Castillo-Dominguez, Instituto Nacional de Astrofisica, Optica y Electronica, Mexico; Tabitha C. Voytek, University of Kansas, United States
13:40

**TU-A1.1P.3**
Compact Combined Antenna with Slit For Monopolar Input Pulse
Vignesh Shanmugam Bhaskar, Eng Leong Tan, King Ho Holden Li, Min Siu Tse, Nanyang Technological University, Singapore
14:00

**TU-A1.1P.4**
Circularly Polarized Broadband Patch Antenna Using Artificial Ground Structure and Meandered Probe for Low Cross-Polarization
Md Rakinul Islam, Sungkyun Lim, Georgia Southern University, United States
14:20

**TU-A1.1P.5**
Combination of Bow-Tie Antenna and Log Periodic Dipole Array for Circular Polarization
Guang Fu, Zhiya Zhang, Xidian University, China
14:40

**TU-A1.1P.6**
A Broadband Dual-Polarized Antenna with Beamwidth Improvement
Guang Fu, Zhiya Zhang, Xidian University, China
15:00

**TU-A1.1P.7**
Broadband Differentially-Fed Circularly Polarized Antennas
Hui Liu, Yuehui Cai, RongLin Li, South China University of Technology, China
15:20

**TU-A1.1P.8**
A Broadband Low Profile High Gain and Dual Polarization Antenna Element Applied to Mobile Base Station
Shu Lin, Ling Liu, Maosui Zhang, Habin Institute of Technology, China
15:40

**TU-A1.1P.9**
A 6–18 GHz Wideband SIW H-Plane Dual-Ridged End-Fire Antenna
Jian Li, Yongjun Huang, Guangjun Wen, University of Electronic Science and Technology of China, China; Haidun Zhang, Science and Technology on Electronic Information Central Laboratory, China
16:00

**TU-A1.1P.10**
Design of Wideband Miniaturized Cross Dipole Antennas with Chamfers
Rui Wu, Qing-Xin Chu, South China University of Technology, China
16:20

**TU-A1.1P.11**
Wideband Axial-Mode Helical Antenna with 3D Printed Proliferated Radome
Jiukun Che, Chi-Chih Chen, The Ohio State University, United States
16:40

**TU-A1.1P.12**
HIBiscus, a broadband antenna with matching impedance and uniform radiation pattern
Jose Miguel Javegui-Garcia, Jeffrey B. Peterson, Carnegie Mellon University, United States; Edgar Castillo-Dominguez, Instituto Nacional de Astrofisica, Optica y Electronica, Mexico; Tabitha C. Voytek, University of Kansas, United States
17:00

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**TU-A1.2P**
Wideband Axial-Mode Helical Antenna with 3D Printed Proliferated Radome
Jiukun Che, Chi-Chih Chen, The Ohio State University, United States
13:20

**TU-A1.3P**
HIBiscus, a broadband antenna with matching impedance and uniform radiation pattern
Jose Miguel Javegui-Garcia, Jeffrey B. Peterson, Carnegie Mellon University, United States; Edgar Castillo-Dominguez, Instituto Nacional de Astrofisica, Optica y Electronica, Mexico; Tabitha C. Voytek, University of Kansas, United States
13:40

**TU-A1.4P**
Compact Combined Antenna with Slit For Monopolar Input Pulse
Vignesh Shanmugam Bhaskar, Eng Leong Tan, King Ho Holden Li, Min Siu Tse, Nanyang Technological University, Singapore
14:00

**TU-A1.5P**
Circularly Polarized Broadband Patch Antenna Using Artificial Ground Structure and Meandered Probe for Low Cross-Polarization
Md Rakinul Islam, Sungkyun Lim, Georgia Southern University, United States
14:20

**TU-A1.6P**
Combination of Bow-Tie Antenna and Log Periodic Dipole Array for Circular Polarization
Guang Fu, Zhiya Zhang, Xidian University, China
14:40

**TU-A1.7P**
A Broadband Dual-Polarized Antenna with Beamwidth Improvement
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15:00

**TU-A1.8P**
Broadband Differentially-Fed Circularly Polarized Antennas
Hui Liu, Yuehui Cai, RongLin Li, South China University of Technology, China
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**TU-A1.9P**
A Broadband Low Profile High Gain and Dual Polarization Antenna Element Applied to Mobile Base Station
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Jian Li, Yongjun Huang, Guangjun Wen, University of Electronic Science and Technology of China, China; Haidun Zhang, Science and Technology on Electronic Information Central Laboratory, China
16:00

**TU-A1.11P**
Design of Wideband Miniaturized Cross Dipole Antennas with Chamfers
Rui Wu, Qing-Xin Chu, South China University of Technology, China
16:20

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**TU-A1.12P**
Wideband Axial-Mode Helical Antenna with 3D Printed Proliferated Radome
Jiukun Che, Chi-Chih Chen, The Ohio State University, United States
16:40

**TU-A1.13P**
HIBiscus, a broadband antenna with matching impedance and uniform radiation pattern
Jose Miguel Javegui-Garcia, Jeffrey B. Peterson, Carnegie Mellon University, United States; Edgar Castillo-Dominguez, Instituto Nacional de Astrofisica, Optica y Electronica, Mexico; Tabitha C. Voytek, University of Kansas, United States
17:00

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**TU-A1.2P**
Wideband Axial-Mode Helical Antenna with 3D Printed Proliferated Radome
Jiukun Che, Chi-Chih Chen, The Ohio State University, United States
16:40

**TU-A1.3P**
HIBiscus, a broadband antenna with matching impedance and uniform radiation pattern
Jose Miguel Javegui-Garcia, Jeffrey B. Peterson, Carnegie Mellon University, United States; Edgar Castillo-Dominguez, Instituto Nacional de Astrofisica, Optica y Electronica, Mexico; Tabitha C. Voytek, University of Kansas, United States
17:00
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<tr>
<th>Session</th>
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<tbody>
<tr>
<td><strong>Fast Solvers and Well-Conditioned Formulations</strong>&lt;br&gt;TU-A3.1P</td>
<td>13:20 &lt;br&gt;<strong>Matrix Inversion in Spatial Frequency Analysis of Electromagnetic Scattering and Radiation</strong>&lt;br&gt;Doyalan Kasilingam, Anthony Fosca, University of Massachusetts Dartmouth, United States</td>
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<tr>
<td>13:40 &lt;br&gt;<strong>On a Well-Conditioned Impedance Boundary Condition EFIE</strong>&lt;br&gt;Alexandre Dely, Francesco P. Andriulli, IMT Atlantique, France; Kristof Cools, University of Nottingham, United Kingdom</td>
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<td>14:00 &lt;br&gt;<strong>Accuracy Directly Controlled Fast Direct Solutions of General H2-Matrices</strong>&lt;br&gt;Miaomiao Ma, Dan Jiao, Purdue University, United States</td>
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<td>14:20 &lt;br&gt;<strong>Accelerated Randomized vs. Deterministic Algorithms for MoM Blocks’ Low-Rank Factorization</strong>&lt;br&gt;Yaniv Brick, Ali E. Yilmaz, The University of Texas at Austin, United States</td>
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<td>14:40 &lt;br&gt;<strong>Hybrid Cross Approximation for Electric Field Integral Equation Based Scattering Analysis</strong>&lt;br&gt;Tu Zhao, Shanghai Jiao Tong University, China; Dan Jiao, Purdue University, United States; Junfa Mao, Shanghai Jiao Tong University, China</td>
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<td>15:20 &lt;br&gt;<strong>Primal and Dual Wavelets for Fast Electric Field Integral Equation Solutions on Unstructured Meshes</strong>&lt;br&gt;Simon Adrian, Technical University of Munich, Germany; Francesco P. Andriulli, Ecole Nationale Supérieure Mines-Télécom Atlantique, France; Thomas F. Eibert, Technical University of Munich, Germany</td>
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<td>15:40 &lt;br&gt;<strong>On the Low-Frequency and Refinement Regularization of the Reduced Kernel Wire EFIE</strong>&lt;br&gt;Adrien Merlini, Axelle Pillain, IMT Atlantique, France; Francesco P. Andriulli, IMT Atlantique, France</td>
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<td>16:00 &lt;br&gt;<strong>Enhancing the Jacobi Method with the CBFM for array antenna analysis</strong>&lt;br&gt;Danie Ludik, Matthys Botha, Stellenbosch University, South Africa; Rob Maaskant, Chalmers University of Technology, Sweden; David Davidson, Stellenbosch University, South Africa</td>
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<td>16:20 &lt;br&gt;<strong>Skeletonization Accelerated Multilevel Fast Multipole Algorithm for Volume Integral Equation</strong>&lt;br&gt;Yan-Nan Liu, Xiao-Min Pan, Xin-Qing Sheng, Beijing Institute of Technology, China</td>
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<td>16:40 &lt;br&gt;<strong>Fast Solution of Linear Systems With Many Right Hand Sides Using MPI Parallel Skeletonization</strong>&lt;br&gt;Si-Lo Huang, Xiao-Min Pan, Xin-Qing Sheng, Beijing Institute of Technology, China</td>
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<tr>
<td><strong>Impedance Matching Devices, Circuits and Techniques</strong>&lt;br&gt;TU-A1.2P</td>
<td>13:20 &lt;br&gt;<strong>Passive and Active Matching of Electrically-Small Helical Antenna for HF-Band Communications</strong>&lt;br&gt;Gitansh Gulati, University of Arizona, United States; Ahmed Abdeelmaun, University of Colorado Boulder, United States; Qi Tang, Min Liang, Tamal Bose, Hao Xin, University of Arizona, United States</td>
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<td>13:40 &lt;br&gt;<strong>Comparison of S-parameters of Wide-band Planar Baluns</strong>&lt;br&gt;Kanakshi Sato, Akinori Matsui, Saitama Institute of Technology, Japan</td>
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<td>14:00 &lt;br&gt;<strong>Measured performances of coaxial-to-circular waveguide transitions</strong>&lt;br&gt;Tetsuya Yamamoto, Kei Urabe, Hiroshi Suzuki, AIST, Japan</td>
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<td>14:20 &lt;br&gt;<strong>Planar Sleeve Antenna with Left-handed Choke Structure</strong>&lt;br&gt;Takatsugu Fukushima, Naobumi Michishita, Nisshin Maruhana, National Defense Academy, Japan; Naoya Fujimoto, Hitachi Kokusai Electric Inc., Japan</td>
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<td>14:40 &lt;br&gt;<strong>A Novel T-junction Waveguide Power Divider with Anti-phases and Broad Bandwidth</strong>&lt;br&gt;Peng Zhao, Qingyuan Wang, Fan Zhang, Yi He, School of Physical Electronics, China</td>
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<td>15:20 &lt;br&gt;<strong>Characteristic Modes for U-Slot’s Feed Placement</strong>&lt;br&gt;Mahrukh Khan, Deb Chatterjee, University of Missouri-Kansas City, United States</td>
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<td>15:40 &lt;br&gt;<strong>Compact Single/Multi Bands Frequency Reconfigurable Antenna Using PIN Diode Controlled Meta-surface</strong>&lt;br&gt;Ahmed Zahran, Future University in Egypt, Egypt; Mahmoud A. Abdalla, Military Technical College, Egypt</td>
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<td>16:00 &lt;br&gt;<strong>Wideband and Compact Microstrip Tapered Balun with Circular Slot and Double Dielectric Layer</strong>&lt;br&gt;Seung Gook Cha, Chan Ju Park, Young Joong Yoon, Yonsei University, Republic of Korea; Hyungtrak Kim, Daegu University College, Republic of Korea</td>
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<td>16:20 &lt;br&gt;<strong>A three-port reconfigurable network for multi-polarization antenna applications</strong>&lt;br&gt;Linfeng Yuan, Xianling Liang, Haijun Fan, Maohua Zhu, Weiren Zhu, Junping Geng, Ronghong Jin, Shanghai Jiao Tong University, China</td>
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<td>16:40 &lt;br&gt;<strong>The Impact of Introduced Coupling Elements on Characteristic Mode</strong>&lt;br&gt;Zhiping Liang, Jun Gao, Xuewu Cui, University of Electronic Science and Technology of China, China</td>
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**Electrically Small Antennas for MIMO WLAN and 5G**
Session Co-Chairs: Wei Lin, University of Technology Sydney; Francisco Falcone, Universidad Publica de Navarra

**TU-A1.3P.1**
13:20
**Ultra-Low Profile Tri-Polarized Antenna for WLAN/MIMO Application**
Komlan Payne, Syracuse University, United States; Taehee Jang, JMA Wireless, United States; Jun H. Choi, Syracuse University, United States

**TU-A1.3P.2**
13:40
**A New Design System for Low Profile Inverted L Antenna Including a Matching Circuit**
Takashi Yamagajo, Yohei Koga, Manabu Kai, Fujitsu Laboratories Limited, Japan

**TU-A1.3P.3**
14:00
**Compact Wideband Circularly Polarized Antipodal Curredly Tapered Slot Antenna**
Xiaohe Cheng, Beijing University of Posts and Telecommunications Beijing, China; Yuan Yao, Beijing University of Posts and Telecommunications, China; Xiaoming Liu, Limai Qi, Zhijiao Chen, Junsheng Yu, Beijing University of Posts and Telecommunications Beijing, China; Xiaodong Chen, Queen Mary University of London, United Kingdom

**TU-A1.3P.4**
14:20
**A Triple-Band Hybrid-mode GPS/WLAN Antenna for Smart Phone with Full Metal Housing**
Yixin Li, Xiaojun Tang, Yumei Yu, Wei Shi, Guangli Yang, Shanghai University, China

**Wideband Feeds for Directional Antennas**
Session Co-Chairs: Maxim Ignatenko, University of Colorado Boulder; Ming Huang, Southwest China Institute of Electronic Technology

**TU-A1.4P.1**
13:20
**Feed Study for a Wideband 18 to 45 GHz Luneburg Lens Antenna**
Milica Notaros, Maxim Ignatenko, Dejan Filipovic, University of Colorado Boulder, United States

**TU-A1.4P.2**
13:40
**The Modified J-Pole: A Wideband End-Fed Half-Wave Dipole for a VHF Reflector Feed System**
Steven Ellingson, Virginia Tech, United States

**TU-A1.4P.3**
14:00
**Wideband High Gain Circularly Polarized Fabry-Perot Resonator Antenna with Asymmetric Superstrates**
Huy Hung Tran, Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea; Truong Khang Nguyen, Ton Duc Thang University, Vietnam

**TU-A1.4P.4**
14:20
**Integrated calibration noise coupler for room temperature SKA Band 1 feed system**
Jonas Flygare, Bhushan Billade, Magnus Dahlgran, Bo Westberg, Miroslav Pantaleev, Chalmers University of Technology, Sweden

**TU-A1.4P.5**
14:40
**A Compact Broadband Switched Beam Antenna With 360° Multibeam Scanning/Omnidirectional Coverage**
Ming Huang, Southwest China Institute of Electronic Technology, China

**Sensors, Filters and Polarizers**
Session Co-Chairs: Abe Akhiyat, Ohio State University; Mehmet Unlu, Ankara Yildirim Beyazit University

**TU-UD.1P.1**
15:20
**Terahertz Slotted Ring Resonator Sensor**
Hadi Amarloo, Safieddin Safavi-Naeini, University of Waterloo, Canada

**TU-UD.1P.2**
15:40
**Full-wave Analysis and Equivalent Circuit Extraction for Capacitive Touch Panels: Theory and Measurements**
Andrea Lootgang, Sameer Sharma, Degan Zhou, University of Toronto, Canada; Darren Leigh, Tactual Labs, Canada; Costas D. Sarris, University of Toronto, Canada

**TU-UD.1P.3**
16:00
**Finite-size passive narrow bandpass filters for shortwave infrared (SWIR) region**
Umar Hasni, Umit Ozgur, Erdem Topsakal, Virginia Commonwealth University, United States

**TU-UD.1P.4**
16:20
**Ultra-compact Broadband TE-pass Polarizer Based on Vanadate-nanowire-integrated SOI Waveguides**
Yasheng Bian, Lei Kang, Qiang Ren, Ping Werner, Douglas H. Werner, The Pennsylvania State University, United States
Biomedical Microwave to THz Imaging
Session Chair: Abas Sabouni, Wilkes University

TU-A5.1P.1 13:20
A Large-scale Clinical Trial of Radar-based Microwave Breast Imaging for Asian Women: Phase I
Fan Yang, Southern University of Science and Technology, China; Lin Sun, Zhenhua Hu, Huaihai Wang, Dan Pang, Rui Wu, Xiaofeng Zhang, Shenzhen El Medical Technology Co., Ltd., China; Yifan Chen, The University of Waseda; Southern University of Science and Technology, New Zealand; Qingfeng Zhang, Southern University of Science and Technology, China

TU-A5.2P 13:40
Detection of the Cervical Spondylotic Myelopathy Using Noninvasive Microwave Imaging Technique
Sarad Al Muqatash, Mahsa Khamechi, Abas Sabouni, Wilkes University, United States

TU-A5.3P 14:00
Permittivity Estimation for Improved Microwave Medical Imaging
Ali Zamani, Amin Abbosh, The University of Queensland, Australia

TU-A5.4P 14:20
Surface Estimation of Imaged Object in Microwave Medical Imaging
Ali Zamani, Amin Abbosh, The University of Queensland, Australia

TU-A5.5P 14:40
Stroke Detection Based on an Improved Artificial Fish Swarm Algorithm
Jun-Bin Li, Ming-Da Zhu, Yi-Zhi Wu, Sheng Ye, Donghua University, China

TU-A5.6P 15:00
Microwave time reversal mirror for breast tumor detection
Saptarshi Mukherjee, Yiming Deng, Lalita Udpa, Satish Udpa, Prem Chahal, Edward Rothwell, Michigan State University, United States

TU-A5.7P 15:20
High-resolution Polarimetric THz Imaging for Biomedical Applications
Nandhini Srinivasan, Cosan Caglayan, Nino K. Nahar, Kubilay Sertel, The Ohio State University, United States

TU-A5.8P 16:00
Near-Field Tapered Waveguide Probe Operating at Millimeter Waves for Skin Cancer Detection
Umair Khokhar, Syed Akbar Raza Noqvi, Noor Al-Badri, Konstanty S. Bielakowski, Amin Abbosh, The University of Queensland, Australia

TU-A5.9P 16:20
Compressed thermoacoustic imaging based on stochastic binary amplitude modulation
Zhi Chen, Xiang Wang, ShanghaiTech University, China

Propagation in Indoor, Urban and Terrestrial Environments
Session Co-Chairs: Christophe Caloz, École Polytechnique de Montréal; Reuven Shavit, Ben Gurion University

TU-A4.1P.1 13:20
Effects of Ionospheric Scintillation on V and W Band Signals
David R. Smith, Bertus Shelters, Derek Hesser, Peter Collins, IEEE, United States; James Fee, James Patrosky, American Nuclear Society, United States; Andrew Tarzwell, Institute of Electrical & Electronics Engineers (IEEE), USA, United States; Caglar Yardim, IEEE, United States

TU-A4.2P 13:40
A Review of the Radio Wave Propagation through Vegetation
Maryam Delghani Estanki, Simon Fraser university, Canada; Chris Hynes, Andrew Lea, Fastback Networks, Canada; Rodney G Voughan, Simon Fraser university, Canada

TU-A4.3P 14:00
Radio-Channel Characterization of an Underground Mine using Circularly polarized antennas at 2.4 GHz
Lorna Arabi, Université du Québec en Abitibi-Témiscamingue, Canada; Moulay Elhassan El Azhari, University of quebec in outaouais, Canada; Maoud Nedil, Nabi Kandil, Mohamedoumedine Seddiki, Université du Québec en Abitibi-Témiscamingue, Canada; Larbi Talbi, University of quebec in outaouais, Canada

TU-A4.4P 14:20
On the Shadowing Distribution for Ultra Wideband In-Body Communication Path Loss Modeling
Jan-Christoph Brumm, Gerhard Bauch, Hamburg University of Technology, Germany

TU-A4.5P 14:40
Quantifying the degradation on radar detection range through vegetation clutter
Paula Gómez-Pérez, Centro Universitario de la Defensa, Spain; Marcos Crego-Garcia, Migo Cuillas, Universidad de Vigo, Spain

TU-A4.6P 15:00
Impact of NLOS on the Path Loss and Channel Capacity of a MIMO Off-body System Inside a Mine
Moulay Elhassan El Azhari, Larbi Talbi, university of quebec in outaouais, Canada; Maoud Nedil, Ismail Bennamoun, Université du Québec en Abitibi-Témiscamingue, Canada

TU-A4.7P 15:20
NLOS Capacity and Time dispersion of a Multipath Fading MIMO Channel Using Directive Antennas in an Underground WBAN Application
Moulay Elhassan El Azhari, Larbi Talbi, University of quebec in outaouais, Canada; Maoud Nedil, Ismail Bennamoun, Université du Québec en Abitibi-Témiscamingue, Canada

TU-A4.8P 16:00
Sub/Super-Luminal Space-Time Slab: Fundamental Scattering Symmetries
Zoé-Lise Deck-Léger, Christophe Caloz, Polytechnique Montréal, Canada

TU-A4.9P 16:20
A Novel Ultrawideband FDTD Numerical Modeling of Ground Penetrating Radar on Arbitrary Dispersive Soils
Luciano Mescia, Politecnico di Bari, Italy; Pietro Bia, EmTeSys s.r.l., Italy; Diego Caratelli, The Antenna Company Nederland B.V., Netherlands

TU-A4.10P 16:40
Troposcatter Transmission Loss Subseciton Model
Peipei Wei, Xiaoyan Du, Huyan Yu, National Digital Switching System Engineering & Technology R&D Center (NDSC), China; Jianhui Liu, National Digital Switching System Engineering & Technology R&D Center (NDSC), Aarhus University Aarhus, China
Recent Developments in Scattering and Propagation Modeling and Experiments
Session Co-Chairs: David Michelson, University of British Columbia; Muhammad Dawood, New Mexico State University

TU-UC.1P.1 13:20
Evaluation of transmission quality of indoor users using low site base station with vertical multi-beams
Tatsuomi Mitui, Kantaro Nishimori, Niigata University, Japan; Takefumi Hiraguri, Nippon Institute of Technology, Japan

TU-UC.1P.2 13:40
Phase Error Compensation in Fourier Domain for Fast Autofocus of Spotlight SAR
Jin-Woo Kim, In-June Hwang, Hye-Won Jo, Ghoo Kim, Jong Sang Yoo, Jong-Won Yu, Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea

TU-UC.1P.3 14:00
A new propagation model for massive MIMO considering outdoor propagation characteristics at 20GHz band
Ryotaro Taniguchi, Kentaro Nishimori, Niigata University, Japan; Ngochao Tran, Koshiro Kitao, Tetsuro Imai, NTT DOCOMO, INC., Japan

TU-UC.1P.4 14:20
Application of Earth-Space Path Loss as a Constraint in the Design of LEO Satellite Constellations
Ibrahim Sanad, David Michelson, University of British Columbia, Canada

Advances in Hardware for MM-Wave Communications and RADAR
Session Co-Chairs: Thomas Fromenteze, University of Limoges; Mahmoud Abdalla, Military Technical College

TU-UC.2P.1 15:20
Fully Polarimetric FMCW Instrumentation Radar at 228 GHz
Adib Nashashibi, Badeea Alazem, Kamal Sarabandi, University of Michigan, United States

TU-UC.2P.2 15:40
95/190 GHz Push-Push VCO in 90 nm CMOS
Yo-Sheng Lin, Kai-Siang Lan, Yu-Ching Lin, Yun-Wen Lin, National Chi Nan University, Taiwan

TU-UC.2P.3 16:00
94 GHz VCO Using Negative Capacitance Technique
Yo-Sheng Lin, Kai-Siang Lan, Yu-Wen Lin, National Chi Nan University, Taiwan

TU-UC.2P.4 16:20
Estimate of Harmonic Loadpull Impedances for RF High Power Devices Using 3D FEM Simulation
Wing Zhu, Damon Holmes, Zachary Cavin, Ebrahim Seragi, Jeffrey Jones, NXP Semiconductors, United States

TU-UC.2P.5 16:40
94 GHz CMOS Down-Conversion Micromixer
Yo-Sheng Lin, Kai-Siang Lan, Ching-Rong Peng, Yun-Wen Lin, National Chi Nan University, Taiwan
Emerging Techniques in Imaging at Microwave, mmWave and THz Frequencies
Session Co-Chairs: Okan Yurduseven, CMIP - Duke University; Thomas Fromenteze, University of Limoges; Jonah Gollub, Duke University; Mohammadreza F. Imani, Duke University; David Smith, Duke University

WE-SP.1A.1 08:00
Optimized Metasurface Apertures for Human-Scale Millimeter Wave Computational Imaging System
David R. Smith, Okan Yurduseven, Daniel L. Marks, Jonah N. Gollub, Duke University, United States

WE-SP.1A.2 08:20
Millimeter wave computational interferometric radiometer
Gyli Decroze, Etienne Lazane Kpe, Mactar Mouhamadou, Thomas Fromenteze, University of Limoges, France; Sebastien Reynaud, CISTEME, France

WE-SP.1A.3 08:40
High Transmit Power and High Transmit/Receive Isolation in a 183 GHz FMCW Radar
Ken Cooper, Raquel Monje, Jose Siles, Matthew Lebsock, Jet Propulsion Laboratory, California Institute of Technology, United States

WE-SP.1A.4 09:00
Compressive Sensing Based Threat Object Detection using Reconfigurable Reflectarray
Min Liang, University of Arizona, United States; Ahmad Abdelrahman, The University of Colorado Boulder, United States; Mark Neifeld, Hao Xin, University of Arizona, United States

WE-SP.1A.5 09:20
Single-bit Compressive Imaging System for the mmW and THz Bands
Syed An Naimu Saqueb, Kabilay Sertel, The Ohio State University, United States

Break 09:40

WE-SP.1A.6 10:00
Wideband Archimedean Spiral Antenna for Millimeter-wave Imaging Array
Mark Jones, David Sheen, Jonathan Tedeschi, Pacific Northwest National Laboratory, United States

WE-SP.1A.7 10:20
Single-pixel mm-Wave Imaging Using 8-bits Metamaterial-based Compressive Reflector Antenna
Ali Molaei, Juan Heredia Jueses, Jose A. Martinez-Lorenzo, Northeastern University, United States

WE-SP.1A.8 10:40
Super Resolution For Microwave Imaging: A Deep Learning Approach
Pratik Shah, Mahsa Moghaddam, University of Southern California, United States

WE-SP.1A.9 11:00
Wavefront shaping of microwaves using tunable reflectarrays for radar, imaging and wireless communications
Philipp del Hougne, Matthieu Dupré, Mathias Fink, Fabrice Lemoult, Geoffrey Lerosey, Institut Langevin - ESPCI ParisTech & CNRS, France

WE-SP.1A.10 11:20
Frequency-Domain Interferometric Imaging and Velocity Vector Estimation using Networked Ultra-wideband 80-GHz Array Radar Systems
Takuya Sakamoto, University of Hyogo, Japan; Toru Sato, Kyoto University, Japan; Kenta Iwasa, Hidekuni Yano, Panasonic Corporation, Japan

WE-SP.2A Special Session Coronado A
Automotive Antennas
Session Co-Chairs: Hyok Song, HRL Laboratories, LLC; Timothy Talty, General Motors

WE-SP.2A.1 08:00
Vehicular Roof Antenna Cavity for Coverage at Low Elevation Angles
Gerald Arndt, Robert Longwieser, Christoph Mackenbräucker, Technische Universität Wien, Austria

WE-SP.2A.2 08:20
Electromechanical Loading of Frequency Selective Surfaces
Walter Wolff, Hyok Song, James Schafftner, HRL Laboratories, LLC, United States

WE-SP.2A.3 08:40
Design and Integration of High Precision GPS/GNSS Antennas for Modern Cars
Bernd Stein, Rahul Bhat, Martin Kuhn, Hirschmann Car communication GmbH, Germany

WE-SP.2A.4 09:00
Cellular Antenna Element Design Impact to Integration on Vehicle (Cellular Antenna Element Performance)
Leo Lancot, Ford Motor Company, United States

WE-SP.2A.5 09:20
Optimal Numerical Analysis of Electronically-Steered Arrays Onboard Electrically-Large Platforms
Derek Campbell, C. J. Reddy, Altair Engineering Inc, United States

Break 09:40

WE-SP.2A.6 10:00
Patterned Textured Fascia for 77 GHz Radar Propagation Variation Reduction
Arthur Bakaryan, Hyok Song, Kevin Geary, HRL Laboratories, LLC, United States; Igal Blik, Jeremy Gray, General Motors, United States

WE-SP.2A.8 10:40
Multi-Coil Wireless Power Transfer System for Electric Vehicles
Manjunath Machnoor, Erik Gamez Rodriguez, Gianluca Lazzi, University of Utah, United States

WE-SP.2A.9 11:00
Array Antenna with Uniformly Excited Elements to Realize an Equivalent Arbitary Field Distribution A key technology for mass-production antenna engineering
Tadashi Ikano, Toshihiro Nogawora, Kuniaki Shibata, Kenji Saegusa, Nihon University, Japan

WE-SP.2A.10 11:20
Inkjet Printing of Antennas on Glass or Solar Cells
Muhammadaziz Tursunniyaz, Rayhan Bakht, Utah State University, United States
**Active and Tunable Meta- and Nano-structures**

Session Co-Chairs: Hossein Mosallaei, Northeastern University; Mohammad Albooyeh, University of California Irvine

**WE-A2.1A**

**WE-A2.1A.1**

Periodic Structures for Scalable High-Power Microwave Transmitters

Aobo Li, University of California, San Diego, United States; Ebrahim Forati, TDK, United States; Sanghoon Kim, Jeyaon Lee, Yunbo Li, Daniel F. Sievenpiper, University of California, San Diego, United States

**WE-A2.1A.2**

Significant Efficiency Enhancements in High Power Backward Wave Oscillators using Inhomogeneous Slow Wave Structures

Ushemadzoro Chipengo, Niru K. Nahar, John L. Volakis, The Ohio State University - Electromagnetics Laboratory, United States

**WE-A2.1A.3**

A Yttrium Dioxide Integrated Hybrid Metamaterial with Electrically Driven Multifunctional Control

Lei Kang, Liu Liu, Sawyer D. Campbell, Taiwei Yue, Qiang Ren, Theresa Mayer, Douglas H. Werner, The Pennsylvania State University, United States

**WE-A2.1A.4**

Multifunctional Metasurfaces Nanoantennas by Gate-Tunable Materials

Ali Forouzmand, Hossein Mosallaei, Northeastern University, United States

**WE-A2.1A.5**

Antenna-transmitter based on Non-Foster Source

Silvio Hrabar, Aleksandar Kincsik, Igor Krus, University of Zagreb, Croatia

**Break**

**WE-A2.1A.6**

Reconfigurable Nanowire Assembly Enabled Field-Switchable Broadband Polarizers

Lei Kang, Sarah Boehm, Taiwei Yue, Qiang Ren, Christine Keating, Douglas H. Werner, The Pennsylvania State University, United States

**WE-A2.1A.7**

Manipulating Light in Nanophotonics Devices Using Double-Metasurface Cavity

Luzhou Chen, Karim Achouri, Christophe Caloz, École Polytechnique de Montréal, Canada; Efthymios Kallios, Metamaterial Technologies Inc., Canada

**WE-A2.1A.8**

Graphene-based terahertz polarization converters

Tianjing Guo, Christos Argyropoulos, University of Nebraska-Lincoln, United States

**WE-A2.1A.9**

Nonlinear graphene metasurface to enhance third harmonic generation at terahertz frequencies

Boyan Jin, Christos Argyropoulos, University of Nebraska-Lincoln, United States

**WE-A2.1A.10**

Design of A Reconfigurable Polarization Converter Based on RF Switches

Wei Li, Song Xia, Hongyu Shi, Guoxiang Dong, Anxue Zhang, Zhenrong Li, Zhou Xu, Xi'an Jiaotong University, China

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**Electromagnetic Material Properties: Measurements**

Session Co-Chairs: Maria Pour, University of Alabama in Huntsville; Jing Wang, University of South Florida

**WE-A2.2A**

**WE-A2.2A.1**

Broadband Complex Permittivity Measurement of Paraffin Films at 26 GHz–1 THz Using Time Domain Spectroscopy

Behnam Ghasemparvar, Nima Ghalehcheshmeh, The Ohio State University, United States

**WE-A2.2A.2**

Permittivity Measurement of Thin Dielectrics by Using Metamaterial Absorbers Inside a Waveguide

Filippo Costa, Marco Degiorgi, Michele Borgese, Agostina Monorchio, Giuliana Manana, University of Pisa, Italy

**WE-A2.2A.3**

Permittivity and Loss Characterization of Thin-Film Substrates up to 220 GHz

Patrick Sailer, Disk Plettemeier, Technische Universität Dresden, Germany

**WE-A2.2A.4**

Effectiveness of a Dielectric Probe Calibration using Deionized, Distilled and Tap Water

Sajid Asif, Benjamin Braaten, North Dakota State University, United States; Adnan Iftikhar, COMSATS Institute of Information Technology, Pakistan

**WE-A2.2A.5**

Chiral Media Characterization using both Linear and Circular Polarized Waves

Gregorio J. Molina-Cuberos, María J. Núñez, José Margineda, University of Murcia, Spain; Angel J. García-Collado, Catholic University of San Antonio, Spain; Alvaro Gómez, Oscar Fernandez, University of Cantabria, Spain

**Break**

**WE-A2.2A.6**

High-k and Low-loss Electromagnetic Composites for Direct Digital Manufacturing of mmWave Devices

Juan Casto, Eduardo A. Rojas-Nastrucci, Thomas Weller, Jing Wang, University of South Florida, United States

**WE-A2.2A.7**

Wireless System for the Measurement of Passive Electromagnetic Sensors in Laboratories

Gabriel Galindo-Romero, Javier Carrero-Cano, José Juan Martínez-Martínez, Francisco Javier Hernaiz-Martínez, Universidad Carlos III de Madrid, Spain

**WE-A2.2A.8**

A UWB Near-field Contactless Sensor for Solid and Liquid Material Characterization

Ali Pourghorban Saghafi, Kamran Entesari, Texas A&M University, United States

**WE-A2.2A.9**

Magnetic Induced Heating of Gold-Iron Oxide Nanoparticles

Michael Brown, Kaithin Cooper, Sarah Fulmer, Henry Sessions, Savannah River Nuclear Solutions, United States; Mohammad Ali, University of South Carolina, United States; Simona Murph, Savannah River Nuclear Solutions, United States

**WE-A2.2A.10**

Monte Carlo approach for investigating the fabrication imperfections for metasurface-lenses

Liyi Hsu, Boubacar Kanté, University of California, San Diego, United States
Novel Materials and Techniques for Reconfigurable Antennas
Session Co-Chairs: Dimitris Anagnostou, Heriot Watt University; Derek Doyle, Air Force Research Laboratory

WE-A1.1A.1 08:00
Design of Reconfigurable Meandered Line Dipole Antenna for Printed Graphene Applications
Ting Leng, Xeven Pan, Xianjun Huang, Zhirun Hu, University of Manchester, United Kingdom; Habiba Ousliman, Université Paris Ouest Nanterre La Défense, France; Mahmoud A. Abdalla, MIT College, Egypt

WE-A1.1A.2 08:20
Mill-Wave 2D Beam-Steering Focal Plane Array with Microfluidically Switched Feed Network
Enrique Gonzalez, Gokhan Mumcu, University of South Florida, United States

WE-A1.1A.3 08:40
Continuously Tunable Frequency Reconfigurable Liquid Metal Microstrip Patch Antenna
Khaled Alqurashi, James R. Kelly, University of Surrey, United Kingdom

WE-A1.1A.4 09:00
Phase agile BST-loaded dual resonance reflectarray design at K_a-Band
Michael Trampler, Xin Gang, University of Central Florida, United States

WE-A1.1A.5 09:20
A Configurable and Repeatable Multipath Channel Emulator
James Jamison, Blake Hewgill, Jeff Frolik, The University of Vermont, United States

Break 09:40

WE-A1.1A.6 10:00
Separation of Overlapped Sources Using Subarray Technique and Independent Component Analysis
Paulo Isart, Leite Ferreira, Federal Inst. of Science and Tec. of Paraíba, IFPB, Brazil; Glaucia Fontgalland, Federal University of Campina Grande, UFCG, Brazil

WE-A1.1A.7 10:20
A Digitally Tuned Reconfigurable Patch Antenna for IoT Devices
Fatima Asadallah, Joseph Costantine, American University of Beirut, Lebanon; Youssef Tawk, Notre Dame University Louaize, Lebanon; Leonardo Lizz, Fabien Ferret, University of Cate D’aze, France; Christos Christodoulou, University of New Mexico, United States

WE-A1.1A.8 10:40
A Dual Band Reconfigurable 6/4th Mode SIW-Inspired Antenna
Suwadeep Choudhury, Akhilesh Mohan, Indian Institute of Technology Kharagpur, India; Debashis Guha, University of Calcutta, India

WE-A1.1A.9 11:00
Dual band reconfigurable plasmonic antenna using bilayer graphene
Sasmita Dash, Arnabendra Parmeik, Indian Institute of Technology Roorkee, India

WE-A1.1A.10 11:20
Generations of radio vortex using circular time modulated arrays
Feng Lin, Yang Wang, Xiaoming Jing, Chongqing University of Posts and Telecommunications, China

Wideband Antennas for 5G, Full-Duplex, MIMO and AoA
Session Co-Chairs: Gabriel Rebeiz, University of California San Diego; Christophe Caloz, Polytechnique Montréal; Steven Ellingson, Virginia Tech

WE-A1.2A.1 08:00
The Advent of 5G Mobile
John Smee, Qualcomm Technologies Inc, United States

WE-A1.2A.3 08:40
Design of MAW Spiral Antennas for Direction-of-Arrival Sensing Using the Cramér-Rao Bound
Riley Pack, Dejan Filipovic, University of Colorado Boulder, United States

WE-A1.2A.4 09:00
A Spiral Antenna for Amplitude-Only Direction Finding
Gregor Lasser, Jake Cazden, Dejan Filipovic, University of Colorado, United States

WE-A1.2A.5 09:20
A Wideband Switched Beam Antenna System for 5G Femtocell Applications
Petros Santavas, ENSTA - Bretagne, France; Christos Kolitsidas, B.L.G. Jonsson, KTH Royal Institute of Technology, Sweden; Tzihat Empliouk, George Kyriacou, Democritus University of Thrace, Greece

Break 09:40

WE-A1.2A.6 10:00
Characterization of Dispersion Code Multiplexing (DCM) in Wireless Indoor Environment
Lianfeng Zou, Christophe Caloz, École Polytechnique de Montréal, Canada

WE-A1.2A.7 10:20
Wideband RF and Analog Self-Interference Cancellation Filter for Simultaneous Transmit and Receive System
Satheesh Bajo Venkatakrishnan, Elias Alwan, John L. Volakis, The Ohio State University, United States

WE-A1.2A.8 10:40
Processing Gain Using CDMA in Ultra-Wideband Multi-Channel Digital Beam-Formers
Dimitrios Siafarikas, Elias Alwan, John L. Volakis, The Ohio State University, United States

WE-A1.2A.9 11:00
Continuous Updating of Radio Environment Maps for Millimeter-Wave Networks with Beamforming
Steven Ellingson, Virginia Tech, United States

WE-A1.2A.10 11:20
Compact Wideband MIMO Antenna for 5G Communication
Wang Fei, Zhaoyun Duan, Qian Li, Yanyu Wei, Yubin Gong, University of Electronic Science and Technology of China, China
Applications of Computational Electromagnetics
Session Co-Chairs: Jianming Jin, University of Illinois at Urbana-Champaign; Maokun Li, Tsinghua University

WE-A3.1A.1 08:00
Electromagnetic Simulation of Specific Absorption Rate at 5G Frequencies with a Simplified Human Head Model and a Multi-Solver Method
Jian Guan, Su Yan, Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

WE-A3.1A.2 08:20
Quantitative Statistical Analysis with Physics-based Surrogate Modeling for Wave Chaotic Systems
Shen Lin, Zhan Peng, University of New Mexico, United States; Thomas Antonsen, University of Maryland, United States

WE-A3.1A.3 08:40
Quasi-static Analysis of Slotted Coaxial Cable
Jaeyul Choo, Hyun Shin Park, Youngsik Cho, Korea Institute of Nuclear Safety, Republic of Korea; Ho Joong Choi, Marvell Semiconductor, Inc, United States

WE-A3.1A.4 09:00
A Novel Input Impedance Computation Method for Coaxial Probe Fed Microstrip Antennas by Utilizing Characteristic Modes
Metehan Canir, Akgun A.S., Turkey; Lale Alatan, Middle East Technical University, Turkey

WE-A3.1A.5 09:20
Monostatic RCS Analysis for Armed and Unarmed UAV
Engleyan Durly, H. Taha Hayvaci, TDK University of Economics and Technology, Turkey

WE-A3.1A.6 09:40
Wiener-Hopf Formulation of the Scattering by a Stepped Wedge
Vito Daniele, Guido Lombardi, Rodolfo S. Zich, Politecnico di Torino - ISMB, Italy

WE-A3.1A.7 10:00
An Integral Equation Scheme for Plasma based Thin Sheets
Hasan Abbas, Robert Novels, Texas A&M University, United States

WE-A3.1A.8 10:20
Analysis on the characteristics of the EM wave propagation in the plasma sheath
Xin Yang, Bing Wei, Weizhe Yin, Xianning University, China

WE-A3.1A.9 11:00
The Radial Point Interpolation Method for Plasma Modeling
Yang Wu, University of Electronic Science and Technology of China, China; Zhizhang (David) Chen, Dalhousie University, Canada; Junfeng Wang, University of Electronic Science and Technology of China, China

WE-A3.1A.10 11:20
Research on the Electromagnetic Wave Scattering Characteristics of Time and Space Inhomogeneous Plasma Sheath
Wei Chen, Liang Gao, Jiangting Li, Xidian University, China

Numerical Techniques in Electromagnetics
Session Co-Chairs: Lijun Jiang, Hong Kong University; Kristof Cools, University of Nottingham

WE-A3.2A.1 08:00
Parallellization Efficiency of 2D MoM Code with Higher Order Basis Functions
Dragan Olcan, Jovana Perovic, University of Belgrade, Yugoslavia; Jasmin Musin, Branko Koldaž, WPED d.o.o., Yugoslavia

WE-A3.2A.2 08:20
2.5D Quasi-Axisymmetric Finite Difference Frequency Domain Modeling
Ann Morgenhaler, Casey Rappaport, Northeastern University, United States

WE-A3.2A.3 08:40
Numerical Benchmark Based on Characteristic Modes of a Spherical Shell
Miloslav Capek, Vrmlazkynich, Lukas Jelinek, CTU in Prague, Czech Republic; Mats Gustafsson, Doruk Tayel, Lund University, Sweden

WE-A3.2A.4 09:00
Antenna Termination Transformations in MoM
Nicholas Buys, NIEBENS, United States

WE-A3.2A.5 09:20
Comparison of Two Forward Models For Electric Field of Microwave Imaging Systems
Samar Hassainezadeh, Paul M. Meaney, Andreas Flager, Mikael Persson, Chalmers University of Technology, Sweden

WE-A3.2A.6 09:40
Green’s function in waveguides with inhomogeneous dielectrics using the method of Broadband Green’s functions
Tian-Hao Liao, Jet Propulsion Laboratory, United States; Kung-Hau Ding, Air Force Research Laboratory, Wright-Patterson AFB, United States; Leung Tsang, University of Michigan, United States

WE-A3.2A.7 10:00
Machine Learning Based Method of Moments (ML-MoM)
Heming Yao, Lijun Jiang, The University of Hong Kong, Hong Kong SAR of China; Yuwei Qin, Carnegie Mellon University, United States

WE-A3.2A.8 10:20
A Fast Algorithm for Quasi-Periodic Array Modeling Using Reduced Basis Method
Xunwang Dang, Maokun Li, Tsinghua University, China

WE-A3.2A.9 11:00
An Efficient Preconditioner for Analysis of Composite Dielectric and Thin Conductive Plate Objects
Lu Liu, Zaiqing Niu, Dinghong Wen, School of Electronic Engineering University of Electronic Science and Technology of China, China

WE-A3.2A.10 11:20
Hierarchical Loop-flower Basis Function for Low Frequency Breakdown Problem
Dinghong Wen, Zaiqing Niu, Yiling Wang, Lu Liu, University of Electronic Science and Technology of China, China
Miniature Antennas and Metamaterial Devices
Session Co-Chairs: Sima Noghanian, University of North Dakota; John Volakis, Ohio State University

WE-UB.1A.1 08:00
Performance Analysis of Textile AMC Antenna on Body Model
Ala Alemareyeen, Sima Noghanian, University of North Dakota, United States

WE-UB.1A.2 08:20
A Multi-Channel Passive Brain Implant for Wireless Neuropotential Monitoring
Wei-Chuan Chen, Cedric W. Lee, Asimina Kiourti, John L. Volakis, The Ohio State University, United States

WE-UB.1A.3 08:40
Significant Size-Reduction and Wideband Response of Acoustic Metamaterials with Non-Foster Technologies
Yasushi Horii, Yuki Uchiku, Tashiaki Kitamura, Kansai University, Japan

WE-UB.1A.4 09:00
Supershaped Complementary Split-Ring Resonators
Enrique Rubio Martínez-Dueñas, University of Granada, Spain; Carlos Moreno de Jong van Coevorden, Diego Caratelli, The Antenna Company, Netherlands

WE-UB.1A.5 09:20
A SIW Filter With Square Complementary Split-Ring Resonators (CSRRs)
Xiangou Zhang, Mengqian Yu, University of Electronic Science and Technology of China, China

Antenna Measurements
Session Co-Chairs: John Volakis, Ohio State University; Jennifer Bernhard, University of Illinois at Urbana-Champaign

WE-UB.2A.1 10:00
Improved Circuit Models for Wheeler Cap Efficiency Measurements
Elias Wilken-Resman, Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

WE-UB.2A.2 10:20
Approximating the Radiation Pattern of an Antenna in Complex Scenarios from Partial Information
Marco Righero, Giorgio Giordanengo, Matteo Alessandro Francavilla, Istituto Superiore Mario Boella, Italy; Francesca Vipiana, Giuseppe Vecchi, Politecnico di Torino, Italy

WE-UB.2A.3 10:40
Measurements and De-embedding Techniques for 5G Millimeter-wave Arrays
Brooke DeLong, Elias Alwan, John L. Volakis, The Ohio State University, United States

WE-UB.2A.4 11:00
Polarization Ratio Determination with Two Identical Linearly Polarized Antennas
Herbert Aumann, University of Maine, United States; Francis Willwerth, Kristan Tuttle, Massachusetts Institute of Technology Lincoln Laboratory, United States

WE-UB.2A.5 11:20
Fiber-coupled Probe for Atom-based RF Electric Field Metrology
Matt Simons, Joshua Gordon, Christopher Holloway, National Institute of Standards and Technology, United States

Antenna Theory and Design
Session Co-Chairs: Amir I. Zaghloul, Army Research Laboratory; Kubilay Sertel, Ohio State University

WE-UB.3A.1 08:00
Using Machine Learning Techniques to Analyze Characteristic Mode Data of Electrically Large Structures
John Outhwaite, Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

WE-UB.3A.2 08:20
Modeling Printed Slot Antenna Properties Versus Slot Thickness Using a Signal Flow Graph Model
Brian Gibbons, Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

WE-UB.3A.3 08:40
An Investigation of Radiation from Slot Antennas Etched on Finite Ground Planes using Characteristic Mode Theory
Pallavi Sharma, Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

WE-UB.3A.4 09:00
5:1 Bandwidth, Dual-Polarized Dielectric Rod Antenna Using a Novel Feed Structure
Anas Abumunshar, Kubilay Sertel, The Ohio State University, United States

WE-UB.3A.5 09:20
Increased Bandwidth of a Dual Band and Dual Polarization Probe-fed Microstrip Antenna
Gregory Mitchell, Amir Zaghloul, U.S. Army Research Laboratory, United States

WE-UB.3A.6 10:00
On the Modelling of Antenna Pattern Performance Using Equivalent Source Distributions for Vehicle Antenna Placement Engineering
Richard Termbinski, University of Ottawa / Royal Canadian Navy, Canada; Derek McNamara, University of Ottawa, Canada

WE-UB.3A.7 10:20
Compact Expressions for Efficiency and Bandwidth of Modulated Metasurface Antennas
Gabriele Minardi, Marco Fasani, Enrico Martini, University of Siena, Italy; Marco Sabbadini, European Space Agency, Netherlands; Stefano Maci, University of Siena, Italy

WE-UB.3A.8 10:40
Design and Comparison of Backward Helical and Spiral Antennas
Ali Mehrabani, LofotCraft Shafai, University of Manitoba, Canada

WE-UB.3A.9 11:00
TriBand Circularly Polarized Single Layer Patch Antenna for GPS Receivers
Asem Elfrgani, C. J. Reddy, Altair Engineering Inc, United States

WE-UB.3A.10 11:20
A New Active Steering Antenna for IoT Devices
Jaakko Kylänen, Olivier Pajonan, Laurent Descloux, Alexandre Padeau, Ethertronics, France
WE-A1.3A

Reflector Analysis and Design
Session Co-Chairs: Erik Jørgensen, TICRA; Dirk De Villiers, Stellenbosch University; Yehuda Leviatan, Technion - Israel Institute of Technology

WE-A1.3A.1 08:00
An End-to-End Optimization Approach to Drastically Reduce Cross-polarization in Offset mmWave Reflector Antennas
Joshua Kovitz, Vignesh Manohar, Yahya Rahmat-Samii, University of California, Los Angeles, United States

WE-A1.3A.2 08:20
An Exact, Closed Form Solution to Reflector Shaping
George Cheng, Yong Zhu, Jan Grzesik, Allwave Corporation, United States

WE-A1.3A.3 08:40
Multi-Objective Optimization of Reflector Antennas using Kriging and Probability of Improvement
Dirk de Villiers, Stellenbosch University, South Africa; Ivo Couckuyt, Tom Dhaene, Ghent University, Belgium

WE-A1.3A.4 09:00
Computation of Reflector Contours for Gaussian Beam Shaping Phased Array Antenna Elements
Christian Koenen, Uwe Siart, Thomas F. Eibert, Technical University of Munich, Germany

WE-A1.3A.5 09:20
Aperture Efficiency Performance Limits of the SKA Reflector System
Robert Lehmensiek, EWISS Antennas, South Africa; Dirk de Villiers, Stellenbosch University, South Africa

Break 09:40

WE-A1.3A.6 10:00
Efficient Surface Optimization of Large Dual Reflector Systems
Oscar Barries, Erik Jørgensen, Stig Busk Sørensen, Hans-Henrik Viskum, TICRA, Denmark

WE-A1.3A.7 10:20
Advanced Techniques for Grating Lobe Reduction for Large Deployable Mesh Reflector Antennas
Jakub Rosenkrantz de Larson, Cecilia Cappolin, Rolf Jørgensen, TICRA, Denmark; Lea Datsashvili, LSS, Germany; Jean-Christophe Angenot, ESTEC, Netherlands

WE-A1.3A.8 10:40
Development of a Circularly Polarized L-Band SAR Deployable Mesh Reflector Antenna for Microsat Earth Observation
Kotia Nagamine Urata, Josaphat Tetuko Sir Sumantyo, Nobuyoshi Imura, Koichi Ito, Chiba University, Japan; Steven Goo, University of Kent, United Kingdom

WE-A1.3A.9 11:00
L Band Circularly Polarized Synthetic Aperture Radar onboard Microsatellite using Parabolic Mesh Antenna
Josaphat Tetuko Sir Sumantyo, Kotia Nagamine Urata, Nobuyoshi Imura, Koichi Ito, Chiba University, Japan; Steven Goo, University of Kent, United Kingdom

WE-A1.3A

Antenna and EM Interactions with the Human Body
Session Co-Chairs: Gianluca Lazzi, University of Utah; Asimina Kiourti, Ohio State University

WE-UK.1A.1 08:00
Safe and Efficient Powering of Biomedical Implants through Multi-coil Wireless Power Transfer
Erik Gamez Rodriguez, Manjunath Machnoor, Pragya Kosta, Gianluca Lazzi, University of Utah, United States

WE-UK.1A.2 08:20
Communication System Design for Magnetic Induction-Based Wireless Body Area Network
Negar Galestani, Mahrih Maghabbohm, University of Southern California, United States

WE-UK.1A.3 08:40
Classification of Human Motions Using a Single On-Body Antenna
Yang Li, Baylor University, United States; Youngwook Kim, California State University, Fresno, United States

WE-UK.1A.4 09:00
60 GHz SIW horn antenna : off-body performance comparison with 4 GHz UWB monopole antenna
Sofia Razafimahatrana, Julien Sarazin, University Pierre and Marie Curie, France; Theodoros Movindis, Luca Patrillo, Philippe De Doncker, Université Libre de Bruxelles, Belgium; Aziz Benlarbi-Delai, University Pierre and Marie Curie, France

WE-UK.1A.5 09:20
Optically Transparent ISM Band Antenna for Wearable Medical Sensors
Ryan Green, Md Ullah, Vitaly Avrutin, Umit Orgur, Hads Morkoc, Erdem Topsakal, Virginia Commonwealth University, United States

Break 09:40

WE-UK.1A.6 10:00
Body-Worn 67:1 Bandwidth Antenna Using 3 Overlapping Dipole Elements
Cédric W. Lee, Dimitrios Papanastassios, Asimina Kiourti, John L. Volakis, The Ohio State University, United States

WE-UK.1A.7 10:20
A Comparison of Solid, Mesh, and Segmented Broad Dipoles in Biological Environments
Kristin Hall, Andrew Chrysler, Cindy Furse, University of Utah, United States

WE-UK.1A.8 10:40
A Modified Bow-Tie Antenna for Contact-Based Heartbeats Detection Applications
Yingsong Li, Songjie Bi, Xiaoguang "leo" Liu, University of California, Davis, United States

WE-UK.1A.9 11:00
A Low Profile Circular Patch Loaded Monopole Antenna Embedded in a Manhole Cover
Eun-Suk Yang, Jung-Woong Yao, Hoe-Won Soo, Chonbuk National University, Republic of Korea; Eun-Hoe Kim, In-Hwan Lee, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea
## Random and Complex Media I

**Session Co-Chairs:** Saba Mudaliar, Air Force Research Laboratory; Akira Ishimaru, University of Washington

### WE-UF.1A.1  08:00
**Excitation of Seismic Pulse Coda Waves in Random Heterogeneous Earth**
Akira Ishimaru, Yasuo Kuga, University of Washington, United States

### WE-UF.1A.2  08:20
**Truncation Effects in the Single Scatter Subtraction Approach**
Kevin Diomedi, Gary Brown, Virginia Tech, United States

### WE-UF.1A.3  08:40
**Scattering of Electromagnetic Waves by Ocean Surfaces at L Band Based on Numerical 3D Solutions of Maxwell Equations**
Tai Qiao, University of Michigan, Ann Arbor, United States; Leung Tsang, University of Michigan, Ann Arbor, United States; Simon Yueh, Joint Propulsion Laboratory, United States; Douglas Vandemark, University of New Hampshire, United States

### WE-UF.1A.4  09:00
**Brightness Temperature of Layered Media with Rough Surface via FDTD Method**
Zhi-Hong Lai, Jean-Fu Kiang, National Taiwan University, Taiwan

### Break  09:40

### WE-UF.1A.6  10:00
**A Rayleigh-Ritz Approach to Green's Function of an Inhomogeneous Layer**
Saba Mudaliar, Air Force Research Laboratory, United States; C. P. Vendhan, Indian Institute of Technology Madras, India; C. Prabavathi, Research Professional, United States

### WE-UF.1A.7  10:20
**Terrain Clutter Simulation Using Rough Surface Scattering Models with Digital Elevation Data and National Land Cover Data**
James Park, Air Force Research Laboratory, United States; Ryan Shaver, Michael Saville, Wright State University, United States; Scott Gobert, Panos Tzanos, Kristopher Kim, Air Force Research Laboratory, United States; Joel Johnson, The Ohio State University, United States; Kung-Hau Ding, Air Force Research Laboratory, United States

### WE-UF.1A.9  11:00
**Micro-Doppler Study of an Array of Rotating Spheres**
Sara Wheeland, Oren Sternberg, Drew Overturf, John Melding, SPAWAR Systems Center Pacific, United States

### WE-UF.1A.10  11:20
**Parametric Inversion of 3D Anisotropic Permittivities from Scattered Electromagnetic Fields**
Lin Sun, Youngstown State University, China

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## Magnetic Resonance Imaging

**Session Co-Chairs:** Ji Chen, University of Houston; Gregory Noetscher, Worcester Polytechnic Inst.

### WE-A5.1A.1  08:00
**Impacts of RF Shimming on Local SAR Caused by MRI 3T Birdcage Coil near Femoral Plate Implants**
Qi Zeng, Ran Guo, Jianfeng Zheng, Ji Chen, University of Houston, United States

### WE-A5.1A.2  08:20
**Metamaterial Loop Body Coil Element for 10.5T MRI**
Vijayaraghavan Panda, Gregor Adriany, University of Minnesota, United States; Thomas Vaughan, Columbia University, United States; Anand Gopinath, University of Minnesota, Twin Cities, United States

### WE-A5.1A.3  08:40
**A New Medical Implant Lead for 1.5 T, 3 T, and 7 T MRI Systems**
Rupam Das, Hyun-Suk Yoo, University of Ulsan, Republic of Korea

### WE-A5.1A.4  09:00
**Fast Prediction of MRI RF-induced Heating For Implantable Plate Devices Using Neural Network**
Jianfeng Zheng, Rui Yang, Ji Chen, University of Houston, United States

### WE-A5.1A.5  09:20
**RF-induced Heating Comparison between TEM and Birdcage Coils for Circular External Fixator**
Rui Yang, Jianfeng Zheng, Xin Huang, Ji Chen, University of Houston, United States

### Break  09:40

### WE-A5.1A.6  10:00
**Flexible RF Coil Array System Utilizing Electro-textiles for 3T MRI Carotid Artery Imaging**
Dasang Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

### WE-A5.1A.7  10:20
**Numerical evaluation of RF-induced heating for gap and pitch variation of helical stent under MRI**
Xiaohe Ji, Jianfeng Zheng, Ji Chen, University of Houston, United States

### WE-A5.1A.8  10:40
**Comparison of in-vivo and in-vitro MRI RF Heating for Orthopedic Implant at 3 Tesla**
Ran Guo, Jianfeng Zheng, Ji Chen, University of Houston, United States
**Electromagnetic Metasurfaces**

Session Co-Chairs: Valentina Sozio, Istituto Superiore Mario Boella; Muhammed Zubaraj, Los Alamos National Laboratory

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

Magnet-free Non-reciprocal Graphene Metasurfaces at THz Frequencies

Dimitrios Souanas, The University of Texas at Austin, United States; Tianqiu Guo, Choson Asagpoulos, The University of Nebraska-Lincoln, United States; Andrea Ali, The University of Texas at Austin, United States

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

Coding Metasurfaces for Diffuse Scattering: Theoretical Bounds and Sub-Optimal Design

Massimo Maci, University of Sannio, Italy; Shao Liu, Rui Yuan Wu, Southeast University, China; Giuseppe Castaldi, University of Sannio, Italy; Antonello Andreone, University of Naples, Italy; Tie Jun Cui, Southeast University, China; Veronica Cali, University of Sannio, Italy

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

Demonstration of Negative-Index Metasurface Composed of Concentric Copper-Dielectric Spheres

Boris Tanasic, Kassandra Maxwell, Air Force Research Laboratory, United States; Thomas Steffen, Defense Engineering Co., United States; Justin Wheatcroft, Bernet Hill Co., United States

**WE-UB.A.4** 09:00

Losses Estimation in Liquid-Crystal-Based Reconfigurable Slotted Metasurfaces

Santh Concerto Pavone, Enrica Martin, Francesco Caminita, Matteo Albani, Stefano Masi, University of Sannio, Italy

**WE-UB.A.5** 09:20

Metasurface Waveguide for Wireless Information Transfer from Sensors inside High-power Motors

Qingchi Liao, Masung Bengtsson, Nathaniel Taylor, Malikirajun Kande, Oscar Quevedo-Terval, KTH Royal Institute of Technology, Sweden

**WE-UB.A.6** 09:40

Dual-band modulated metasurface antennas

Marta Faenzi, University of Siena, Italy; David González Ovejero, Institut d’Electronique et de Télécommunications de Rennes - UMR CNRS 6164, France; Gabrielle Minatti, University of Sannio, Italy; Enrica Martin, Francesco Caminita, Wave Up Srl, Italy; Marco Sabbadini, European Space Agency, Netherlands; Stefano Masi, University of Sannio, Italy

**WE-UB.A.7** 10:00

Electrically Tunable Metasurfaces Based on Transparent Conducting Al-doped ZnO

Jun Ding, The University of Massachusetts Lowell, United States; David George, The University of North Texas, United States; Sangsoo An, Bowen Zhang, The University of Massachusetts Lowell, United States; Yuanjun Lin, The University of North Texas, United States; Huiliang Zhang, The University of Massachusetts Lowell, United States

**WE-UB.A.8** 10:20


John Hodge, Virginia Tech, United States; Amrit Zoghbi, U.S. Army Research Laboratory, United States

**WE-UB.A.9** 11:00

Metasurfaces with Engineered Reflection and Transmission Properties Based on Asymmetric Resonators

Hamdouna Chalabi, Dimitrios Souanas, Andrea Ali, The University of Texas at Austin, United States

**WE-UB.A.10** 11:20

Adiabatic Mode Formulation for Conical Metahorn

Valentina Sozio, Istituto Superiore Mario Boella, Italy; Marco Faenzi, University of Siena, Italy; Matteo Alessandro Francavilla, Istituto Superiore Mario Boella, Italy; Enrica Martin, Francesco Caminita, University of Sannio; Wave Up srl, Italy; Marco Sabbadini, European Space Agency, Netherlands; Stefano Masi, University of Sannio, Italy; Giuseppe Vecchi, Politecnico di Torino, Italy
Innovative Phased Arrays and Beamforming Technology
Session Co-Chairs: Jeffrey Herd, Massachusetts Institute of Technology Lincoln Laboratory; Paolo Rocca, University of Trento; Robert Mailloux, University of Trento

WE-SP.2P.1 13:20
Advances in Low-Cost Phased Arrays Using Silicon Technologies
Gabriel M. Rebeiz, University of California, San Diego, United States; Lee M. Paaske, Rockwell Collins, United States

WE-SP.2P.2 13:40
High Power Metasurface Reflectarray Antennas Using Switched Shorted Circular Elements
Michaël Gregoire, Jason Daniel Binnion, Daniel Zhu, John Easum, Qingjian Werner, Douglas H. Werner, The Pennsylvania State University, United States; Clinton P. Scarborough, E. x H, Inc., United States; Scott Griffiths, Joshua Pompeii, Joint Non-Lethal Weapons Directorate, United States

WE-SP.2P.3 14:00
Polarization Reconfigurable Sequentially-Rotated-Element Subarrays for Multifunctional Array Systems
Joshua Kovitz, Yahya Rahmat-Samii, University of California, Los Angeles, United States

WE-SP.2P.4 14:20
Multistatic Imaging Radar for Standoff Concealed Threat Detection
William Moulder, Janusz Majewski, Charles Coldwell, James Krieger, Huy Nguyen, Amanda Savage, Sean Tobin, Jeffrey Herd, Massachusetts Institute of Technology Lincoln Laboratory, United States

WE-SP.2P.5 14:40
Generation of Orbital Angular Momentum Modes by Four Dimensional Antenna Arrays
Chao Sun, Shiwen Yang, Yukai Chen, Shwei Ou, University of Electronic Science and Technology of China, China

Break 15:00

WE-SP.2P.6 15:20
Frequency-Domain Synthesis of Time-Modulated Arrays
Roberto Mana-Antone, Julio Bilpains, José A. García-Naya, Luis Castedo, University of A Coruna, Spain

WE-SP.2P.7 15:40
Simultaneous Transmit and Receive Performance of an 8-channel Digital Phased Array
Jonathan Doane, Kenneth Kolodziej, Bradley Perry, Massachusetts Institute of Technology Lincoln Laboratory, United States

WE-SP.2P.8 16:00
A Mask Matching Tiling Optimization Method for Clustered Phased Arrays
Nicola Anselmi, Paolo Rocca, Marco Salucci, Giorgio Gottardi, Andrea Massa, University of Trento, Italy

WE-SP.2P.9 16:20
Concentric Ring Array of Connecting Spirals with WAVES
Pedro Mendes Rui, Israel Hinostroza, Régis Guinvarc'h, CentraleSupélec, France; Randy Hant, Colorado School of Mines, United States

WE-SP.2P.10 16:40
Radio Array of Portable Interferometric Detectors (RAPID) : Design and Applications
Frank Lind, Colin Lonsdale, Ryan Volz, Anthea Castex, Chris Eckert, Rüya McWhirter, Jim Manchee, Robert Schafer, William Rideout, Reggie Wilcox, Massachusetts Institute of Technology, United States; Andrew Faulkner, Eley de Lera Aceda, Nina Razavi-Ghods, University of Cambridge, United Kingdom; Chris Martmann, Paul Ramirez, Jet Propulsion Laboratory, United States

Nanostructures and Materials
Session Co-Chairs: Brian Lail, Florida Institute of Technology; Juan Sebastian Gomez-Diaz, University of California Davis

WE-A2.1P.1 13:20
Quantum Light Rectification in Nano-Rectennas
Gregory Slepyan, Timo Gilad, Ami Boag, Tel Aviv University, Israel

WE-A2.1P.2 13:40
Radiation properties of THz photomixing antennas loaded with nanoplasmonic periodic structures in the gap
S. Mohsen Raeis-Zadeh, Saffadin Safaei-Noeini, Terahertz research lab, School of Electrical and Computer Engineering, University of Waterloo, Waterloo, ON, Canada, Canada

WE-A2.1P.3 14:00
Invisible Near-Field Probes at Infrared Frequencies based on Impedance Engineering at the Nanoscale
Abo Chan, Cornell University, United States; Andrea Alù, The University of Texas at Austin, United States; Francesca Monticone, Cornell University, United States

WE-A2.1P.4 14:20
Metasurface Solar Sail
Karim Achour, Christophe Caloz, École Polytechnique de Montréal, Canada

WE-A2.1P.5 14:40
An Efficient Wideband Numerical Simulation Technique for Nanostructures Comprised of DCP Media
Qiang Ren, Jogender Nagar, Lei Kang, Yusheng Bian, Ping Werner, Douglas H. Werner, The Pennsylvania State University, United States

Break 15:00

WE-A2.1P.6 15:20
Ultraslow Backward Propagating Hybrid Hyperbolic Phonon Polariton Waveguide Mode Characterization
Michael Finch, Brian Lail, Florida Institute of Technology, United States

WE-A2.1P.7 15:40
Tuning Simple Light Absorber of Fabry-Perot-Like Resonator
Ahmed Mekawy, Zewail City for Science and Technology, Egypt; Tamer A. Ali, Zewail City for Science and Technology, Cairo University, Egypt; Ashraf H. Badawy, Zewail City for Science and Technology, Egypt

WE-A2.1P.8 16:00
Modelling of the Effective Dielectric Constant of Corrugated Planar Goubau Lines for Terahertz Band
Muhammed Abdullah Unutmaz, Mehmet Uluu, Yıldırım Beyazıt University, Turkey

WE-A2.1P.9 16:20
Scattering properties of parity-time symmetric nanoparticle dimers
Robert Duggan, Mohammad Ali-Mei, Andrea Alù, The University of Texas at Austin, United States

WE-A2.1P.10 16:40
Mid-Infrared Plasmon Canalization over Black Phosphorus Metasurfaces
Diego Coreas-Serrano, University of California, Davis, United States; Andrea Alù, The University of Texas at Austin, United States; Juan Sebastian Gomez-Diaz, University of California, Davis, United States
Frequency Selective Surfaces: Antenna Applications  
**Session Co-Chairs:** Tayeb Denidni, Institut National de la Recherche Scientifique (INRS); Jorge Costa, Instituto de Telecomunicacoes, Instituto Superior Tecnico

**WE-A2.2P.1** 13:20
Antenna-Filter-Antenna-Based Cell for Linear-to-Circular Polarizer Transmit-Array  
Parinaz Naseri, Carlos A. Fernandes, Sérgio A. Matos, Jorge R. Costa, Instituto de Telecomunicacoes, Portugal

**WE-A2.2P.2** 13:40
Wideband FSS Superstrate for Millimeter-wave Antenna Gain Enhancement  
Arun Kesavan, Jamal Zaid, Tayeb A. Denidni, Institut National de la Recherche Scientifique (INRS), Canada

**WE-A2.2P.3** 14:00
Simple Beam Control of End-Fire Antenna Using FSS for MM-Wave Applications  
Mohamad Manzah, Tayeb A. Denidni, Institut National de la Recherche Scientifique (INRS), Canada

**WE-A2.2P.4** 14:20
Subwavelength Metamaterial-Lined Apertures as Far-Field Imaging Devices  
Elham Baladi, Ashwin K. Iyer, University of Alberta, Canada

Electromagnetic Material Properties: Modelling  
**Session Co-Chairs:** Roberto Graglia, Politecnico di Torino; Nathan Jastram, University of Colorado Boulder

**WE-A2.3P.1** 13:20
A High-Q Annular Ring Antenna as a Microwave Near-Field Material Sensor  
Ali Albishi, Omar Ramahi, University of Waterloo, Canada

**WE-A2.3P.2** 15:20
On the Use of Radome Materials for a High-Power, Wideband, Millimeter Wave Antenna  
Conrad Andrews, Roger Hasse, Ljubodrag Boskovic, Nathan Jastram, Dejan Filipovic, University of Colorado Boulder, United States

**WE-A2.3P.3** 16:00
Recent Developments in Liquid Crystals for Microwave Applications  
Carsten Fritzsch, Michael Wittek, Merck KGaA, Germany

**WE-A2.3P.4** 16:20
Metallic Nanoparticles in Dielectrics: A Comparative Study  
Agamyrat Agambayev, Mohamed Farhat, Hakan Bagci, Khaled Nabil Salama, King Abdullah University of Science and Technology, Saudi Arabia

**WE-A2.3P.5** 16:40
Morphological Structure Optimization for 3D Nano ZnOw Microwave Absorbing Material  
Yu-Chen Zhao, Yan-Ning Yuan, Yu-Rong Pu, Jiang-Fan Liu, Xiao-Li Xi, Xi’an University of Technology, China

Wireless Power Transfer and Harvesting Involving Antenna Arrays and Metamaterials  
**Session Co-Chairs:** Payam Nayeri, Colorado School of Mines; John Pantoja, Universidad Nacional de Colombia

**WE-A5.1P.1** 13:20
Balanced Full-wave Rectenna for Electromagnetic Energy Harvesting  
Faruk Erkmen, Thamer Almoneef, Omar Ramahi, University of Waterloo, Canada

**WE-A5.1P.2** 13:40
Exploiting Antenna Array Configurations for Efficient Simultaneous Wireless Information and Power Transfer  
Gustaf Silver, Christos Koltsidas, Oskar Björkqvist, Martin Mårtsson, Oskar Dahlberg, Lars Jonsson, KTH Royal Institute of Technology, Sweden

**WE-A5.1P.3** 14:00
A Smart Wireless Energy Harvesting System with Adaptive Beamforming and Power Management  
Daniel Schemmel, Payam Nayeri, Colorado School of Mines, United States

**WE-A5.1P.4** 14:20
A Planar Transmitting Array System with a Single Tuning Capacitor for uniform Power Transfer Coverage  
Zhu Liu, Qi Yang, Yu, University of Electronic Science and Technology of China, China; Zhizhang (David) Chen, Dalhousie University, China

**WE-A5.1P.5** 14:40
Design of a High Gain Quasi-Yagi Antenna and Array for Rectenna  
Yuting Song, Junjun Wang, Xiling Luo, Beihang University, China

**WE-A5.1P.6** 15:20
A Multi-Resonant Meta-Absorber as an Electromagnetic Energy Harvester  
Safullah Khan, Thomas F. Eibert, Technical University of Munich, Germany

**WE-A5.1P.7** 15:40
Investigation of Hybrid Metamaterial for Enhancing Efficiency of Wireless Power Transfer Systems  
Y-Chen Chen, Ming-Lung Kung, Ken-Huang Lin, National Sun Yat-sen University, Taiwan

**WE-A5.1P.8** 16:00
Preliminary Investigations into a Simple and Effective Rectenna for RF Energy Harvesting  
Joseph J. Trad, Basit A. Zeb, Karu P. Esselle, Mohammad U. Afzal, Macquarie University, Australia

**WE-A5.1P.9** 16:20
Antenna Array Assessment for RF Energy Harvesting  
Carlos Rivera, John J. Pantoja, Francisco Roman, Universidad Nacional de Colombia, Colombia

**WE-A5.1P.10** 16:40
A Model for 3D-Printed Microstrip Transmission Lines using Conductive Electrifi Filament  
Syany Ray, Mohammad Bilal Qureshi, Sojed Asif, Benjamin Braaten, North Dakota State University, United States
Ultra Wideband Antennas and Systems

**WE-A5.2P.1**
Wideband Monostatic Spiral Array for Full-Duplex Applications
Ehab Etellisi, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder, United States

**WE-A5.2P.2**
Wideband Amplitude-Only Direction Finding Subsystem with Conical Spirals
Jake Cazden, Dejan Filipovic, University of Colorado Boulder, United States

**WE-A5.2P.3**
Single and Dual-Polarized Wideband Simultaneous Transmit and Receive Antenna System
Mohamed Elmansouri, Prathap Valala Prasannakumar, Elie Tianang, Ehab Etellisi, Dejan Filipovic, University of Colorado, United States

**WE-A5.2P.4**
4.8-Gbit/s Broadband Orbital Angular Momentum and Polarization Multiplexing at Radio Frequency
Baiyang Liu, Yuehui Cui, RongLin Li, South China University of Technology, China

**WE-A5.2P.5**
Development of GPR Using 16 Channel Impulse UWB Radar Array
Jihoon Kwon, Nojun Kwak, Seoul National University, Republic of Korea; Yeosun Yoon, Hanwha Systems, Republic of Korea; Dongwon Yang, Agency for Defense-Development, Republic of Korea

**WE-A5.2P.6**
Broadband Spiral Diversity Antenna with Dielectric Loading
Shilpa Kharche, Pragati Patel, Jayanta Mukherjee, Indian Institute of Technology Bombay, India; Pummy Ratna, Usha Verma, Advanced Systems Laboratory (ASL), Hyderabad, India

**WE-A5.2P.7**
Vector Channel-Sounder Using Fiber Delay Lines to Separate the Channels
Saad Mahboob, Simon Fraser University, Canada; Siamak Bonyadi Ram, University of British Columbia, Canada

**WE-A5.2P.8**
An Ultra-Wideband Low-Phase Noise Local Oscillator for Phased Array Antenna System
Jingjing Ye, Wenxun Li, Xiaohong Tang, Xin Xu, Ying Jiang Guo, University of Electronic Science and Technology of China, China

Multiphysics Methods and Applications

**WE-A3.1P.1**
Multiphysics Modeling in Computational Electromagnetics: Technical Challenges and Potential Solutions
Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

**WE-A3.1P.3**
Electromagnetic-Micromagnetic Simulator for Magnetization-Eddy Current Dynamics in Magnetic Materials and Devices
Simon Couture, Vitaliy Lomakin, University of California, San Diego, United States

**WE-A3.1P.5**
A Novel Spin Wave Based Antenna Using Magnetic Materials
Ying Jiang Guo, Xiaohong Tang, Ke Fan Hou, Wen Xun Li, University of Electronic Science and Technology of China, China; Kai Da Xu, Xiamen University, China

**WE-A3.1P.6**
Multiphysics Simulation of Microstructure Formation by Self-Propagating Photopolymer Waveguides
Adour Kabakian, Sophia Yang, Shuoqin Wang, Alan Jacobsen, HRL Laboratories, LLC, United States

**WE-A3.1P.7**
Coupling of Electromagnetic and Elastic Waves: Modeling of Anisotropic Elastic Wave Propagation in Acoustic Well Logging Excited by a Piezoelectric Transducer
Mingwei Zhang, Yuanguo Zhou, Xiamen University, China; Qiwei Zhan, Duke University, United States; Na Liu, Xiamen University, China; William Thomas Janes, Qing Huo Liu, Duke University, United States

**WE-A3.1P.8**
3D Modeling of BAW-based Multiferroic Antennas
Zhi Yao, Yuanxun Wang, University of California, Los Angeles, United States

**WE-A3.1P.9**
Full-wave-Hydrodynamic Modeling of 2DEG Graphene Channels for Terahertz Devices using ADI-FDTD Algorithm
Shabindu Bhandaw, Fernando Teixeira, John L. Volakis, The Ohio State University, United States

**WE-A3.1P.10**
DGTD Simulation of HPM Air Breakdown Using a 5-Moment Fluid Model and Non-Maxwellian EEDF
Su Yan, University of Illinois at Urbana-Champaign, United States; Andrew D Greenwood, Air Force Research Laboratory, United States; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States
Wednesday, July 12
WE-A3.2P
Mission Beach AB

Time Domain Integral Equations
Session Co-Chairs: Su Yan, University of Illinois at Urbana-Champaign; Zhen Peng, University of New Mexico
WE-A3.2P.1
A Full Wave Analysis of a Propagator Method for Electromagnetic Fields
Jongchul Shin, Robert Nevels, Texas A&M University, United States
13:20
WE-A3.2P.2
Integration Rules and Time Domain Integral Equation Stability
Daniel Weile, Jielin Li, Ismail Uluer, University of Delaware, United States; David Hopkins, U.S. Army Research Laboratory, United States
13:40
WE-A3.2P.3
A Novel Method of Moments Technique to Analyze Scattering from Arbitrary Shaped Wire Structures in the Time-Domain
Kapil Sharma, The Pennsylvania State University, United States; Kadappan Panayappan, Peregrine Semiconductor, United States
14:00
WE-A3.2P.4
An Explicit MOT Scheme for Solving the TD-EFIE on Nonlinear and Dispersive Scatterers
Soodeh Bin Sayed, King Abdullah University of Science and Technology, Saudi Arabia; Huseyn Arda Ulkü, Gebze Technical University, Turkey; Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia
14:20
WE-A3.2P.5
Investigation of Stability Issue in Marching-on-in-Degree Scheme for TD-EFIE
Ming-Da Zhu, Donghua University, China
14:40

Wednesday, July 12
WE-UB.1P
Mission Beach AB

Fast Methods and Parallelization Techniques
Session Co-Chairs: Branislav Notaros, Colorado State University; Michal Mrozowski, Gdansk University of Technology
WE-UB.1P.1
Algorithms for Adaptive Trees Within a Parallel MLFMA
Stephen Hughey, Hasan Metin Aktulga, Balasubramaniam Shanker, Michigan State University, United States
15:20
WE-UB.1P.2
A Space-Time Parallel Domain Decomposition Method for High Fidelity Electromagnetic Analysis
Shao Wang, Zhen Peng, University of New Mexico, United States
15:40
WE-UB.1P.3
Accelerating Electromagnetic FEM Computations Using CUDA
Adam Dziatkowski, Piotr Sypek, Adam Lamecki, Michal Mrozowski, Gdansk University of Technology, Poland
16:00
WE-UB.1P.4
Efficient Parallelization of MLFMA with a Hybrid Global Interpolation/Anterpolation Scheme
Stephen Hughey, Hasan Metin Aktulga, Balasubramaniam Shanker, Michigan State University, United States
16:20
WE-UB.1P.5
Numerical Analysis of Convergence of Sommerfeld Integrals in Layered Media Green’s Functions
Kalyan C. Dutbhakola, Daniel S. Kiddle, Deb Chatterjee, Ahmed Hassan, University of Missouri-Kansas City, United States; Michael Khoskins, Naval Research Laboratory, United States
16:40

Wednesday, July 12
WE-A1.1P
Promenade AB

Reconfigurable Antennas and Techniques
Session Co-Chairs: Majid Manteghi, Virginia Tech; Alexandros Feresidis, University of Birmingham; David Kelly, Bucknell University
WE-A1.1P.1
Multi-band Reconfigurable Quasi-Yagi Antenna
Abdurahman Himouda, Toyeb A. Danidi, INRS-EMT, Quebec University, Canada
13:20
WE-A1.1P.2
Multiple Parameter Reconfigurable Microstrip Patch Antenna
Marion Alloiaiti, James R. Kelly, University of Surrey, United Kingdom
13:40
WE-A1.1P.3
Wideband to Multi Sub-band Antenna with Different Bandwidths
Mohamedlamine Seddiki, Abdessalem Talbi, Mourad Nafli, Engineering School, LRCS University of Quebec, UQAC, Quebec, Canada; Farid Ghanem, Telecom Product Direction R&D&I, Brand Group, Civil Aviation Industry Pole, Algeria
14:00
WE-A1.1P.4
Circular Polarization Agile Microstrip Antenna with Double Balanced Multiplier on Ring Slot
Eisuke Nishiyama, Hiroki Matsui, Ichihiko Toyoda, Saga University, Japan
14:20
WE-A1.1P.5
Reconfigurable Multiband Bowtie Antenna for WiFi, WiMax, and WLAN Applications
Ali Mansoul, CDTA, Algeria
14:40
WE-A1.1P.6
A Mast Mounted Directional Antenna
Shiguang Chen, Mahmoud Khalil, Steven Goodall, US Army, United States
15:00
WE-A1.1P.7
Reconfigurable Pentagonal Slot Based 4-Element MIMO Antennas
Rifatag Hussain, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia
15:20
WE-A1.1P.8
Energy Efficient Reconfigurable Antenna for Ultra-Low Power IoT Devices
Thomas Hournet, Leonardo Lizza, Fabien Ferrero, Université Côte d’Azur, CNRS, LEAP, France; Christophe Danchesi, Stephane Boudaud, Abewey, France
15:40
WE-A1.1P.9
A Reconfigurable Monopole Antenna for GPS and SDAR Applications
Chao-Wei Hsu, Kuan-Wei Li, Jun-Yu Lai, ChienJen Wang, National University of Tainan, Taiwan
16:00

WE-A1.1P.10
Inverted F Antennas with Hexagonal Patches
Hisamatsu Nakana, Tomoki Abe, Yuhei Kameta, Junji Yamauchi, Hosei University, Japan
16:20
WE-A1.1P.11
A Reconfigurable Monopole Antenna for GPS and SDAR Applications
Chao-Wei Hsu, Kuan-Wei Li, Jun-Yu Lai, ChienJen Wang, National University of Tainan, Taiwan
16:40
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<th>Session</th>
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| WE-A1.2P.1 | 13:20 | Application Driven Antenna Design
Session Co-Chairs: Gregor Lasser, University of Colorado Boulder; Jie Xu, Loyola Marymount University |
| WE-A1.2P.2 | 13:40 | Degrees of Freedom of OAM-Based Communication Systems
Jie Xu, Loyola Marymount University, United States |
| WE-A1.2P.3 | 14:00 | Study of Antenna Systems located on Complex Platforms by using Characteristic Mode Analysis and Related Techniques
Raj Mittra, Ashwani Kumar, University of Central Florida, United States |
| WE-A1.2P.4 | 14:40 | Underdetermined DOA Estimation in the Presence of Mutual Coupling for Sparse Circular Array
Thomas Boskalo, Koichi Ichige, Hiroyuki Arai, Yokohama National University, Japan |
| WE-A1.2P.5 | 15:20 | Dual Band Multi-beam Base Station Antennas
Lin-Ping Shen, Hua Wang, Sadegh Farzaneh, Willi Lotz, Nasrin Hojjat, Minya Gavrilovic, Communication Components Antenna Inc, Canada |
| WE-A1.2P.6 | 15:40 | Antenna Design Methodology for Ear-to-ear/Ear-to-remote Communications
Zhichao Li, George Shaker, Mohammad-Reza Nezhad-Mirmo, Safieddin Safavi-Naeini, University of Waterloo, Canada |
| WE-A1.3P.1 | 13:20 | Reflectarray Analysis and Synthesis
Session Co-Chairs: Sean Hum, University of Toronto; Manuel Arrebola, Universidad de Oviedo |
| WE-A1.3P.2 | 13:40 | Circuit-based synthesis of a reflectarray
Alexandre Grossetete, Erwan Foum, Raphael Gillard, Maria Garcia-Viguenes, Institut of Electronics and Telecommunications of Rennes, France |
| WE-A1.3P.3 | 14:00 | Synthesis of a Multi-beam Dual Reflectarray Antenna Using Genetic Algorithms
Ciaran Geaney, Jianwei Sun, University of Toronto, Canada; Eduardo Martinez-de-Rioja, Jose A. Encinar, Technical University of Madrid, Spain; Sean V. Hum, University of Toronto, Canada |
| WE-A1.3P.4 | 14:20 | Efficient Computation of the Reflectarray Far Fields in Adaptive Grids for Speed Improvement
Daniel R. Prado, Manuel Arrebola, Marcos R. Pino, Fernando Las-Heras Andres, Universidad de Oviedo, Spain; Jose A. Encinar, Universidad Politecnica de Madrid, Spain |
| WE-A1.3P.5 | 14:40 | Reflectarray Antenna Simplification through Non-Radiating Currents Synthesis
Marco Salucci, Giacomo Oliveri, Angelo Gelmini, University of Trento, Italy; Daniele Bresciani, Thales Alenia Space, France; Andrea Masso, University of Trento, Italy |
| WE-A1.3P.6 | 15:20 | Advances on High-Performance Curved Reflectarrays for Telecommunication Applications
Min Zhou, Stig Bisk Sorensen, Jakob Rosenkranz de Lasson, Niels Vestergaard, Rolf Jørgensen, Erik Jürgensen, TDK/R, Denmark; Giovanni Toso, European Space Agency, Netherlands |
| WE-A1.3P.7 | 15:40 | Feed system optimization for Convex Conformal Reflectarray Antennas
Michele Becchina, Politecnico di Torino, Italy; Giuseppe Abdamo, CNR/IEIIT, Italy; Paolo Pirotta, Politecnico di Torino, Italy; Oscar Antonio Peverini, Giuseppe Vivone, CNR/IEIIT, Italy; Diego Marfidi, Flaviana Calignano, II Center for Sustainable Futures CSF@PolTo, Italy |
| WE-A1.3P.8 | 16:00 | Optimal Element Arrangement of Folded Reflectarray for High Aperture Efficiency
Jun Gi Jeong, Young Joong Yoon, Yonsei University, Republic of Korea; Hyunguk Kim, Daeilim University College, Republic of Korea |
| WE-A1.3P.9 | 16:20 | Generation of an Orbital Angular Momentum Mode based on a Cassegrain Reflectarray Antenna
Woo Jin Byun, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea; Yong Hee Cho, Mokwon University, Republic of Korea |
| WE-A1.3P.10 | 16:40 | Dual Orbital Angular Momentum Mode Antenna by Combination of Transimmiter and Reflectarray
Peng Kai Li, Chang Jiang You, Hong Fang Yu, Quan Wang, School of Communication and Information Engineering, China; Yu Jian Cheng, School of Electronic Engineering, China |
Therapeutic Applications of EM and Dosimetry
Session Co-Chairs: Kazuyuki Saito, Chiba University; Takuji Arima, Tokyo University of Agriculture and Technology

WE-UK.1P.1 13:20
Electrosurgical scalpel by combining RF current and microwave
Kazuyuki Saito, Sho Suzuki, Chiba University, Japan

WE-UK.1P.2 13:40
Optimization of Orientation and Positioning of Magnetic Coils for Implantable Neural Stimulation
Pragya Kosta, Kyle Lauzis, Gianluca Lazzi, University of Utah, United States

WE-UK.1P.3 14:00
Designing Electrical Stimulation in Hippocampal Prosthetic Devices Using a Closed-Loop Multi-Scale Simulation Strategy
Javad Paknahad, Kyle Lauzis, Gianluca Lazzi, University of Utah, United States

WE-UK.1P.4 14:20
Development of Wideband Local Exposure Antenna for Laboratory Small Animal Study
Takuji Arima, Toru Uno, Tokyo University of Agriculture and Technology, Japan

Electromagnetics for Therapeutic Applications
Session Chair: J.-C. Chiao, University of Texas at Arlington

WE-A5.3P.1 15:20
A novel coil for highly focused magnetic hyperthermia with nanoparticles
Danilo Brizi, University of Pisa, Italy; Nunzia Fontana, Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), Italy; Agostino Monorchio, University of Pisa, Italy

WE-A5.3P.2 15:40
Electroquasistatic Model of RF Capacitive Hyperthermia with Heat Convection Mechanism
Chien-Chang Chen, Jean-Fu Kiang, National Taiwan University, Taiwan

WE-A5.3P.3 16:00
Auto-Phase Calibration Loop of a Transmission Array for Focused Microwave Thermotherapy
Soon-Jik Jeon, Jang-Yool Kim, Seong-Ho Son, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea

Random and Complex Media II
Session Co-Chairs: Akira Ishimaru, University of Washington; Saba Mudaliar, Air Force Research Laboratory

WE-UF.1P.1 13:20
Modeling Snowpack Scattering and Emission Using a Fully Coherent Model
Shuran Tan, Jiyoue Zuo, Leung Tsang, University of Michigan, United States; San Nygliem, Jet Propulsion Laboratory, United States

WE-UF.1P.2 13:40
Efficient calculation of CBFs for the modeling of scattering by complex-shaped snow aggregates
Ines Fenni, Ziad S. Haddad, Jet Propulsion Laboratory, United States; Hélène Roussel, L2E UPMC, France; Raj Mittra, University of Central Florida, United States

WE-UF.1P.3 14:00
CASPER East Campaign LES-based RF Scintillation Study
Swagato Mukherjee, Caglar Yardim, The Ohio State University, United States; Tao Cao, Lian Shen, University of Minnesota, United States

WE-UF.1P.4 14:20
Small Scale Surface Roughness Effects on Enhanced Backscatter from a Layer of Vegetation
Avinash Sharma, The Johns Hopkins University Applied Physics Laboratory, United States; Roger Lang, The George Washington University, United States

WE-UF.1P.5 14:40
Designing sources for enhancement of early-time diffusion in short pulse propagation through random particulate media
Elizabeth Bleszynski, Marek Bleszynski, Thomas Jaroszewicz, Monopole Research, United States

Break 15:00

WE-UF.1P.6 15:20
An Operational Approach to Scattering of Objects in Complex Environment
Saba Mudaliar, Air Force Research Laboratory, United States

WE-UF.1P.7 15:40
Scattering of Electromagnetic Waves by Vegetation Based on Numerical 3D Solutions of Maxwell Equations
Huoning Huang, Leung Tsang, University of Michigan, United States; Tien-Hao Liao, Eni Njoku, Andreas Collinander, Jet Propulsion Laboratory, California Institute of Technology, United States; Kung-Hau Ding, Air Force Research Laboratory, Wright-Patterson AFB, United States

WE-UF.1P.8 16:00
SAR images simulation of tropical forests at P and L band
Jean-Pascal Manuaisin, Pierre Bordier, Vincent Gabin, Pascale Dubois-Fernandez, ONERA, France; Dominique Dubucq, Cedric Taillande, TOTAL, France

WE-UF.1P.9 16:20
A new convenient tool for ice sheets exploration The fractal dimension
Gerardo Di Martino, ALESSIO DI SIMONE, GIORGIO FRANCESCHETTI, DANIELE RICCIO, UNIVERSITÀ DI NAPOLI FEDERICO II, ITALY; Stephen Wall, Jet Propulsion Laboratory, California Institute of Technology, Italy

WE-UF.1P.10 16:40
Monte Carlo Simulation of Underwater Wireless Optical Communications in Turbulent Environments
Zahra Vat, Aghgar Ghafam, Isfahan University of Technology, Iran; David Michelson, University of British Columbia, Canada; Zahir Ghossemlou, Northumbria University, United Kingdom; Masoud Omoymi, Isfahan University of Technology, Iran; Hamed Noori, University of British Columbia, Canada
Remote Sensing Applications
Session Chair: Yee Hui Lee, Nanyang Technological University

**WE-UF.2P.1** 13:20
Radar Backscatter Modeling of Road Surfaces Near Grazing incidence at 77GHz
Xiuzhang Cai, Kamal Sarabandi, University of Michigan, United States; Douglas Blue, Ford Motor Company, United States

**WE-UF.2P.2** 13:40
Statistical Backscatter RCS Model for Vehicles and Pedestrians at 77GHz
Xiuzhang Cai, Kamal Sarabandi, University of Michigan, United States; Douglas Blue, Ford Motor Company, United States

**WE-UF.2P.3** 14:00
A Constant Conversion Factor for Retrieval of PWV from GPS Signals in Tropical Region
Shilpa Manandhar, Feng Yuan, Yee Hui Lee, Nanyang Technological University, Singapore; Yu Song Meng, Agency for Science, Technology and Research (A*STAR), Singapore

**WE-UF.2P.4** 14:20
Cloud Radiative Effect Study Using Sky Camera
Soumyabrata Das, Shilpa Manandhar, Feng Yuan, Yee Hui Lee, Nanyang Technological University, Singapore; Stefan Winkler, Advanced Digital Sciences Center (ADSC), Singapore, Singapore

**WE-UF.2P.5** 14:40
Investigation on Traffic Flow Control by Using A Millimeter Wave Radiometric Imaging System
Shengchang Lan, Haoyu Tang, Caitian Yang, Jinghui Qiu, Nannan Wang, Hua Zong, Alexander Denisov, Harbin Institute of Technology, China

Subsurface Remote Sensing
Session Co-Chairs: Jiefu Chen, University of Houston; Jaideva Goswami, C&J Research and Technology

**WE-UF.3P.1** 15:20
FDTD Modeling of Scattered Electromagnetic Waves at Ultra Low-Frequencies from Objects in Ocean Water
Dallin Smith, Sean Burns, University of Utah, United States; Stephen Potashnik, Office of Naval Research, United States; Jameima Simpson, University of Utah, United States

**WE-UF.3P.2** 15:40
Algorithm and Experimental System for Arbitrary 3D Fracture Network Detection and Mapping in Tri-axial Through-Casing Induction Measurement
Yuan Fang, Yunyun Hu, Dezhi Wang, Qing Huo Liu, Duke University, United States

**WE-UF.3P.3** 16:00
Hydraulic fracture imaging with galvanic measurements
Yunyun Hu, Yuan Fang, Dezhi Wang, Qing Huo Liu, Duke University, United States

**WE-UF.3P.4** 16:20
Geosteering Benchmark Models for Standardization of Directional Electromagnetic Logging-While-Drilling
Jiefu Chen, J Chen, University of Houston, United States

**WE-UF.3P.5** 16:40
Solving Subsurface Inverse Problem on the MapReduce Platform: A Langevin Dynamics Approach for Geosteering Inversion
Qiuyang Shen, Xuqing Wu, Jiefu Chen, University of Houston, United States; Yueqin Huang, Cyentech Consulting LLC, United States; Zhu Han, University of Houston, United States

Electrically Small Antenna Characteristics
Session Co-Chairs: Ted Simpson, University of South Carolina; Peder Hansen, Independent Consultant

**WE-A1.4P.1** 13:20
On Hertz and the Speed of Light
Ted Simpson, University of South Carolina, United States

**WE-A1.4P.2** 13:40
Upper Bounds on the Radiation Efficiency of Electrically Small Antennas
Carl Pfeiffer, Defense Engineering Corporation, United States

**WE-A1.4P.3** 14:00
Antenna G/T Degradation with Inefficient Receive Antennas at HF (2.30 MHz)
Marcus Walden, Pieltek, United Kingdom

**WE-A1.4P.4** 14:20
Electrically Small Antenna with Switchless Pattern Reconfiguration
Adam Nobilewicz, Max Annan, Dublin Institute of Technology, Ireland; Dirk Heberling, RWTH Aachen University, Germany

**WE-A1.4P.5** 14:40
Frequency Shift Keying for Direct Antenna Modulation (DAM) with Electrically Small Antenna
Rui Zhu, Skyler Selvin, University of California, Los Angeles, United States; Nian Guo, The University of Hong Kong, Hong Kong SAR of China; Yuanxun Wang, University of California, Los Angeles, United States

**WE-A1.4P.6** 15:00
Broadband Electrically Short Transmitters via Hi-Speed Time-Varying Antenna Properties
Morris Cohen, Lee Thompson, Nathan Opalinski, Parker Singleterry, Mitchell Walker, Cheong Chan, Georgia Institute of Technology, United States; Mark Golkowski, University of Colorado Boulder, United States

**WE-A1.4P.7** 15:20
Design of Miniaturized Multiple U-Slot Antenna using Theory of Characteristic Modes
Mehrukkh Khan, Deb Chatterjee, University of Missouri-Kansas City, United States

**WE-A1.4P.8** 16:00
Highly Scalable Slotted Small Antennas
Altan Ferendeci, University of Cincinnati, United States

**WE-A1.4P.9** 16:20
C-band Self-oscillating Active Integrated Antenna
Ming Cai, Xiaoqiang Li, Guangli Yang, Shanghai University, China

**WE-A1.4P.10** 16:40
A Single-fed Circularly Polarized Using Water Substrate Patch Antenna with Small Size Low-Profile and Broadband
Dong Wang, Junping Geng, Ronghong Zhu, Weiwen Zhu, Liang Liu, He Qi, Yunxiao Xu, Department of Electronics Engineering, China
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<th>Session Co-Chairs</th>
<th>08:00 - 11:40</th>
<th>Special Session</th>
<th>Grand Hall D</th>
<th>Thursday, July 13</th>
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<tr>
<td><strong>Applications of Electromagnetics and RF Techniques in Medicine and Biology</strong></td>
<td><strong>TH-SP.1A</strong></td>
<td>08:00</td>
<td><strong>Towards a Minimally Invasive Integrated Microwave Approach for Image-Guided Thermal Ablation of Cancer</strong></td>
<td>Luz Maria Navar, James Sawicki, Hung Luyen, Yahyo Mohandas, Barry Van Veen, Nader Behdad, Susan Haggard, University of Wisconsin-Madison, United States</td>
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<td><strong>Study of Practical Limitations of Real-Time Microwave Imaging of Tissue</strong></td>
<td><strong>TH-SP.1A.2</strong></td>
<td>08:20</td>
<td><strong>Overview of Human Vital Signs Detection Using Radar Techniques</strong></td>
<td>Aly E. Fathy, Lingyun Ran, SSBihan Nahar, University of Tennessee, United States; Ozlem Kicic, The Catholic University of America, United States</td>
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<td><strong>Electrical Stimulation Waveform Design Towards Increasing the Effectiveness of Retina Prosthetic Devices</strong></td>
<td><strong>TH-SP.1A.3</strong></td>
<td>09:00</td>
<td><strong>An Approach for Cardiovascular Monitoring Based on Electromagnetic Induction</strong></td>
<td>Gregorios Karagiorgos, Christos Manopoulos, Sokrates Tsangaris, Konstantina Niki, National Technical University of Athens, Greece</td>
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<td><strong>Development of an Unobtrusive Patch to Acquire EEG in the Home Setting for Studies of Alzheimer’s Disease</strong></td>
<td><strong>TH-SP.1A.4</strong></td>
<td>09:40</td>
<td><strong>Novel On-Body Microwave Antenna Array Testbed for Highly-Sensitive Measurements of Wrist Bone Signature</strong></td>
<td>Sergey N Mokarov, NEVA Electromagnetics, LLC, United States; William Appleyard, Patrick D. Carberry, Harshal V Tankaria, Worcester Polytechnic Inst., United States; Gregory M Noetscher, NEVA Electromagnetics, LLC, United States; Ara Nuzanian, Harvard Medical School, United States</td>
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<td><strong>Efficiency Analysis of a Conformal SCMR System for Wearable Devices</strong></td>
<td><strong>TH-SP.1A.5</strong></td>
<td>10:20</td>
<td><strong>On Pneumothorax Detection in Microwave Frequencies Region</strong></td>
<td>Thanasis Baner, Kun Bao, Carlos Flores, Kevin Baze, Stavros V. Georgakopoulos, Florida International University, United States</td>
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<td><strong>Wireless Power Transfer to High-Voltage Subcutaneous Implants using Near-Field Capacitive Coupling</strong></td>
<td><strong>TH-SP.1A.6</strong></td>
<td>11:00</td>
<td><strong>A 3D Printed Half-Width Microstrip Leaky-Wave Antenna</strong></td>
<td>Vincenzo Gjokaj, Pramjeet Chahal, Lea Kempe, Edward Rothwell, Michigan State University, United States</td>
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<td><strong>A Novel 3D Printed Dual GSM Band Near Isotropic On-Package Antenna</strong></td>
<td><strong>TH-SP.1A.7</strong></td>
<td>11:20</td>
<td><strong>A Novel 3D Printed Vivaldi Antenna Utilizing a Substrate Integrated Waveguide Transition</strong></td>
<td>Vincenzo Gjokaj, Pramjeet Chahal, John Popapolymerou, John Albrecht, Michigan State University, United States</td>
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<td><strong>3D Printed Antennas and Components</strong></td>
<td><strong>TH-SP.2A</strong></td>
<td>08:00</td>
<td><strong>A Triple Mode Waveguide Corrugated Horn Antenna Using 3D Printing Technology</strong></td>
<td>Alejandro Castro, Satish Kumar Sharma, San Diego State University, United States</td>
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<td><strong>Application of 3-D Printing to Fabrication of Highly-Efficient Waveguide-Based Antenna Array with Integrated Monopulse Comparator</strong></td>
<td><strong>TH-SP.2A.1</strong></td>
<td>08:20</td>
<td><strong>Wideband Ku-Band Antennas using Multi-Layer Direct Digital Manufacturing</strong></td>
<td>Mere Kocar, University of South Florida, United States; Casey Perkowski, Paul Deffenbaugh, Scipio Inc., United States; Janice Booth, US Army, United States; Gokhan Mumcu, Thomas Weller, University of South Florida, United States</td>
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<td><strong>Novel 3D-Printed “Chinese Fan” Bow-Tie Antennas for Origami/Shape-Changing Configurations</strong></td>
<td><strong>TH-SP.2A.2</strong></td>
<td>09:00</td>
<td><strong>Novel 3D-Printed Half-Width Microstrip Leaky-Wave Antenna</strong></td>
<td>Vincenzo Gjokaj, Pramjeet Chahal, Lea Kempe, Edward Rothwell, Michigan State University, United States</td>
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<td><strong>3D Printed Multilayer mm-Wave Dielectric Rod Antenna with Enhanced Gain</strong></td>
<td><strong>TH-SP.2A.3</strong></td>
<td>09:40</td>
<td><strong>A 3D Printed Dual GSM Band Near Isotropic On-Package Antenna</strong></td>
<td>Zhen Su, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia</td>
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<td><strong>A Novel 3D Printed Vivaldi Antenna Utilizing a Substrate Integrated Waveguide Transition</strong></td>
<td><strong>TH-SP.2A.4</strong></td>
<td>10:00</td>
<td><strong>A Novel 3D Printed Half-Width Microstrip Leaky-Wave Antenna</strong></td>
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<td><strong>Break</strong></td>
<td><strong>TH-SP.2A.6</strong></td>
<td>10:40</td>
<td><strong>A 3D Printed Half-Width Microstrip Leaky-Wave Antenna</strong></td>
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<td><strong>TH-SP.2A.8</strong></td>
<td>11:20</td>
<td><strong>A 3D Printed Half-Width Microstrip Leaky-Wave Antenna</strong></td>
<td>Vincenzo Gjokaj, Pramjeet Chahal, John Popapolymerou, John Albrecht, Michigan State University, United States</td>
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**Note:** Sessions are listed in chronological order from 08:00 to 11:40 on Thursday, July 13. Each session includes a title, a brief description, and the authors/presenters' names and affiliations. The sessions cover topics ranging from medical applications of electromagnetics and RF techniques to advancements in 3D printed antennas and components.
Applications of Metamaterials

Session Co-Chairs: Reuven Shavit, Ben-Gurion University; Ferran Paredes, Universitat Autònoma de Barcelona

TH-A2.1A.1
A Smart Mobile Handset Plastic Case With Integrated Split Ring Resonators to Reduce SAR
Hengyi Zhou, Arpan Pal, Amit Mehta, Swansea University, United Kingdom; Danush Mirshekar-Syahkal, University of Essex, United Kingdom

TH-A2.1A.2
2D Flat Lens Design Made of Dielectric Cylinders Using the Array Scattering Method
Eran Falek, Reuven Shavit, Ben-Gurion University, Israel

TH-A2.1A.3
Broadband Metamaterial Absorber for both Normal and Oblique Incidence
Toan Trong Nguyen, Sungjoon Lim, Chung-ANG University, Republic of Korea

TH-A2.1A.4
A Phenomenological Electromagnetic Theory of CNT-DNA Metabiomaterials for Applications to Biosensing and DNA Sequencing
Said Nikki, Saeid Saba, University of New Haven, United States; Gangadhar Behera, Royal Military College of Canada, Canada; Christopher Morris, University of New Haven, United States; Yassine M. M. Antar, Royal Military College of Canada, Canada

TH-A2.1A.5
Mutual Coupling Reduction in Millimeter-Wave MIMO Dielectric Resonator Antenna Using Metamaterial Polarization Rotator Wall
Mamadoumadi Fantoni, Jamal Zaid, Tayeb A. Denidni, Institute of National Research and Scientific (INRS), Canada; Mohammad Akbari, Abdol Razik Sabah, Concordia University, Canada; Mourad Nedil, University of Quebec, Canada

TH-A2.1A.6
Planar Fan-Beam Reflective Array Antenna based on Non-Bianisotropic Complementary Split-Ring Resonators (NB-CSRRs)
Pau Agulló, Gerard Zamora, Ferran Paredes, Ferran Martín, Joni Bonache, Universitat Autònoma de Barcelona, Spain

TH-A2.1A.7
Ultra Compact Quad Band Resonator Based on Novel D-CRLH Configuration
Abo Fed, Omar I. Hussein, Hania S. Abdelhamid, MSA University, Egypt; Mahmoud A. Abdalla, Nile College, Egypt

TH-A2.1A.8
Coherent control of absorption in water based metamaterial
Weiren Zhu, Chang He, Xiaoling Liang, Junping Geng, Ronghang Jin, Shanghai Jiao Tong University, China

TH-A2.1A.9
A novel circular patch antenna of generating vortex beams based on complex transformation optics
Xiang Liao, Zhu Zhang, Beijing Jiaotong University, China

TH-A2.1A.10
Frequency-Controlled Beam Scanning Array Fed by Spoof Surface Plasmon Polaritons
Jia Yuan Yan, Tie Jun Lui, Southeast University, China

Terahertz Devices

Session Co-Chairs: Nuria Llombart, Delft University of Technology; Giorgio Carluccio, Delft University

TH-A5.1A.1
Terahertz Field Localization Using Slot Dielectric Waveguide Implemented in Si-On-Glass (SOG) Technology
Hadi Amerloos, Saeid Safavi-Naeini, University of Waterloo, Canada

TH-A5.1A.2
Optical Leaky Waveguide Antenna Using Shallow Etched Circular Waffled Waveguide
Hiroyuki Asahi, Toshihiko Baba, Hiroshi Arai, Yokohama National University, Japan

TH-A5.1A.3
Study of free-space coupling into mm-wave whispering-gallery mode resonators for a radioastronomy receiver
Gabriel Santamaría-Botelle, Karlos Atia Abdulmadad, Universidad Carlos III de Madrid, Spain; Mário-Justino Schlecht, Friedrich-Alexander Erlangen-Nurnberg University, Germany; David González-Oviedo, California Institute of Technology, United States; Florian Sedlmeier, Harald G. L. Schwefel, University of Orangerie, New Zealand; Stefan Malzer, Heiko Weber, Friedrich-Alexander Erlangen-Nurnberg University, Germany; Daniel Segovia-Vargas, Universidad Carlos III de Madrid, Spain; Danagh McCarthy, John Anthony Murphy, Gottfried Dohler, Maynooth University, Ireland; Luis Enrique García Muñoz, Universidad Carlos III de Madrid, Spain

TH-A5.1A.4
Modelling of Photonic Band Gap Filters for Terahertz Photoconductive Antennas and Photomixers
Kazim Demir, Asaf Behzat Sahin, Mehmet Unlu, Yildirim Beyazit University, Turkey

TH-A5.1A.5
Design of a Phase Shifting Impedance Tuner for Terahertz Photomixers Arrays
Suleyman Burak Celik, Kazim Demir, Asaf Behzat Sahin, Mehmet Unlu, Ankara Yildirim Beyazit University, Turkey

TH-A5.1A.6
Analysis of Absorbers under Quasi-Optical Systems: Distributed Incoherent Sources
Shahab Udin Dabirunezare, Andrea Noto, Nuria Llombart, Delft University of Technology, Netherlands

TH-A5.1A.7
Efficiency Enhancement of Bowtie Photomixer Antenna by using Resistively Loaded Line
Adam Yilmaz, KTO Karatay University, Turkey; Mehmet Unlu, Ankara Yildirim Beyazit University, Turkey

TH-A5.1A.8
Design of Slot Surface Plasma Polariton Based Terahertz Delay Lines
Muhammad Abdullah Unutmaz, Mehmet Unlu, Yildirim Beyazit University, Turkey

TH-A5.1A.9
Performance Analysis of Next-generation Passive Optical Network (XG-PON)
Prasant Kumar Sahni, Debaldina Ghosh, Indian Institute of Technology Bombay Bhuvaneswar, India

TH-A5.1A.10
Terahertz Metamaterial to Demonstrate Extremely Wide Range of Effective Refractive Indices in the 0.3-THz Band
Kazuhiro Watan, Koki Ishihara, Satoshi Kondoh, Tatsuya Sato, Masato Shiyo, Takehito Suzuki, Ibaraki University, Japan
### Wireless Power Transfer

Session Co-Chairs: Joseph Costantine, American University of Beirut; Mauro Ettorre, CNRS, University of Rennes

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<td>TH-A5.2A.1</td>
<td>Long Slot Van Atta Array for Far-Field Wireless Power Transfer</td>
<td>08:00</td>
<td>Mauro Ettorre, CNRS UMR 6164, University of Rennes 1, France; Waleed A. Alomar, Communication and Information Technology Research Institute (CITRI), KAUST, Saudi Arabia; Anthony Grbic, University of Michigan, United States</td>
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<td>TH-A5.2A.2</td>
<td>Warpage-free Antenna for Smart Contact Lens</td>
<td>08:20</td>
<td>Loyao Chen, George Shaker, Salieedin Safavi-Naeini, University of Waterloo, Canada</td>
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<td>TH-A5.2A.3</td>
<td>Applications of Using Conformal SCMR System for Batteryless Wearable Sensor Device</td>
<td>08:40</td>
<td>Kun Bo, Stavros V. Georgakopoulos, Florida International University, United States</td>
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<td>TH-A5.2A.4</td>
<td>Cylindrical Vector Beams for Wireless Power Transfer</td>
<td>09:00</td>
<td>Fans Alsalamy, University of Michigan, United States; Waleed A. Alomar, Communication and Information Technology Research Institute (CITRI), KAUST, Saudi Arabia; Anthony Grbic, University of Michigan, United States</td>
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<td>TH-A5.2A.5</td>
<td>Miniaturized Wireless Power Transfer Systems using 3-D Strongly Coupled Magnetic Resonance</td>
<td>09:20</td>
<td>Hao Hu, Kun Bo, Stavros V. Georgakopoulos, Florida International University, United States</td>
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<td>Daerhan Liu, Stavros V. Georgakopoulos, Florida International University, United States</td>
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<td>Experimental Validation of Multi-Layer Coil Inductance Estimation Method</td>
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<td>Jihoon Kim, Gwangju Institute Science and Technology, Republic of Korea; Bobae Kim, Jihan Kang, Hanwha Systems, Republic of Korea; Kangwook Kim, Gwangju Institute Science and Technology, Republic of Korea</td>
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<td>Hao Hu, Kun Bo, Daerhan Liu, Stavros V. Georgakopoulos, Florida International University, United States</td>
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<td>TH-A5.2A.9</td>
<td>Microwave Power Transmission for Multi-targeting Antenna Using Time-Reversal Technology</td>
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<td>Ping Lu, Xue-Song Yang, Bing-Zhang Wang, University of Electronic Science of Technology of China Chengdu, China, China</td>
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<td>TH-A5.2A.10</td>
<td>Wideband Wide-Slot Antenna Array with Protrusion for Wide-Angle Scanning</td>
<td>11:20</td>
<td>Sheng Ye, Donghua University, China; Xianling Liang, Juxin Qiang, Shanghui Jiao Tong University, China</td>
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### Wideband Horn and Vivaldi Antennas

Session Co-Chairs: Nathan Jastram, University of Colorado Boulder; Marco Panduro, Centro de Investigación Científica y de Educación Superior de Ensenada

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<td>Elie Tianang, Mohamed El mansouri, Dejan Filipovic, University of Colorado Boulder, United States</td>
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<td>Comparative Study of Dual-Linear Versus Dual-Circular Horns for 18 to 45 GHz Repeaters</td>
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<td>Nathan Jastram, Dejan Filipovic, University of Colorado Boulder, United States</td>
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<td>Marco A. Panduro, CICESE Research Center, Mexico; Alberto Reyna, Omar Elizarraraz, Aldo Mendez, Universidad Autónoma de Tamaulipas, Mexico</td>
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<td>Yury Yukhanov, Tatiana Prividalova, Arsen Gevorkyan, Southern federal university, Russian Federation</td>
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<td>Chintrajit Sarkar, University of Calcutta, India; Lathu J. A. Shank, Indian Institute of Space Science and Technology, India; Jawad A. Siddiqui, University of Calcutta, India; Chinnay Sahe, Indian Institute of Space Science and Technology, India; Yahia M. M. Antar, Royal Military College of Canada, Canada</td>
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<td>Hangyu Zhang, Shiwen Yang, Yangjun Du, Yikai Chen, University of Electronic Science and Technology of China, China</td>
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<td>Jinyi Huang, Mahmoud Shirazi, Xin Gung, University of Central Florida, United States</td>
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Hybrid Methods
Session Co-Chairs: Jianming Jin, University of Illinois at Urbana-Champaign; Alexander B. Yakovlev, University of Mississippi

TH-A3.1.1 08:00
Broadband Monostatic Scattering Calculation of Deep Open Cavities
Kedi Zhang, Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States; Chao-Fu Wang, National University of Singapore, Singapore

TH-A3.1.2 08:20
An MPI-Accelerated Multi-Solver Algorithm for Electromagnetic Modeling of Complex Objects
Jian Guan, Su Yan, Kedi Zhang, Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

Computations of Electromagnetic Wave Scattering Using FEM-BEM-DDM with H-Matrices
Ping-Hao Jia, Jun Hu, Rongrong Zhang, Lianning Song, Zaiping Nie, University of Electronic Science and Technology of China, China

Computations of Scattering by Shaped Dielectric Lenses and a comparison with Measurements
Ravishankar Sankaranarayanan, Shrinivas Kr. Jayaram, Rashtriya Vidyalaya College of Engineering, India; Arjun Ravishankar, Qualcomm Inc, United States

TH-A3.1A.9 11:00
Improved Current Continuity Boundary Condition of Hybrid MoM-PO Method
Zi-Liang Liu, Chao-Fu Wang, National University of Singapore, Singapore

Layered Medium Integral Equation Methods
Session Co-Chairs: Donald Wilton, University of Houston; Ali Yilmaz, University of Texas at Austin

TH-A3.2A.1 08:00
Singularity Extraction for Periodic Layered Medium Green’s Function under Matrix-Friendly Formulation
Jun Niu, Duke University, United States; Yi Ren, Chongqing University of Posts andTelecommunications, China; Qing Hua Liu, Duke University, United States

TH-A3.2A.2 08:20
Accuracy Preserving Computation of Asymptotically Smoothed Layered Medium Green’s Functions in Finite Precision Arithmetic
Hongfeng Yang, Ali E. Yilmaz, The University of Texas at Austin, United States

TH-A3.2A.3 08:40
Efficiency Improvement with a Recursive Taylor Expansion of Bessel Functions for Layered Media Green’s Function
Keisuke Kanno, Qiang Chen, Tohoku University, Japan; Robert Burkholder, The Ohio State University, United States

TH-A3.2A.4 09:00
Far Field Approximation of Half-Space Green’s Function
Chun Yun Kee, Chao-Fu Wang, Temasek Laboratories@NUS, Singapore

TH-A3.2A.5 09:20
Efficient Simulation of Electromagnetic Telemetry Using Thin Wire Kernel and Layered Media Green’s Function
Shubin Zeng, Dawei Li, Donald Wilton, Jiefu Chen, University of Houston, United States

Novel Integral Equation Formulations
Session Co-Chairs: Hakan Bagci, King Abdullah University of Science and Technology (KAUST); Meisong Tong, Tongji University

TH-A3.3A.1 10:00
A Single-Source Surface Integral Equation Formulation for Composite Dielectric Objects
Utkarsh Patel, Piero Triverio, Sean V. Hum, University of Toronto, Canada

TH-A3.3A.2 10:20
Potential Integral Equations in Electromagnetics
Jie Li, Michigan State University, United States; Xin Fu, The University of Hong Kong, China; Balasubramaniam Shanker, Michigan State University, United States

TH-A3.3A.3 10:40
An Accurate Combined Source Integral Equation for Perfect Electrically Conducting Bodies
Jonas Komprast, Thomas F. Eibert, Technical University of Munich, Germany

TH-A3.3A.4 11:00
Two New Volume Integral Equation Formulations of Composite Material Bodies
Shaozhu Huang, Jin Peng, University of Electronic Science and Technology of China, China

TH-A3.3A.5 11:20
Fastly Converging 2D Solutions of TE-EFIE on Modified Superformula Contours Optimized via Genetic Algorithms
Sadik Güler, Can Onal, Özgür Engl, Middle East Technical University, Turkey; Emrah Sefer, Fatih Dikmen, Vary A. Tezkin, Gebze Technical University, Turkey
### Frequency Reconfigurable Antennas

#### Session Co-Chairs: Raed Shubair, Khalifa University of Science and Technology; Kwai Man Luk, City University of Hong Kong

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<td>Xueli Liu, Shun Yao, Stavros V. Georgakopoulos, Florida International University, United States</td>
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<td>Shuhai Sato, Sukayoshi Sato, Yuichi Kimura, Saitama University, Japan</td>
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<td>Abdul-Sattar Kadour, Serge Boixes, CEA-LETI, France; Anthony Bellian, CNES, France; Christophe Delaveaud, CEA-LETI, France</td>
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<td>A Low-Profile Frequency Reconfigurable Metasurface Patch Antenna</td>
<td>Yuan-Ming Cai, Yingzheng Yin, Xidian University, China; Ke Li, Northwest University, China</td>
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<td>A Wideband Monopole Antenna with Tunable and Switchable Notch Response</td>
<td>Ke Fan Hou, Ke Wei Qian, Ying Jiang Guo, Wen Jun Li, University of Electronic Science and Technology of China, China</td>
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<td>A Novel mm-Wave Antenna Array Design for Future Metallic Casing Mobile Phone Applications</td>
<td>Bin Xu, Kang Yang, Zhan-Yi Qian, Huzhou Speed Wireless Technology Co., Ltd., China; Chau-Yen-Desmond Sim, Feng Chia University, Taiwan; Guangli Yang, Shanghai University, China</td>
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### Smart Beam Switching and Multi-beam Antennas

#### Session Co-Chairs: Ali Gharsallah, University of Tunis El Manar; Ahmed Abdelrahman, University of Colorado Boulder

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<td>Compact Smart Antenna System for Improving Probability of Detection</td>
<td>Abhishek Singh, Jaakko Kyllonen, Sebastian Cadoc, John Shamblin, Mehak Garg, Akhino Horie, Ethertronics, United States</td>
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<td>Soroush Rasti Boroujeni, Zhichao Li, Safedinni Safari-Nasini, University of Waterloo, Canada</td>
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<td>Performance of Full Azimuth Beam Switching Antenna System</td>
<td>Mohamed Aymen El Cafs, University of Tunis El Manar, Tunisia; Mourad Nofli, Université du Québec en Abitibi-Temsescamingue, Canada; Lath Osman, Ali Gharsallah, University of Tunis El Manar, Tunisia</td>
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<td>Antenna Beam Shaping Using Deformable Grating Grid</td>
<td>Ar-Yao Chou, Chia-Chen Chang, Shang-Fuh Chang, National Chung-Cheng University, Taiwan; Wei-Lun Sung, Wei-Leun Feng, National Yang Hua University, Taiwan</td>
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<td>Rectangular and Circular Arrays with Independently Controlled Beamwidth and Sidelobe Level</td>
<td>Mohammed Al-Husseini, Hassan Ghazizi, Lebanese Center for Studies and Research, Lebanon; Elias Yaacoub, Arab Open University, Lebanon; Karim Kabadan, American University of Beirut, Lebanon</td>
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<td>Planar Array Design based on the GEPSO-vm Algorithm</td>
<td>Feng Xu, Xiaojin Wang, Jiahe Mei, Tao Jiang, Harbin Engineering University, China; Sanjun Dong, Northwestern Polytechnical University, China</td>
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### Wave Propagation in Indoor Environments
Session Co-Chairs: Darmindra Arumugam, Jet Propulsion Laboratory; Simon Cotton, Queen’s University Belfast

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<td>The Calibration of Ray Tracer based on Indoor Office Measurement at 28 GHz</td>
<td>Xin Liu, Bo Ai, Danping He, Ke Guan, Zhangdui Zhong, Longhe Wang, Beijing Jiaotong University, China</td>
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<td>Channel Characteristics Analysis in Smart Warehouse Scenario</td>
<td>Longhe Wang, Bo Ai, Danping He, Guangkai Li, Ke Guan, Ruisi He, Zhangdui Zhong, Beijing Jiaotong University, China</td>
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### Reconfigurable Antennas and Cognitive Radio
Session Co-Chairs: Anthony Grbic, University of Michigan; Amelendu Patnaik, IIT Roorkee

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<td>Carlene Goodbody, Gregory Makar, Washington State University Vancouver, United States; Ngh Tran, University of Akron, United States; Torka Karacolak, Washington State University Vancouver, United States</td>
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<td>Study of the Influence of Dogs in Radio Propagation Considering Domestic Environments</td>
<td>Erik Aguirre, Peio Lopez-Hernández, Public University of Navarra, Spain; Laye Azpilicueta, Tecnológico de Monterrey, Mexico; Daniel Santesteban, Francisco Falcone, Public University of Navarra, Spain</td>
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RF Propagation Modeling and Measurements

Session Co-Chairs: Michael Newkirk, JHU/APL; Jacques Claverie, CREC St-Cyr & IETR

TH-UF.1A.1 08:00
Assessment of an analytical expression for an evaporation duct refractivity profile
Jacques Claverie, CREC St-Cyr & IETR, France; Yvanick Hurtaud, DGA MI, France

TH-UF.1A.2 08:20
Multipath Signals in a Refractive Environment
Mark Wagner, Santosh Nannuru, Peter Gerstoft, University of California, San Diego, United States

TH-UF.1A.3 08:40
Efficient Field Reconstruction Using Compressive Sensing
Andrew Austin, Michael Neve, The University of Auckland, New Zealand

TH-UF.1A.4 09:00
RF propagation measurement in maritime environment off Southern California during Santa Ana winds episode
Luyao Xu, Caglar Yardim, Swagato Mukherjee, The Ohio State University, United States; Qing Wang, Naval Postgraduate School, United States

TH-UF.1A.5 09:20
The Current State of Radar and Communication Electromagnetic Wave Propagation Models
Abby Anderson, Naval Surface Warfare Center Dahlgren Division, United States

Break 09:40

TH-UF.1A.6 10:00
Investigation of Gaseous Attenuation on a Ka-Band Propagation Link in Tropical Region
Feng Yuan, Shilpa Manandhar, Yee Hu Lee, Nanyang Technological University, Singapore; Yu Song Meng, Agency for Science, Technology and Research (A*STAR), Singapore

TH-UF.1A.7 10:20
A Cost/Benefit Analysis of Spatially Processed GNSS Signals under Different Conditions of Geometrical Dilution of Precision (GDOP)
Soood Khan, Kansas State University, United States

TH-UF.1A.8 11:00
In Situ Far-Field Measurement Antenna Patterns Using an Unmanned Air Vehicle
Jorge Salazar-Cerreno, Simon Burholt, William Doyle, Brenton Wolf, Arturo Umeayama, Phillip Chilson, Caleb Fulton, The University of Oklahoma, United States

TH-UF.1A.9 11:20
Ionospheric Clutter Simulator for High Frequency Radars Wave Propagation
Marie José Abi AK, Florent Jangal, ONERA The French Aerospace Lab, France; Muriel Darcies, Marc Hélène, Sorbonne Universités, University Pierre and Marie Curie, France

MIMO Technology Implementations

Session Co-Chairs: Jon Wallace, Lafayette College; Michael Jensen, Brigham Young University

TH-A5.3A.1 08:00
Efficient Optimization Method for a Reconfigurable OTA Chamber
Matthew Arnold, Rashid Mehmoood, Brigham Young University, United States; Jon Wallace, Lafayette College, United States; Michael Jensen, Brigham Young University, United States

TH-A5.3A.2 08:20
Numerical Analysis of Correlation Coefficient for MIMO Antennas in a Mode-Stirred Chamber
Jongsung Kim, Kyungsung University, Republic of Korea; Raj Mittra, University of Central Florida, United States

TH-A5.3A.3 08:40
Over the Air Calibration of Massive MIMO TDD Arrays for 5G Applications
Lars Jacob Foged, Luca Scialacqua, Francesco Saccardi, Microwave Vision Italy, Italy; Nicolas Grass, Alessandro Scannavini, Microwave Vision Industries, France

TH-A5.3A.4 09:00
Experimental Evaluation of 1-Tap Time Domain Beamforming based on 75 GHz Indoor CSI
Mizuki Suga, Kazuto Goto, Takahiro Tsuchiya, Hideyuki Tsuboi, Chunhsiang Huang, Kazuki Maruta, Atsushi Ohno, NTT Corporation, Japan

TH-A5.3A.5 09:20
High Data rate Wireless Transmission in the Non-far Zone with 2D Orthogonal Beams
Karim Tekkouk, Jiro Hirokawa, Makato Ando, Tokyo Institute of Technology, Japan

Break 09:40

TH-A5.3A.6 10:00
Dual Slant Polarized Cavity Backed Massive MIMO Panel Array Antenna with Digital Beamforming
Mohana Komandla, Ghanshyam Mishra, Satish Kumar Sharma, San Diego State University, United States

TH-A5.3A.7 10:20
Discretely-Sampled Partial Aperture Receiver for Orbital Angular Momentum modes
Timothy Drysdale, The Open University, United Kingdom; Ben Allen, Christopher Stevens, The University of Oxford, United Kingdom

TH-A5.3A.8 10:40
Direction of Arrival Estimation Using Compact MIMO Array for Portable Devices
Sining Sun, Hui Li, Dalian University of Technology, China; Jiang Xiong, Computational Electromagnetics Laboratory in University of Electronic Science & Technology of China, Chengdu, China

TH-A5.3A.9 11:00
Performance Analysis of a Reconfigurable Antenna Array in WLAN Channel Models
Simon Begashaw, Kapil Dandekar, Drexel University, United States
Millimeter Wave Antennas
Session Co-Chairs: Dejan Filipovic, University of Colorado Boulder; Raineet Simons, NASA Glenn Research Center

TH-UB.2A.1 08:00
Assembly Strategies for Millimeter Wave Horn Antennas
Saunobhi Sanghai, Ljubodrag Boskovic, Nathan Jastram, Dejan Filipovic, University of Colorado Boulder, United States

TH-UB.2A.2 08:20
Metamaterial-Corrugated Fermi Tapered Slot Antenna for MMW Applications
Shriraman Gupta, Zouhair Briqech, Abdel Razik Sebak, Concordia University, Canada

TH-UB.2A.3 08:40
Millimeter-Wave Conformal Antenna Array for 5G Wireless Applications
Syeda Fizzah Jilani, Akram Alomainy, Queen Mary University of London, United Kingdom

TH-UB.2A.4 09:00
An LTCC Beam-switching Antenna with High Beam Overlap for 60-GHz Mobile Access Points
Francesco Foglia Manzillo, University of Rennes 1 - IETR, France; Maciej Smierzchalski, CEA-LETI, France; Mauro Ettorre, University of Rennes 1 - IETR, France; Jouka Aurinsalo, Kari T. Kautio, Markku S. Lahti, Antti E. I. Lamminen, Jussi Säily, VTT Technical Research Centre of Finland Ltd., Finland; Ranan Sauleau, University of Rennes 1 - IETR, France

TH-UB.2A.5 09:20
Circuit-Board Edge-Mount Dual-Polarized Millimeter-Wave Antenna
Zunnurain Ahmad, Jan Hesselbarth, University of Stuttgart, Germany

Break 09:40

TH-UB.2A.6 10:00
A 60-GHz RLSA Fed by Butler Matrix Carrying Three OAM Modes
Xin Xu, Dan Mori, Tokyo Institute of Technology, Japan; Agnese Mazzinghi, Angelo Freni, University of Florence, Italy; Joo Hoikaw, Makoto Ando, King Abdullah University of Science and Technology, Saudi Arabia; Atif Shamim, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia

TH-UB.2A.7 10:20
A Ka-Band (26 GHz) Circularly Polarized 2x2 Microstrip Patch Sub-Array with Compact Feed
Andrew Chrysalis, Cindy Furse, University of Utah, United States; Raineet Simons, Felix Miranda, NASA Glenn Research Center, United States

TH-UB.2A.8 10:40
A Millimeter-Wave Connected Antenna Array for 5G Applications
Muhammad Ikram, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia; Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia

TH-UB.2A.9 11:00
A Millimeter-Wave Patch-Fed Slot Antenna with Air Cavity
Peiqin Liu, Yue Li, Zhijun Zhang, Zhenghe Fang, Tsinghua University, China
Modern Longwave Antennas

Session Co-Chairs: Walter Wall, HRL Laboratories, LLC; Jim Plesa, DXE, LLC

TH-SP.2P.1 13:20
Low Frequency Mechanical Antennas
James Bickford, Ronald McNabb, Paul Ward, Daniel Freeman, Marc Weinberg, Draper, United States

TH-SP.2P.2 13:40
Spinning Magnets: An Unconventional Method for Compact Generation of ELF Radio Signals
David Arnold, Hunter Burch, Michael Mitchell, Alexandra Ganrourd, Robert Moore, University of Florida, United States

TH-SP.2P.3 14:00
Spinning Magnet Antenna for VLF Transmitting
Skyler Salvin, Srinivas Prasad M N, Yikun Huang, Yuanxun Ethan Wang, University of California, Los Angeles, United States

TH-SP.2P.4 14:20
Wideband VLF and LF Systems
David Hershberger, Continental Electronics, United States

TH-SP.2P.5 14:40
An Electrically Small Antenna Concept Design for Transmitting a Baseband Signal
Majid Manteghi, Virginia Tech, United States

Break 15:00

TH-SP.2P.6 15:20
An Overview of Low Profile Miniaturized Antennas for Low Frequency Applications
Kamal Sarabandi, The University of Michigan, United States

TH-SP.2P.7 15:40
VLF/LF Generation via Electrically Short Plasma Antennas
Parker Singletary, Nathan Opalinski, Cheong Chan, Mitchell Walker, Georgia Institute of Technology, United States; Mark Golkowski, University of Colorado Boulder, United States; Morris Cohen, Georgia Institute of Technology, United States

TH-SP.2P.8 16:00
HF Heating of the Ionosphere: An Interesting Source of ELF and VLF Waves
Robert Moore, University of Florida, United States

TH-SP.2P.9 16:20
Circuit Analysis of the Stability of a Two-Element Non-Foster Impedance Matching Network
Stephen Stearns, Consulting Engineer, United States

TH-SP.2P.10 16:40
Monopole and Conformal PIFA for Small Cylindrical Groundplane Mounting
Roshanak Zabihi, Rodney G Vaughan, Simon Fraser University, Canada

Applications of Metasurfaces

Session Co-Chairs: Alexander B. Yakovlev, University of Mississippi; Mohammad Albooyeh, University of California Irvine

TH-A2.1P.1 13:20
Controllable Angular Scattering with a Biaxialotropic Metasurface
Karim Achouri, Christophe Caloz, Polytechnique Montréal, Canada

TH-A2.1P.2 13:40
Dual-band chiral metasurfaces
Minsook Kim, George Eleftheriades, University of Toronto, Canada

TH-A2.1P.3 14:00
A Highly-confined Dielectric Waveguide Enabled by Conformal Anisotropic Impedance Surfaces
Zhi Hao Jiang, Southeast University, China; Lei Kang, Taimei Yue, Douglas H. Werner, The Pennsylvania State University, United States

TH-A2.1P.4 14:20
Metasurface-based lens with application to horn beam squinting
Mario Jerome, University of Siena, Italy; Francesca Caminita, Enrica Martini, Wave Up Srl, Italy; Stefano Mancini, University of Siena, Italy

TH-A2.1P.5 14:40
Windmill clutter mitigation using active meta-surfaces
Yang Wang, Mingqiu Wu, Hong Lin, Zhongjie Liu, Chongqing University of Posts and Telecommunications, China

Break 15:00

TH-A2.1P.6 15:20
Tunable hybrid metasurfaces for image quality enhancement
Alexey Slabatnyuk, Yuri Kirshar, Australian National University, Australia; Elena Shchelokova, Irina Melnikova, Stanislav Glybovski, Pavel Belov, ITMO University, Russian Federation; Andrew Webb, Leiden University Medical Center, Netherlands

TH-A2.1P.7 15:40
Cylindrical Metasurfaces for exotic electromagnetic wave manipulations
Mahdi Safari, Ali Abdolali, Iran University of Science and Technology, Iran; Hamideh Kazemi, Mohammad Albooyeh, Mehdi Veyy, Filippo Capolino, University of California, Irvine, United States

TH-A2.1P.8 16:00
A Circular Polarization Selective Surface Employing Jerusalem Cross-Based Polarizers
Mehdi Haseini, Sean V. Ham, University of Toronto, Canada

TH-A2.1P.9 16:20
Reconfigurable Impedance Ground Plane for Broadband Antenna Systems
Sanghoon Kim, Aabo Li, Daniel F. Sievenpiper, University of California, San Diego, United States

TH-A2.1P.10 16:40
Design of Broadband Reflecting Metasurfaces for Polarization Conversion
Michele Borgese, Filippo Costa, Simone Genovese, Agostino Manorchi, Università di Pisa, Italy
Dielectric Resonator and Slot Antennas: High Gain or Circular Polarized Designs
Session Co-Chairs: Yahia Antar, Royal Military College of Canada; Hussein Attia, King Fahd University of Petroleum and Minerals

TH-A1.1P.1 13:20
Wide-band Circularly Polarized Dielectric Resonator Antenna Array
Abdelhady Mahmoud, Benha University, Egypt; Hussein Attia, King Fahd University of Petroleum and Minerals, Saudi Arabia

TH-A1.1P.2 13:40
High-Gain Circularly Polarized Multilayer Dielectric Resonator Antenna for Millimeter-Wave application
Mejdi Larbi, Nadir Hekem, Taieb ElKankouri, LRTCS, Canada

TH-A1.1P.3 14:00
Inverted Stair Case/ Hat Shaped Dielectric Resonator Antenna: High Gain Design with Higher Order Mode
Debato Guha, Poulomi Gupta, University of Calcutta, India; Chandrakanta Kumar, ISRO Satellite Centre, Govt. of India, India; Yahia M. M. Antar, Royal Military College of Canada, Canada

TH-A1.1P.4 14:20
Integration of Substrate Integrated Waveguide Filter with Dielectric Resonator Antenna
Hanyue Xu, Ying Wang, University of Ontario Institute of Technology, Canada; Wael Abdel-Wahab, University of Waterloo, Canada; Langis Roy, University of Ontario Institute of Technology, Canada; Jingping Liu, Nanjing University of Science and Technology, China

TH-A1.1P.5 14:40
Substrate integrated waveguide fed circularly polarized elliptical dielectric resonator antenna array
Jyoti Roat, Abhishek Sharma, Animesh Biswas, M. J. Akhtar, Indian Institute of Technology Kanpur, India

Break 15:00

TH-A1.1P.6 15:20
Wideband Circularly Polarized Cylindrical Dielectric Resonator Antenna
Jian Ren, City University of Hong Kong, Hong Kong SAR of China; Lei Guo, École Polytechnique de Montréal, Canada; Kwok Wa Leung, City University of Hong Kong, Hong Kong SAR of China

TH-A1.1P.7 15:40
A Circular Truncated Cone Slot Antenna with Circular Polarized Conical Beam
Guanshao Chenhu, Jinping Geng, Liang Liu, Han Zhou, Xiaonan Zhao, Yuliang Liang, Xianling Liang, Weiren Zhu, Ronghong Jin, Shanghai Jiao Tong University, China
### Spiral and Log-Periodic Antennas

**Session Co-Chairs:** Hisamatsu Nakano, Hosei University; Mohamed Elmansouri, University of Colorado Boulder

**TH-A1.2P.1**
**13:20**
Effects of a Dielectric Substrate on the Radiation Characteristics of a Spiral Antenna with Slots
Hisamatsu Nakano, Ittoku Yoshino, Yuhei Kameta, Junji Yamaguchi, Hosei University, Japan

**TH-A1.2P.2**
**13:40**
4-40 GHz Conical Spiral Antenna Recessed in a Cavity
Maxim Ignatenko, Dejan Filipovic, University of Colorado Boulder, United States

**TH-A1.2P.3**
**14:00**
An Updated Version of the Dyson Conical Quad-Spiral Array (DYQSA) Feed System for VGOS Applications
Karlos Ato Abdalnabid, Gabriel Santamaria Botello, Sergio Llorente Romano, Luis Enrique Garcia Muñoz, Daniel Segovia Vargas, Carlos III University of Madrid, Spain

**TH-A1.2P.4**
**14:20**
A 6-18 GHz Log-Periodic Monopole End-Fire Antenna Based on Microstrip-to-Slotline Transition
Yuanhua Sun, Yongjun Huang, Guangjun Wen, University of Electronic Science and Technology of China, China; Haobin Zhang, Science and Technology on Electronic Information Control Laboratory, China

**TH-A1.2P.5**
**14:40**
3-Arm Spiral Antennas for Direction Finding Applications
Nahid Rahman, Gregor Lasser, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder, United States

**Break 15:00**

**TH-A1.2P.6**
**15:20**
Wide Bandwidth and Beamwidth Flush-Mountable Planar and Pyramidal Log-Periodic Antennas
Joeeun Ha, Dejan Filipovic, University of Colorado Boulder, United States

**TH-A1.2P.7**
**15:40**
Structural Composite Materials near a Broadband Log-Periodic-Dipole-Array (LPDA)
Mohammad Ali, Nicholas Bishop, University of South Carolina, United States; William Baron, Jason Miller, James Tuss, David Zappettella, Air Force Research Laboratory, United States

**TH-A1.2P.8**
**16:00**
A 6–18 GHz Cavity-Backed Log-Periodic-Slot End-Fire Antenna for Conformal Application
Yangjun Huang, Jian Li, Guangjun Wen, University of Electronic Science and Technology of China, China; Haobin Zhang, Science and Technology on Electronic Information Control Laboratory, China

**TH-A1.2P.9**
**16:20**
Double-Arm Hexagonal Archimedean Spiral Antenna for Wideband Compact Array
Chun Ju Park, Seung Sook Cho, Young Joong Yoon, Yonsei University, Republic of Korea; Hyung suk Kim, Daehak University College, Republic of Korea

**TH-A1.2P.10**
**16:40**
A Multimode Wideband Dual-Polarized Antenna Based on Stub-Loaded Dipoles
Dong-ze Zheng, Qiong-xin Chu, South China University of Technology, China

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### Basis Functions and Numerical Integration

**Session Co-Chairs:** Francesco P. Andriulli, Ecole Nationale Superieure Mines-Telecom Atlantique; Zhen Peng, University of New Mexico

**TH-A3.1P.1**
**13:20**
Results in quadrature error estimation for weak near-singular MoM integrals
Matthys Botha, Stellenbosch University, South Africa; Thomas Rylander, Chalmers University of Technology, Sweden

**TH-A3.1P.2**
**13:40**
Isogeometric Analysis of EM Scattering on Multiply-Connected Subdivision Surfaces
Je Li, Balasubramaniion Shanker, Michigan State University, United States

**TH-A3.1P.3**
**14:00**
Linear-Linear Basis Functions for Source Reconstruction Using Magnetic-Field Integral Equations in Very-Near-Field Measurements
Raxon Rejfee Alavi, Ali Kiae, Rashid Mirzavand, Pedram Mousavi, University of Alberta, Canada

**TH-A3.1P.4**
**14:20**
Acceleration of the Fully Numerical Evaluation of Galerkin Interactions on Surface Elements
Javier Rivero, Universidad de Extremadura, Spain; Francesco Vigiana, Politecnico di Torino, Italy; Donald R. Wilton, University of Houston, United States; William A. Johnson, New Mexico Institute of Mining and Technology, United States

**TH-A3.1P.5**
**14:40**
Higher Order Electromagnetic Modeling in Current and Charge Integral Equation Method
Yi Ren, Shi-Wei Zhao, Chongqing University of Posts and Telecommunications, China; Jing-He Li, Guolin University of Technology, China; Jun Niu, Duke University, United States; Hong-Sheng Zhang, Wen Huang, Chongqing University of Posts and Telecommunications, China

**Break 15:00**

**TH-A3.1P.6**
**15:20**
Clarifications on the Surface Integral Equation Computation of the Characteristic Modes of Dielectric Objects
Hamad Alroughani, The Pennsylvania State University, United States; Derek McNamara, University of Ottawa, Canada

**TH-A3.1P.7**
**15:40**
Fast multiple-reflection physical optics (FMROPO) through comprehensive MLFMM acceleration
Dao Xiang, Matthys Botha, Stellenbosch University, South Africa

**TH-A3.1P.8**
**16:00**
A General Equivalent Model for Understanding Theory of Characteristic Modes
Fu-Gang Hu, Chao-Fu Wang, National University of Singapore, Singapore

**TH-A3.1P.9**
**16:20**
Duffy Transformation with a Simple Polynomial Smoothing Strategy for Weakly Singular Integrals
Ming-Da Zhu, Donghua University, China

**TH-A3.1P.10**
**16:40**
Electromagnetic Scattering Analysis from Anisotropic Media Using Volume Integral Equation with Higher Order Hierarchical Vector Basis Functions
Zhi-Peng Zhang, Yan-Wen Zhao, Qiang-Ming Cai, Yu-Teng Zheng, Li Gu, Zai-Ping Nie, University of Electronic Science and Technology of China, China
Advances in the Finite Element Methods
Session Co-Chairs: Dan Jiao, Purdue University; Joseph Kotulski, Sandia National Laboratories

TH-A3.2P.1 13:20
Hybrid FEM-Random Walk Method for Plasmonic Structure Field Computations
Ramakrishna Janaswamy, Dimitrios Makris, Marinos N. Vouvakis, University of Massachusetts, United States

TH-A3.2P.2 13:40
Analytical Method for Finding the Nullspace of Stiffness Matrix in the Finite Element Method
Li Xue, Dan Jiao, Purdue University, United States

TH-A3.2P.3 14:00
A Memory-efficient Sparse Direct Solver with Applications in CEM
Javad Moshfegh, Marinos N. Vouvakis, University of Massachusetts Amherst, United States

TH-A3.2P.4 14:20
Frequency-Domain Method Having a Diagonal Mass Matrix in Arbitrary Unstructured Meshes for Efficient Electromagnetic Analysis
Kaiyuan Zeng, Dan Jiao, Purdue University, United States

TH-A3.2P.5 14:40
Finite Element Modeling of Anisotropic Half-Space Problems by a Simple Mesh Truncation Scheme
Ozlem Ozgun, Hacettepe University, Turkey; Mustafa Kuzuoglu, Middle East Technical University, Turkey

Changes for Thursday, July 13

TH-UB.1P 15:20 - 17:00
Mission Beach AB

Advances in Differential Equation Based Methods
Session Co-Chairs: Andrew Austin, The University of Auckland; Joseph Kotulski, Sandia National Labs

TH-UB.1P.1 15:20
A Perfectly Matched Layer Integrated with Boundary Integral Equation to Serve as the Absorbing Boundary Condition
Runren Zhang, Qingtao Sun, Qinghuo Liu, Duke University, United States

TH-UB.1P.2 15:40
Time-Stepping Schemes for Quasi-Magnetostatic Analysis of Magnetic-Conducting Material
John Young, University of Kentucky, United States; Stephen Gedney, University of Colorado Boulder, United States; Robert Adams, University of Kentucky, United States

TH-UB.1P.3 16:00
Fast Scan FEM Preconditioning for Infinite Periodic Structures
Dimitrios Makris, Marinos N. Vouvakis, University of Massachusetts Amherst, United States

TH-UB.1P.4 16:20
Efficient Estimation of Parameter Sensitivities in the FDTD Method Using Automatic Differentiation
Andrew Austin, Michael Neve, The University of Auckland, New Zealand

TH-UB.1P.5 16:40
A Numerical Approach for Efficient Simulation and Design of Yagi-Uda Nanoantennas
Qiang Ren, Yusheng Bian, Lei Kang, Jogender Nagar, Peng Yang, Douglas H. Werner, The Pennsylvania State University, United States

TH-UB.1P.6 15:20
A Perfectly Matched Layer Integrated with Boundary Integral Equation to Serve as the Absorbing Boundary Condition
Runren Zhang, Qingtao Sun, Qinghuo Liu, Duke University, United States

TH-UB.1P.7 15:40
Time-Stepping Schemes for Quasi-Magnetostatic Analysis of Magnetic-Conducting Material
John Young, University of Kentucky, United States; Stephen Gedney, University of Colorado Boulder, United States; Robert Adams, University of Kentucky, United States

TH-UB.1P.8 16:00
Fast Scan FEM Preconditioning for Infinite Periodic Structures
Dimitrios Makris, Marinos N. Vouvakis, University of Massachusetts Amherst, United States

TH-UB.1P.9 16:20
Efficient Estimation of Parameter Sensitivities in the FDTD Method Using Automatic Differentiation
Andrew Austin, Michael Neve, The University of Auckland, New Zealand

TH-UB.1P.10 16:40
A Numerical Approach for Efficient Simulation and Design of Yagi-Uda Nanoantennas
Qiang Ren, Yusheng Bian, Lei Kang, Jogender Nagar, Peng Yang, Douglas H. Werner, The Pennsylvania State University, United States

TH-A1.3P 13:20 - 17:00
Promenade AB

Phased Array Antennas: Theory and Design
Session Co-Chairs: Steven Holland, Milwaukee School of Engineering; Jie Xu, Loyola Marymount University

TH-A1.3P.1 13:20
The Vertigo Array for Grating Lobe Reduction
Lucas Piette, Rainer Maria Rossi, Ivan Russo, Eletronics S.p.A., Italy

TH-A1.3P.2 13:40
Near-Field and Far-Field Characterization of Active Electronically Scanned Antennas (AESA) Using Electro-Optic Field Probes
Kazem Sabet, Richard Darragh, Ali Sabet, EMAG Technologies Inc., United States; Kamal Sarabandi, The University of Michigan, United States

TH-A1.3P.3 14:00
Impedance Bandwidth of a Slotted Waveguide Array: Impact of Waveguide Length and Element Shape
Maryam Razmhosseini, Rodney G Vaughan, Simon Fraser University, Canada

TH-A1.3P.4 14:20
Generating LG Modes with Aperture or Array
Jie Xu, Loyola Marymount University, United States

TH-A1.3P.5 14:40
Control of Scattering Patterns of a Phased array with Switches Loaded Annular Slot Elements
Peng Yang, Fei Yan, Feng Yang, University of Electronic Science and Technology of China, China

TH-A1.3P.6 15:20
Generating LG Modes with Aperture or Array
Jie Xu, Loyola Marymount University, United States

TH-A1.3P.7 15:40
Grating Lobe Reduction in Phased Arrays with Regular Subarray Architecture
Fei Yan, Peng Yang, Min Gao, Xuewu Cui, Feng Yang, University of Electronic Science and Technology of China, China

TH-A1.3P.8 16:00
Efficiency Improvement in TMA Using Complementary Mode Switching
Mohammad Hossein Mazheri, Mohammad Fakharzadeh, Mahmood Akbari, Sharif University of Technology, Iran
### Antennas for Energy Harvesting

**Session Co-Chairs:** Joseph Costantine, American University of Beirut; John Pantoja, Universidad Nacional de Colombia

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<th>Time</th>
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<tr>
<td>13:20</td>
<td>A Wideband and High Gain Antenna on Multilayer Insulation Blanket for RF Energy Harvesting</td>
<td>Jun Iwata, Japan Patent Office, Japan; Jo Bito, Manos M. Tentzeris, Georgia Institute of Technology, United States</td>
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<tr>
<td>13:40</td>
<td>A Novel Efficient Multiple Input Single Output RF Energy Harvesting Rectification Scheme</td>
<td>Oskar Björkqvist, Christos Kolhisidas, Oskar Dahlberg, Gustaf Silver, Martin Mattsson, Lars Jansson, KTH Royal Institute of Technology, Sweden</td>
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<tr>
<td>14:00</td>
<td>A Compact Fractal Structure Based Rectenna with the Rectifier Circuit Integrated</td>
<td>Euclides Lourenco Chuma, Lisandro de la Torre Rodriguez, Yuzo Iano, Leonardo L. Bravo Roger, University of Campinas - UNICAMP, Brazil; Miguel-Angel Sanchez-Soriano, University of Alicante, Spain</td>
</tr>
<tr>
<td>14:20</td>
<td>A high gain Dual-Polarised Differential Rectenna for RF Energy Harvesting</td>
<td>Martin Mattsson, Christos Kolhisidas, Gustaf Silver, Oskar Björkqvist, Oskar Dahlberg, Lars Jansson, KTH Royal Institute of Technology, Sweden</td>
</tr>
<tr>
<td>14:40</td>
<td>Multi-port RF Energy Harvester with a Tapered Matching Network</td>
<td>Aline Eid, Joseph Costantine, American University of Beirut, Lebanon; Youssef Tawk, Notre Dame University Louaize, Lebanon; Mahmoud Abdallah, American University of Beirut, Lebanon; Ali Ramadan, Fahad Bin Sulaim University, Saudi Arabia; Christos Christodoulou, University of New Mexico, United States</td>
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<tr>
<td>15:00</td>
<td>Wearable Inkjet Printed Energy Harvester</td>
<td>Tong-Hong Lin, Jo Bito, Manos M. Tentzeris, Georgia Institute of Technology, United States</td>
</tr>
<tr>
<td>15:40</td>
<td>A Study of Directional Antenna for Recycled Energy Improvement in Electromagnetic Wave Energy Harvesting</td>
<td>Nabiya Takanum, Yohei Kobara, Syunta Ichikawa, Hideto Kando, Nippon Institute of Technology, Japan</td>
</tr>
<tr>
<td>16:00</td>
<td>High Efficiency Rectifier for RF Energy Harvesting in the GSM band</td>
<td>Alex Mouapi, Nadir Hakem, Nahi Kandil, Université du Québec en Abitibi-Témiscamingue, Canada</td>
</tr>
<tr>
<td>16:20</td>
<td>Ultra Small Dual Band Antenna Design for Implantable Devices</td>
<td>Joaechun Lee, Joonsang Kong, Wonsook Lee, Junyuek Suh, Young-jun Hang, Samsung Advanced Institute of Technology, Republic of Korea</td>
</tr>
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### Wave Propagation in Terrestrial, Oceanic and Atmospheric Environments

**Session Co-Chairs:** Magdy Iskander, University of Hawaii at Manoa; Darmindra Arumugam, Jet Propulsion Laboratory

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<tr>
<th>Time</th>
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<th>Authors</th>
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<tbody>
<tr>
<td>13:20</td>
<td>Vector vs. Raster Representations of 3D Ridges for Propagation Modeling Over Terrains</td>
<td>Zhengqing Yun, Magdy F. Iskander, University of Hawaii, United States</td>
</tr>
<tr>
<td>13:40</td>
<td>Mitigation of time-varying spectral nulls in a wideband HF signal</td>
<td>Michael Daly, Jeffery Allen, Tomasz Woznajczak, Marcos Ortinheiros, SPAWAR Systems Center Pacific, United States</td>
</tr>
<tr>
<td>14:00</td>
<td>LTE signal propagation in a maritime environment: validation of a hybrid MoM-ray tracing prediction method</td>
<td>Marco Stecola, Italian Navy, Italy; Alessandro Corucci, Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNI), Italy; Agostino Manarchio, Università di Pisa, Italy</td>
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<tr>
<td>14:20</td>
<td>Localization in planetary sub-surfaces using deep-sub-wavelength magnetoquasistatics</td>
<td>Darmindra Arumugam, California Institute of Technology, United States</td>
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<td>14:40</td>
<td>Rain Attenuation Analysis at 84 GHz</td>
<td>Nadine Bouid, Christos Christodoulou, University of New Mexico, United States; David Murrell, Air Force Research Laboratory, United States</td>
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<tr>
<td>15:00</td>
<td>Link Performance Analysis of 433MHz Band in High Stress Environments</td>
<td>Saleem Shahid, Politecnico di Milano, Italy; Aweis Askam, Saad B. Daisar, National University of Sciences &amp; Technology, Pakistan; Ijaz Naqvi, Lahore University of Management Sciences (LUMS), Pakistan</td>
</tr>
<tr>
<td>15:40</td>
<td>Robust Extraction of Rectangular Waveguide Surrogate Models of Wave Propagation in Tunnels</td>
<td>Xingai Zhang, Costas D. Sarris, University of Toronto, Canada</td>
</tr>
<tr>
<td>16:00</td>
<td>A Doppler Frequency Calibration Method by Ionosphere for Skywave OTHR</td>
<td>Yang Li, Chang Liu, Ning Zhang, Harbin Institute of Technology, China</td>
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<tr>
<td>16:20</td>
<td>An Ionospheric Clutter Recognition Method Based on Machine Learning</td>
<td>Yang Li, Mengke He, Ning Zhang, Harbin Institute of Technology, China</td>
</tr>
<tr>
<td>16:40</td>
<td>A Hybrid Method of FDTD and Vector Parabolic Equation for Radio Wave Propagation Prediction in Tunnels</td>
<td>Weibin Hau, Junhong Wang, Yujian Li, Beijing Jiaotong University, China</td>
</tr>
</tbody>
</table>
**Biological Imaging and Sensing**
Session Co-Chairs: Erdem Topsakal, Virginia Commonwealth University; Ozlem Kilic, Catholic University of America

**TH-UK.1P.1** 13:20  
Future of Implantable Wireless Medical Telemetry  
Erdem Topsakal, Virginia Commonwealth University, United States

**TH-UK.1P.2** 13:40  
Non-invasive Home-Based Maternal-Fetal ECG Monitoring System  
Victor Ho, Daniel Schossow, Peter Ritchie, Manju Sharma, Tadasse Ghirmai, Daniel Bustillos, Mabel Ezenwok, Sandeep Krishnan, University of Washington, United States; Michael P.H. Lau, Sensoriis, United States; J.-C. Chiao, The University of Texas at Arlington, United States; Hung Cao, University of Washington, United States

**TH-UK.1P.3** 14:00  
Surface Mapping of Cardiac Electrical Activity using Implantable Electrodes  
Sanjana Paul, Madeline Hays, Alex Surette, Sarah Moore, Umar Hasni, Umit Ozgur, Vigneshwar Kasirajan, Erdem Topsakal, Virginia Commonwealth University, United States

**TH-UK.1P.4** 14:20  
Sensing Volume of Breast Tissue for Microwave Dielectric Characterization  
Madeline Hays, Erdem Topsakal, Virginia Commonwealth University, United States

**TH-UK.1P.5** 14:40  
Non-invasive Monitoring and Tracking of Human Activities using Continuous-wave Radar  
Nghia Tran, Ozlem Kilic, The Catholic University of America, United States

Break 15:00

**TH-UK.1P.6** 15:20  
Human Activity Estimation by Height and RCS Information Detected by MIMO Radar  
Dai Sasakawa, Naoki Hamma, Iwate University, Japan; Takashi Nishiyama, Shuchin Iizuka, Panasonic Corporation, Japan

**TH-UK.1P.7** 15:40  
Electric and Hydrodynamic Properties of Stem Cells with Realistic Three-Dimensional Morphologies  
Samen Baidya, Ahmed Hassan, University of Missouri-Kansas City, United States; Beatriz Pazmino, Jack Douglas, Edward Garboczi, National Institute of Standards and Technology, United States

**TH-UK.1P.8** 16:00  
Increasing the Amount of Data for Microwave Imaging System Using Field Perturbing Elements  
Mohammad Asefi, Joe Lovetri, University of Manitoba, Canada

**TH-UK.1P.9** 16:20  
Microwave Hyperthermia for Breast Cancer Therapy Monitored by Compressive Thermocoupage Imaging  
Lifan Xu, Xiang Wang, ShanghaiTech University, China

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**Electromagnetic Compatibility and Interference**
Session Co-Chairs: Salvatore Campione, Sandia National Laboratories; Scott Tyo, University of New South Wales Canberra

**TH-UE.1P.1** 13:20  
Measuring Coupled Signals on Active Ship-Based Communication System  
Alan O’Donnell, Alan Michaels, Robert McGwier, Virginia Tech, United States

**TH-UE.1P.2** 13:40  
A CubeSat Platform for Characterizing the Reliability of Electronic Components  
Paul Tarantino, Nicolas Lee, Sigrid Close, Stanford University, United States

**TH-UE.1P.3** 14:00  
Evaluation of Harmful Interference in Realistic Operating Environments  
Sakshi Srivastava, Jennifer T. Bernhard, University of Illinois at Urbana-Champaign, United States

**TH-UE.1P.4** 14:20  
Efficient Cross-talk Reduction of Nanophotonic Circuits Enabled by Periodic Silicon Strip Arrays  
Yusheng Bian, Qiang Ren, Lei Kang, Ping Werner, Douglas H. Werner, The Pennsylvania State University, United States

**TH-UE.1P.5** 14:40  
Finite and Infinite Lossy Conductors over a Lossy Ground Plane Excited by an Electromagnetic Pulse  
Salvatore Campione, Larry K. Wanne, Lorenza J. Basilio, C. David Turner, Keith L. Cartwright, Kenneth C. Chen, Sandia National Laboratories, United States

Break 15:00

**TH-UE.1P.6** 15:20  
Loading cavities with electrical small antenna feeds to accomplish power combining in HPEM applications  
J Scott Tyo, University of New South Wales Canberra, Australia; Richard W. Ziolkowski, University of Arizona, United States

**TH-UE.1P.7** 15:40  
Power Loss Reduction on Right-Angled CPW Bend Using Finger Slots  
Chieh-Yu Liao, Yueh-Hsien Cheng, Chun-Long Wang, National Taiwan University of Science and Technology, Taiwan

**TH-UE.1P.8** 16:00  
Application of the Random Coupling Model to the Hierarchical Modeling of Electromagnetic Coupling to Partially-Shielded Enclosures  
Xiao Ma, Xu Chen, Aosheng Rong, Andreas Cangellaris, University of Illinois at Urbana-Champaign, United States

**TH-UE.1P.9** 16:20  
Application of Space Object Conjunction Method in the Radio Channel Modeling and Interference Analysis  
Tao Jiang, Asad Husnain Baqar, Harbin Engineering University, China; Yachen Zhang, Heilongjiang University, China
**In-Body Devices for Wireless Biotelemetry: Implants and Ingestibles**

Session Co-Chairs: Asimina Kiourti, The Ohio State University; Raed Shubair, Massachusetts Institute of Technology

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

**Implantable and Ingestible Sensors for Wireless Physiological Monitoring: A Review**
Asimina Kiourti, The Ohio State University, United States; Raed Shubair, Research Laboratory of Electronics, MIT, United States

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

**Wireless Telemetry Performance of Transplanted Organ Monitoring at Ultra Wideband Range Considering Respiration-Induced Organ Movement**
Pongphan Leelatien, Koichi Ito, Kazuyuki Saito, Chiba University, Japan; Akram Alomainy, Yang Hao, Queen Mary University of London, United Kingdom; Mammonah Shams, Nanyang Technological University, Singapore

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

**A Novel Design to Power the micro-ECG Sensor Implanted in Adult Zebrafish**
Daniel Schossow, Peter Ritchie, Hung Cao, University of Washington, United States; J.-C. Chiao, The University of Texas at Arlington, United States; Jingchun Yang, Xiaolei Xu, Mayo Clinic, United States

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

**A Wireless, Fully-Passive Recorder for Medical Applications**
Cedric W. Lee, Asimina Kiourti, John L. Volakis, The Ohio State University, United States

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

**An Investigation on In-body Radio Channels Based on Inhomogeneous Model**
Jingzhen Li, Zedong Nie, Yuhang Liu, Lei Wang, Shenzhen Institutes of Advanced Technology, Chinese Academy of Science, China; Yang Hao, School of Electronic Engineering and Computer Science, Queen Mary College, University of London, United Kingdom

**Break 09:40**

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

**Safety Assessment of a Cortical Implant for the Restoration of Vision to the Blind**
Erik Gamez Rodriguez, Pragya Kosta, Javed Paknahad, Kyle Almor, United States; Aqsa Roy, Robert Greenberg, Proyag Datta, Second Sight Medical Products, United States

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

**Miniaturized Implantable Patch Antenna for Near-Field Communication at ISM Band**
Jado M. Felicio, Carlos A. Fernandes, Instituto de Telecomunicacoes/Institute Superior Tecnico, Portugal; Jorge R. Costa, Instituto de Telecomunicacoes/ISCTE-IUL, Portugal

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

**Integration of Inductive Energy Harvesting in a Biotelemetry Implant**
Stavros Koulouridis, University of Patras, Greece; Antoine Diet, Yann Le Bihan, Lionel Pichon, GeePs-CNRS, France

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

**Split Ring Resonator Antenna System with Implantable and Wearable Parts for Far Field Readable Backscattering Implants**
Shubin Ma, Leena Ukkonen, Lauri Sydänheimo, Toni Björninen, Tampere University of Technology, Finland

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

**Miniaturized and Multiple-Polarization Ingestible Capsule Antennas**
Yangxin Guo, National University of Singapore, Singapore

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**Handset LTE Antenna Design and Challenges**

Session Chair: Hongwei Liu, Huawei Device USA, Inc.

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

**A Novel Wide-Band MIMO Antenna System For Smart Phones**
Muhammad Iqram, Rifqat Hussain, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia

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

**Frequency Reconfigurable MIMO Slot and UWB Sensing Antennas for CR Applications**
Rifqat Hussain, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia

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

**Capacity Based MIMO Antenna Design**
Nicholas Buris, NERENS, United States; Mohammed Abdull Gaffoor, Eric Krenz, Motorola Mobility, United States

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

**Multi-Gbps Massive MIMO for Future Smartphones and MIMO System Performance Verification**
Kim Ku Wang, Chi-Hyu Tsai, National Sun Yat-sen University, Taiwan; Wei-Yu Li, Industrial Technology Research Institute (ITRI), Taiwan

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

**OTA Testing of 3G-5G Devices with MIMO: From Anechoic Chambers to Reverberation Chambers and ... Back Again?**
Per-Simon Kildal, Andreas Alayon Glazunov, Chalmers University of Technology, Sweden

**Break 09:40**

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

**Channel Capacity Estimation of Mobile Terminal MIMO Antenna by Correlation and Efficiency**
Hiroyuki Arai, Yokohama National University, Japan

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

**A Compact LTE Multi-Band Loop Antenna With Additional 3400-3800 MHz Coverage for Mobile Phone Application**
Huafeng Shen, Yixin Li, Wei Shi, Xiaoqiang Li, Guangli Yang, Shanghai University, China

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

**A LTE/WLAN antenna design for mobile handset applications**
Chia-Mei Peng, I-Fong Chen, Zong-Han Jiang, Heng-Yi Liao, Jinwen University of Science and Technology, Taiwan

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

**An Antenna Design for LTE 4x4 MIMO Cell Phone**
Hongwei Liu, Wei Kian Tiah, Chulmin Han, Xiaoeng Su, Huawei Device USA, Inc., United States
**Design and Analysis of Metasurfaces I**

Session Co-Chairs: Christophe Caloz, Polytechnique Montreal; Raphael Kastner, Tel Aviv University

**FR-A2.1A.1** 08:00
Normal vs Tangential Polarizations in Metasurfaces
Mohammad Albooyeh, Hamidreza Kazemi, Filippo Capolino, University of California, Irvine, United States; Do-Hoon Kwon, University of Massachusetts Amherst, United States; Sergei Tretyakov, Aalto University, United States

**FR-A2.1A.2** 08:20
Time-domain Circuit Modelling of Huygens’ Metasurfaces
Tom J. Smy, Scott A. Stewart, Shulabh Gupta, Carleton University, Canada

**FR-A2.1A.3** 08:40
Floquet Analysis of Parametric Huygens’ Metasurfaces
Shulabh Gupta, Tom J. Smy, Carleton University, Canada

**FR-A2.1A.4** 09:00
Perfectly Refractive Metasurface using Biaxiosotropy
Guillaume Lavigne, Karim Achoui, Christophe Caloz, Polytechnique Montréal, Canada; Viktar Asadchy, Sergei Tretyakov, Aalto University, Finland

**FR-A2.1A.5** 09:20
Independent Amplitude and Phase Control based on All-Dielectric Huygens’ Metasurfaces
Sonya K. Stuhec-Leonard, Shulabh Gupta, Carleton University, Canada

**FR-A2.1A.6** 10:00
All-Dielectric Biaxiosotropic Metasurfaces
Amin Ranjbar, Anthony Grbic, University of Michigan, United States

**FR-A2.1A.7** 10:20
Dispersion of Surface Waves Supported by Truncated Metasurfaces
Miguel Camacho, University of Exeter, United Kingdom; Rafael R. Boix, Francisco Medina, University of Sevilla, United Kingdom; Masaaki H. P. de R. Hambw, University of Exeter, United Kingdom

**FR-A2.1A.8** 10:40
Transparent Metasurface with Prescribed Aperture Field
Nasim Mohammadi Estakhri, Deboline Ghosh, Indian Institute of Technology Bombay Bhubaneswar, India

**FR-A2.1A.9** 11:00
Characterization of Metascreens Based on Babinet’s Principle and Generalized Sheet Transition Conditions for Metalfilms
Xiao Liu, Fan Yang, Maokun Li, Shenheng Xu, Tsinghua University, China

**Metamaterial-Inspired Antennas**

Session Co-Chairs: Ashwin Iyer, University of Alberta; Tetsuya Ueda, Kyoto Institute of Technology

**FR-A2.2A.1** 08:00
A Low-Profile Dual-Band Circular Patch Antenna for GPS Using Metamaterial-Based EBGs
Stuart Barth, Ashwin K. Iyer, University of Alberta, Canada

**FR-A2.2A.2** 08:20
Broadband Fully Substrate-Integrated Fabry-Pérot cavity Antenna
Lamine Mohamed Abdelghani, Tarek Otharfi, Tarek Ahmed Danidu, INRS, Université du Québec, Canada

**FR-A2.2A.3** 08:40
Equivalent Circuit Model for Wideband Zeroth-Order Resonant Antennas
Shuhei Terada, Tetsuya Ueda, Electronic Engineering and Electronics, Kyoto Institute of Technology, Japan; Masakazu Ikeda, Yuji Sugimoto, Nippon Soken, Inc, Japan; Hironori Kuroki, Shiro Koide, Denso Corporation, Japan

**FR-A2.2A.4** 09:00
Novel Dual-Band Open-Ended Zeroth-Order Resonant Antenna
Pei-Ling Chi, En Deng, National Chiao Tung University, Taiwan

**FR-A2.2A.5** 09:20
High-Isolation Metamaterial MIMO Antenna
Ahmed Ibrahim, Minia University, Egypt; Mahmoud A. Abdalla, MTC College, Egypt; Raed Shubair, Khalifa University & MIT, United Arab Emirates

**FR-A2.2A.6** 10:00
Radiation Enhancement for Planar Omni-directional Antennas with ENZ Metamaterials
Yifeng Hu, Jiang Xiong, University of Electronic Science and Technology of China, China

**FR-A2.2A.7** 10:20
Isolation Enhancement of Patch Antennas using Metamaterial Superstrate
Prakash Kumar Panda, Deboline Ghosh, Indian Institute of Technology Bombay Bhubaneswar, India
Terahertz Antennas and Sources
Session Co-Chairs: Mohamed Othman, University of California Irvine; Georgios Trichopoulos, Arizona State University

Friday, July 14 FR-A5.1A 08:00 - 11:40 Coronado D

FR-A5.1A.1 08:00
A Figure of Merit to Assess the Performance of Photoconductive Antennas at Terahertz Band
Jordi Romeu, Marc de Cea, Lluís Jofre, Universitat Politècnica de Catalunya, Spain; Ayhan Yazgan, Karadeniz Technical University, Turkey

FR-A5.1A.2 08:20
A Long Wave Infrared Polarization Sensing Detector with Wide Dynamic Range
Ashutosh Patri, Patanjali V. Parimi, State University of New York at Oswego, United States

FR-A5.1A.3 08:40
OAM Modulation induced in Millimeter Waves using Impedance Matched Flat Phase Plate
Caiyu Wang, Shubhendu Bhardwaj, John L. Volakis, The Ohio State University, United States

FR-A5.1A.4 09:00
Resonant Tunneling Diodes for Feeding Antenna-Structures for Terahertz Source Applications
Ashutosh Patri, Shubhendu Bhardwaj, John L. Volakis, The Ohio State University, United States

FR-A5.1A.5 09:20
Plasmonic Nano-Antenna Arrays for High-Sensitivity and Broadband Terahertz Detection
Nezih Tolga Yardimci, Mona Jarrahi, University of California, Los Angeles, United States

Break 09:40

FR-A5.1A.6 10:00
Boosting Radiation Efficiency of Photoconductive Nano-Antennas through 3D Light Confinement
Nezih Tolga Yardimci, Semih Cakmakkyapan, Soorosh Hemmati, Mana Jarrahi, University of California, Los Angeles, United States

FR-A5.1A.7 10:20
Space Division Multiplexing Using Disordered Optical Antennas
Muhammad Hyghnahuh, S. Mahson Raisi-Zadeh, Hussam Al-Seoud, Safiaddin Safavi-Naeini, University of Waterloo, Canada

FR-A5.1A.8 10:40
Design of a Frequency Reconfigurable, Terahertz Folded Antenna for Photomixers
Kazim Demir, Asaf Belbazi Sahin, Mehmet Unlu, Yildirim Beyazit University, Turkey

FR-A5.1A.9 11:00
Optimized Design of THz Microstrip Antenna Based-on Dual-Surfaced Multiple Split-Ring Resonators
Ge Zhang, Shi Pu, Xiao-Ying Xu, Can Tao, Jin-Yuan Dun, Wuhan University of Technology, China

FR-A5.1A.10 11:20
Reflector Backed High Gain Photoconductive THz Antenna Using Conical GaAs Horn and Si Lens
Utkarsh Deva, Physical Research Laboratory, India; Chinmoy Saha, Indian Institute of Science and Technology, India; Jawed Y Sidiqvi, University of Calcutta, India

Dielectric Resonator Antennas
Session Co-Chairs: Debashis Guha, University of Calcutta; Zhirun Hu, University of Manchester

Friday, July 14 FR-A1.1A 08:00 - 09:40 Coronado E

FR-A1.1A.1 08:00
On the Cause of Radiation from Dielectric Resonator Antennas
Ahmed Ashour, Omar Ramahi, University of Waterloo, Canada

FR-A1.1A.2 08:20
Graphene Microwave Resonators
Xiao Zhang, Gregory August, Emie Hill, Kewen Pan, University of Manchester, United Kingdom; Hobaba Ouslimani, Université Paris Ouest Nanterre La Défense, France; Mahmoud A. Abdalla, MTC College University, Egypt; Zhirun Hu, University of Manchester, United Kingdom

FR-A1.1A.3 08:40
SIW fed MIMO DRA for future 5G applications
Abhishek Sharma, Ankit Sarker, Mohiyn Adhikary, Animesh Biswas, M. J. Akhtar, Indian Institute of Technology Kanpur, India

FR-A1.1A.4 09:00
Dielectric Resonator Antenna: A solution for its mount on metallic body
Debashis Guha, Chandrayee Sarkar, University of Calcutta, India; Chandrakanta Kumar, Indian Space Research Organisation, India

FR-A1.1A.5 09:20
Design of Dual-band Pattern Reconfigurable Cylindrical Dielectric Resonator Antenna
Bejia Liu, Jinghui Qiu, Hua Zong, Harbin Institute of Technology, China; Guoqiang Li, Harbin Kejia General Mechanical and Electrical Company, China

Techniques for Coupling and Side-lobes Control
Session Co-Chairs: David Kelly, Bucknell University; Ashwin Iyer, University of Alberta

Friday, July 14 FR-A1.2A 10:00 - 11:40 Coronado E

FR-A1.2A.1 10:00
Analytical Model of Coupling for a Set of Randomly Distributed Dipoles
Imad Adali, Benoit Poussot, Shermila Mostarshedi, Jean-Marc Laheurte, Laboratoire ESICOM - Université Paris-Est, France; Ayichatou Gueye, Florence Nadal, Laboratoire ESICOM - ESIEE, France

FR-A1.2A.2 10:20
Investigation of Choke-Ring Structures for Ground-Penetrating Radar
David Sawyer, Ashwin K. Iyer, University of Alberta, Canada; A. Peter Annan, Nectaria Diamanti, Sensors & Software Inc., Canada

FR-A1.2A.3 10:40
Reduction of Cross-Polarized Back Lobe Radiation in Circularly Polarized Loop Yagi Arrays
Ryan Chaky, David Kelley, Bucknell University, United States

FR-A1.2A.4 11:00
Mutual Coupling Reduction in Two Elements UWB Notch Antenna System
Donya Nazir, Raneem Rabie, October University for Modern Sciences and Arts, Egypt; Mahmoud A. Abdalla, MTC College University, Egypt

FR-A1.2A.5 11:20
Self-curing Decoupling Technique for Two Inverted-F Antennas Working in Adjacent Bands
Jiangwei Sui, Xie-Li Wu, The Chinese University of Hong Kong, Hong Kong SAR of China
Wideband Printed Antennas

**Session Co-Chairs:** Diego Caratelli, The Antenna Company; Mitsu Taguchi, Nagasaki University

**FR-A1.3A.1** 08:00
Design and Full-Wave Characterization of Supershaped Printed Monopole Antennas
Diego Caratelli, The Antenna Company, Netherlands; Luciana Mescia, Politecnico University of Bari, Italy; Pietro Bia, EmTeSys, Italy

**FR-A1.3A.2** 08:20
30-2000 MHz Multi-band Body Wearable Antenna (MBWA)
Johnson Wang, John Adley, Wang Ectro-Opto Corporation, United States

**FR-A1.3A.3** 08:40
Offset Fed Planar Inverted L Antenna with Built-in Coplanar Waveguide
Mitsu Taguchi, Koya Takata, Nagasaki University, Japan

**FR-A1.3A.4** 09:00
A Compact CPW-Fed Wideband Antenna Design for 5G/WLAN Wireless Application
Yibo Wang, Shanghai University, China; Zhinong Ying, Sony Mobile Communications AB, Sweden; Guangli Yang, Shanghai University, China

**FR-A1.3A.5** 09:20
A Novel Dual-Polarized Antenna with Low Profile and High Port Isolation
Jinxin Li, Shuowen Yang, Ling Ai, Zaqing Nie, University of Electronic Science and Technology of China, China; William Thomas Joines, Duke University, United States

Break 09:40

**FR-A1.3A.6** 10:00
Miniaturization of Base-station Antenna Element
HaiLiang Zhi, Gao Wei, Luyang Ji, Northwestern Polytechnical University, China

**FR-A1.3A.7** 10:20
A Novel Compact ACS-Fed Antenna with Triple Band-Notched Characteristics for UWB Applications
Guodong Zhao, Peng Gao, University of Electronic Science and Technology of China, China

**FR-A1.3A.8** 10:40
WLAN Wideband-Notched UWB Slot Antenna Using I-shaped MTM
Bihui Xu, University of Electronic Science and Technology of China; Jimes University, China; Yan-Wen Zhao, Yuteng Zheng, Li Gu, University of Electronic Science and Technology of China, China

**FR-A1.3A.9** 11:00
A Broadband and High Gain Yagi Antenna with Complex Parabolic Boundary Reflector
Yu Liu, Shu Lin, Alexander Deniso, Dongyu Liang, Yangyang Cao, Shuo Tran, Harbin Institute of Technology, China

**FR-A1.3A.10** 11:20
A Dual-Band Notched Ultra Wideband Microstrip Antenna
Ying Suo, Wei Li, Hongyang Wang, Harbin Institute of Technology, China

Time Domain Methods

**Session Co-Chairs:** Hakim Bagci, King Abdullah University of Science and Technology (KAUST); Reza Abedi, University of Tennessee Space Institute

**FR-UB.1A.1** 08:00
Time Stepping Alternatives for Higher Order Time-Domain Mixed Finite-Elements
Zane Crawford, Balasubramaniam Shanker, Michigan State University, United States

**FR-UB.1A.2** 08:20
A Nyström-Based Explicit Time Marching Scheme for Solving the Time Domain Magnetic Field Integral Equation
Rui Chen, Sadeed Bin Sayed, Hakim Bagci, King Abdullah University of Science and Technology, Saudi Arabia

**FR-UB.1A.3** 08:40
Broadband Parametric Modeling of Electromagnetic Structures with the FDTD Method Coupled with the Multi-Complex Step Derivative Approximation
Kao-An Liu, Castas D. Sarris, University of Toronto, Canada

**FR-UB.1A.4** 09:00
Quantum-Corrected Transient Analysis of Plasmonic Nanostructures Using a Volume Integral Equation Solver
Sadeed Bin Sayed, Ismael Iones Uyard, King Abdullah University of Science and Technology, Saudi Arabia; Hüseyin Arda Ulku, Gazi Technical University, Turkey; Hakim Bagci, King Abdullah University of Science and Technology, Saudi Arabia

**FR-UB.1A.5** 09:20
Unconditionally Stable Time-Domain Mixed Finite-Element Method
Zane Crawford, Jie Li, Andrew Christlieb, Balasubramaniam Shanker, Michigan State University, United States

Break 09:40

**FR-UB.1A.6** 10:00
DGTD Method for SAR Evaluation in a Human Head Model Exposed to a Wideband Antenna
Geng Chen, Lei Zhao, Wenhua Yu, Jiangsu Normal University, China; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

**FR-UB.1A.7** 10:20
Matrix-Free Time-Domain Method for Thermal Analysis in Unstructured Meshes
Jin Yan, Dan Jiao, Purdue University, United States

**FR-UB.1A.8** 10:40
An h-adaptive Time Domain Discontinuous Galerkin Method for Electromagnetics
Reza Abedi, University of Tennessee Space Institute, United States; Saba Mudaliar, Air Force Research Laboratory, Wright Patterson AFB, United States

**FR-UB.1A.9** 11:00
Scattering and Radiation Simulation by Discontinuous Galerkin Time Domain Method
Xuewu Cai, Longjian Zhou, Min Gao, Zhipeng Liang, Fei Yan, Feng Yang, University of Electronic Science and Technology of China, China

**FR-UB.1A.10** 11:20
The Implementation of Perfectly Matched Layers for the E-H Time-Domain Finite-Element Method
Zhenebo Ye, Haiqing Zhou, Institute of Applied Physics and Computational Mathematics, China
Frequency Domain Methods
Session Co-Chairs: Valentin De la Rubia, Universidad Politecnica de Madrid; Andrew Greenwood, US Air Force Research Laboratory

FR-UB.2A.1  08:00
Optimal Scaling Factors of One-Element Perfectly Matched Layer in Spectral Element Method
Rumen Zhang, Qinghua Liu, Duke University, United States

FR-UB.2A.2  08:20
Data-driven Model Order Reduction for Fast Frequency Sweep in Hybrid BI-FEM Domain Decomposition Solution in Large Finite Frequency Selective Surfaces
Valentin de la Rubia, Universidad Politecnica de Madrid, Spain; Zhen Peng, University of New Mexico, United States

FR-UB.2A.3  08:40
Fast Frequency Sweep for the Computation of Monostatic RCS using the Method of Moments via the Reduced-Basis Method
Alberto Monje-Real, Valentin de la Rubia, Universidad Politecnica de Madrid, Spain

FR-UB.2A.4  09:00
Extremely Low-Frequency Electromagnetic Computation by Using the Mixed Spectral-Element Method to Overcome the Low-Frequency Breakdown
Yuanyu Zhou, Mingwen Zhuang, Na Liu, Xiamen University, China; Qinghui Liu, Duke University, United States

FR-UB.2A.5  09:20
The Higher Accuracy Mixed Spectral Element Method for Computing Graphene Plasmonic Waveguide Modes
Na Liu, Xianying Hou, Institute of Electromagnetics and Acoustics, and Department of Electronic Science, Xiamen University, Xiamen, Fujian, P. R. China; 361005, China; Qinghui Liu, Department of Electrical and Computer Engineering, Duke University, Durham, NC, USA, 27708, United States

Phased Array Antenna Designs
Session Co-Chairs: Atif Elsherbeni, Colorado School of Mines; John Volakis, Ohio State University

FR-A1.4A.1  08:00
Ultra wideband phased arrays and low-cost beamforming
John L. Volakis, The Ohio State University, United States

FR-A1.4A.3  08:40
Innovative Array Architectures for 5G Communications
Giacomo Oliveri, Paolo Rocca, Lorenzo Poli, Giorgio Gottardi, Nicola Anselmi, Marco Salucci, University of Trento, Italy; Renato Lombardi, Ma Chuan, Maurizio Martini, Pietro Vinetti, Fabio Moraga, Huawei Technologies, Italy; Andrea Massa, University of Trento, Italy

FR-A1.4A.4  09:00
UHF Planar Ultra-Wideband Modular Antenna (PUMA) Arrays
Christopher Merola, Masin A. Vouvakis, University of Massachusetts, United States

FR-A1.4A.5  09:20
Small Millimeter Wave Printed Antenna Arrays for 5G Applications
Dimitris Psychoudakis, Alireza Faroozesh, Samsung Research America, United States

Hybrid and Optimization Techniques
Session Co-Chairs: Francesca Vipiana, Politecnico di Torino; Navid Barani, University of Michigan

FR-UB.3A.1  10:00
Hybrid Ray Launching-Collaborative Filtering Approach for Wireless Propagation in Indoor Environments
Piera Lopez-Herr, Public University of Navarre, Spain; Fran Casino, Univ La Ricerca e Università di Pavia, Italy; Emilie Canessa, Italy; Andrea Massa, University of Trento, Italy

FR-UB.3A.2  10:20
New frequency domain discontinuous Galerkin method with domain decomposition technique for electromagnetic modeling
Qinghao Sun, Rumen Zhang, Qinghua Liu, Duke University, United States

FR-UB.3A.3  10:40
Comparison Between Integral Equation and FEM Solvers for Electromagnetic-Microwave Coupled Equations
Simon Couture, Vitaly Lamakin, University of California, San Diego, United States

FR-UB.3A.4  11:00
A Comparative Study of EP, GAs and PSO in Subsurface Inverse Profiling of Secteded Dielectric Elliptical-Cylindrical Objects
Maryam Hojeibi, Amirakbar University of Technology, Iran; Ahmad Hoorfar, Villanova University, United States

FR-UB.3A.5  11:20
Analysis of Wave Propagation in Glide-Symmetric Metasurfaces Using Mode-Matching Technique
Fatemeh Ghassamifard, KTH Royal Institute of Technology, Sweden; Guido Valario, Sorbonne Université, France; Oscar Quevedo-Tenal, KTH Royal Institute of Technology, Sweden
On-chip Antennas
Session Co-Chairs: Oscar Quevedo-Teruel, KTH Royal Institute of Technology; Junming Diao, Brigham Young University

FR-A5.2A.1 08:00
Integrated Dual Polarized On-Chip Antenna for mm-Wave Applications
Ronny Hahnel, Martin Becker, Bernhard Klein, Dirk Plettemeier, Dresden University of Technology, Germany

FR-A5.2A.2 08:20
200 GHz High Gain and Area Efficient On-Chip Yagi-Uda Antenna in 28nm FD-SOI CMOS
Ali Basaligheh, Parvaneh Saffari, Rambabu Karumudi, Kambiz Moez, University of Alberta, Canada

FR-A5.2A.3 08:40
Feasibility study of Transmission between Wireless Interconnects in Multichip Multicore systems
Bounak Singh Norde, Jayanti Venkataraman, Rochester Institute of Technology, United States

FR-A5.2A.4 09:00
Chip Reference Antennas: Improving Millimeter-Wave On-Chip Antenna Measurements
Per O. Iversen, Edward Szpindor, MVG-Orbit/FR, Inc; Lars Jacob Foged, Lucia Scialacqua, MVG Italy, Italy

FR-A5.2A.5 09:20
SU-8 Derived Novel Ultra Compact Carbon Antenna Using C-MEMS Technology
Bidhan Pramanick, Sergio O. Martinez-Chapa, University of California, Mexico; Latheef A Shaik, Chinmoy Saha, Indian Institute of Space Science and Technology, India; Jawad Y Siddiqui, University of Calcutta, India

Design of Phased Array Elements
Session Co-Chairs: Dejan Filipovic, University of Colorado Boulder; Jingni Zhong, Ohio State University

FR-A1.5A.1 10:00
Full Duplex Antenna Subsystem for Handheld Radios
Ahmed Abdelrahman, Dejan Filipovic, University of Colorado Boulder, United States

FR-A1.5A.2 10:20
7.2 to 1 Ultra-Wideband Dual-Linear Polarized Phased Array with 60o Scanning
Jingni Zhong, Elias Akwan, John L. Volakis, The Ohio State University, United States

FR-A1.5A.3 10:40
Hybrid-Fed Microstrip Patch Antenna For MPAR Application
Hadi Saadat-Manesh, Guifu Zhang, University of Oklahoma, United States

FR-A1.5A.4 11:00
Comparison of Radiation Pattern Modeling Methods for GPS Controlled Reception Pattern Array
Jeffrey Maloney, Do-Hoon Kwon, Ramakrishna Janaswamy, University of Massachusetts Amherst, United States; Steven Keller, U.S. Army Research Laboratory, United States

FR-A1.5A.5 11:20
On the Effects of Parasitic Horns Within Tightly Packed Concave Linear Arrangements
Carlos Molero Hernandez, Maxim Ignatienko, Dejan Filipovic, University of Colorado Boulder, United States

Propagation in Complex Environments
Session Co-Chairs: Mahsa Moghaddam, University of Southern California; Francisco Falcone, Universidad Publica de Navarra

FR-A4.1A.1 08:00
Enabling Accurate Propagation Modeling of Complex Tunnel Geometries with Ray-Tracing
Neeraj Saod, Costas D. Saris, University of Toronto, Canada

FR-A4.1A.2 08:20
cmWave through vegetation: correlation of pixels and attenuation using UT and Bayes Inference
Leonardo Menezes, Alexandre Jose Figueiredo Loureiro, University of Brasilia, Brazil

FR-A4.1A.3 08:40
A Discrete Scatterer Technique for FOPEN Radar Scattering and Imaging Characterization
Dehan Liao, U.S. Army Research Laboratory, United States

FR-A4.1A.4 09:00
Modeling and Analysis of Bistatic Scattering from Forests in Support of Soil Moisture Retrieval
Amir Azemati, Mahsa Moghaddam, University of Southern California, United States

FR-A4.1A.5 09:20
Closed-Form Models of Propagation Characteristics of Non-Planar CPW
Royal Majumdar, University of Delhi South Campus, United States

FR-A4.1A.6 10:00
A Numerical Model for Investigating the Effect of Rough Surface Parameters on Radar Cross Section Statistics
Mustafa Nausugu, Middle East Technical University, Turkey; Cetin Ogun, Hacettepe University, Turkey

FR-A4.1A.7 10:20
Analysis of transmission characteristics for periodic perfect and real metal apertures
Sungjin Yoo, Housong Choo, Jang-Eun Park, Hanguk University, Republic of Korea

FR-A4.1A.8 10:40
2.4 GHz Radio-Channel Characterization of an Underground Mine using Patch antennas
Lamia Abdi, Mourad Nedil, Nahi Kandil, Mohamedlamine Seddiki, Université du Québec en Abitibi-Témiscamingue, Canada; Moulay Elhassan El Ahlari, Latif Tabas, University of quebec in outaouais, Canada

FR-A4.1A.9 11:00
Wave structure function of electromagnetic waves propagating through anisotropic hypersonic turbulence
Jiangting Li, Teng Gong, Lixin Guo, Shaofei Yang, School of Physics and Optoelectronic Engineering, Xidian University, China

FR-A4.1A.10 11:20
Effects of atmospheric turbulence on mode purity of orbital angular momentum millimeter waves
Minjian Cheng, Lixin Guo, Jiangting Li, Songhuo Liu, School of Physics and Optoelectronic Engineering, China; Mingjian Cheng, State Key Laboratory of Pulsed Power Laser Technology, China
### Scattering and Diffraction

**Session Co-Chairs:** Zhongxiang Shen, Nanyang Technological University; Yi Huang, University of Liverpool

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<td>FR-A4.2A.1</td>
<td>08:00</td>
<td>An Efficient Hybrid CEM Approach to Modeling Backscatter of Forest Clutter</td>
<td>Raghu Raj, Michael Kloosans, Dale Zolinick, S.T. Chen, John Brazera, U.S. Naval Research Laboratory, United States</td>
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<td>FR-A4.2A.2</td>
<td>08:20</td>
<td>Scattering studies on sorted materials of high-speed rail scenario for propagation channel simulations</td>
<td>Guangkai Li, Bo Ai, Longhe Wang, Ke Guan, Danping He, Zhangdui Zhong, Beijing Jiaotong University, China; Li Tian, Jianwu Dou, ZTE Corporation, China</td>
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<td>FR-A4.2A.3</td>
<td>08:40</td>
<td>Improved Millimeter-Wave Radar Equations to Predict Backscattering in a Sand-and-Dust Storm</td>
<td>Mu-Min Chiou, Jean-Fu Kiang, National Taiwan University, Taiwan</td>
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<td>FR-A4.2A.4</td>
<td>09:00</td>
<td>Low-cost Gas Sensors utilizing mm-Wave Radars</td>
<td>Shuo Liu, George Shaker, Safieddin Safavi-Naeini, J.Michael Chong, University of Waterloo, Canada</td>
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<td>FR-A4.2A.5</td>
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<td>Efficient Measurement Techniques on OTA Test in Reverberation Chamber</td>
<td>Zhijian Tan, Yi Huang, University of Liverpool, United Kingdom; Qian Xu, Nanjing University of Aeronautics and Astronautics, China</td>
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**Break** 09:40

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<td>FR-A4.2A.6</td>
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<td>Dielectric Cloaks as Analytical or Numerical Solutions of Inverse Scattering Problems</td>
<td>Giuseppe Labate, Politecnico d Torino, Italy; Lorenzo Di Donato, University of Catania, Italy; Ladislau Matekovits, Politecnico di Torino, Italy; Tommaso Isma, University Mediterranea of Reggio Calabria, Italy</td>
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<td>FR-A4.2A.7</td>
<td>10:20</td>
<td>A Modified Matching Pursuit Algorithm for Two-Dimensional Electromagnetic Imaging</td>
<td>Ali Imran Sandhu, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia</td>
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**FR-A4.2A.8** 10:40 Efficient Monostatic RCS Calculation with Higher-Order MLFMM

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<td>FR-A4.2A.9</td>
<td>11:00</td>
<td>Accurate Solution of Electromagnetic Scattering by Chiral Objects Based on VIEs</td>
<td>Wenjie Chen, Mei-Song Yang, Tongji University, China</td>
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<td>FR-A4.2A.10</td>
<td>11:20</td>
<td>Cicular Polarization Selective Structure Based on Planar Helix</td>
<td>Jiang Wang, Wei Wu, Nanjing University of Science and Technology, China; Zhongxiang Shen, Nanyang Technological University, Singapore</td>
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### Electromagnetic Interaction, Propagation and Scattering

**Session Co-Chairs:** Wang Che Chew, University of Illinois at Urbana-Champaign; Loic Markley, University of British Columbia

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<td>Minimizing Idle Power Losses in Magnetic Resonance Coupling Wireless Power Transfer</td>
<td>Connor Badovitch, Loic Markley, University of British Columbia, Okanagan Campus, Canada</td>
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<td>FR-UB.4A.2</td>
<td>08:20</td>
<td>Predicting the Nature of Electromagnetic Field Fluctuations in Random Interconnections of Large Complicated Cavities</td>
<td>Ghadeh Hadi, Samer Henmady, Ed Schamiloglu, University of New Mexico, United States</td>
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<td>FR-UB.4A.3</td>
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<td>Performance Considerations on Various Iteration Schemes for the Distorted-Born Iterative Method</td>
<td>Met Hidayatulu, Wen-Mei Huo, Wang Che Chew, University of Illinois at Urbana-Champaign, United States</td>
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<td>FR-UB.4A.4</td>
<td>09:00</td>
<td>Numerical Investigation of the Influence of Stokes Lines on Creeping Wave Propagation</td>
<td>Whitney Larsen, Honeywell Federal Manufacturing &amp; Technologies (FM&amp;T), United States; Deb Chatterjee, University of Missouri-Kansas City, United States</td>
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<td>FR-UB.4A.5</td>
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<td>Ray Tracing Simulations for Millimeter Wave Propagation in 5G Wireless Communications</td>
<td>An-Yao Hsiao, Chang-Fa Yang, National Taiwan University of Science and Technology, Taiwan; Te-Shun Wang, Yuanpei University of Medical Technology, Taiwan; Ike Lin, former Nearfield Systems Inc, Taiwan; Wen-Jiao Liao, National Taiwan University of Science and Technology, Taiwan</td>
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<td>FR-UB.4A.6</td>
<td>10:20</td>
<td>User Association-Based Interference Management in Ultra-Dense Networks</td>
<td>Zhuoyu Wen, Gang Zhu, Wen-Mei Hwu, Beijing Jiaotong University, China</td>
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**FR-UB.4A.7** 10:40 Calibration of Ray-tracing simulator for Millimeter-Wave Outdoor Communications

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<td>FR-UB.4A.8</td>
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<td>Channel Simulation of Adaptive Beamforming at 60GHz Millimeter-Wave band under High-Speed Railway Scenario</td>
<td>Yichuan Lin, Zhangdui Zhong, Danping He, Ke Guan, Beijing Jiaotong University, China; Dongqing Zhang, ZTE Corporation, China</td>
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<td>FR-UB.4A.9</td>
<td>11:20</td>
<td>Efficient Environment Model for Intra-Wagon Millimeter Wave Ray-Tracing Simulation</td>
<td>Kinmei Li, Danping He, Ke Guan, Qian Xu, Nanjing University of Aeronautics and Astronautics, China; Li Tian, Jianwu Dou, ZTE Corporation, China</td>
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MIMO System Applications
Session Co-Chairs: Ryan Adams, University of North Carolina at Charlotte; Leonardo Lizzi, Université Côte d’Azur

FR-A5.3A.1 08:00
UAV Attitude Estimation using Antenna Arrays
Atiya Mahmood, Brigham Young University, United States; Jon Wallace, Lafayette College, United States; Michael Jensen, Brigham Young University, United States

FR-A5.3A.2 08:20
On the Impact of Velocity on the Train-to-Earth MIMO Propagation Channel Statistical observations and Qualitative Analysis
Claes Beckman, KTH Royal Institute of Technology, Sweden; Johan Garcia, Stefan Alfredsson, Anna Brunstrom, Karlstad University, Sweden

FR-A5.3A.3 08:40
Dual Band, Dual Polarized, Rail Mount MIMO Stadium Antenna
Joshua Shehan, Paris McGee, James Carson, Amphenol Antenna Solutions, United States; Ryan Adams, University of North Carolina at Charlotte, United States

FR-A5.3A.4 09:00
High Performance MIMO Antenna For 5G Wearable Devices
Lijia Zhu, Shanghai University, China; Huan-Sheng Hwang, Intel Corp., United States; Eugene Ren, Mojave Inc., United States; Guangli Yang, Shanghai University, China

FR-A5.3A.5 09:20
A Directional Antenna for Higher Order MIMO Applications
John Sanford, Ubiquiti Networks, United States

Break 09:40

FR-A5.3A.6 10:00
Validation of a Decoupling Technique by Using Two Types of Antennas
Lamia Sadaoui, Georges Kossiavas, Robert Staraj, Université Côte d’Azur, CNRS, LEAT, France

FR-A5.3A.7 10:20
Impact of MIMO Antenna Design on Communication Channel Capacity Using the Kronecker Model
A. M. Allam, German University of Cairo, Egypt; Raed Shubair, Khalifa University & MIT, United Arab Emirates; Adham Hemdan, Steven Botros, German University of Cairo, Egypt

FR-A5.3A.8 10:40
Validation Of An Open Source Software Defined Radio Test Bed
Cyril Buey, Philippe Ratajczak, Orange Labs, France; Fabien Ferrero, Leonardo Lizzi, Université Côte d’Azur, CNRS, France; Theoni Magounaki, Florian Kaltenberger, EURECOM, France

FR-A5.3A.9 11:00
Effects of Regular and Aperiodic Array Layout in Multi-User MIMO Applications
Carlo Benvenuti, Andréas Olszunov, Rab Almaskat, Mariannn Iwashina, Chalmers University of Technology, Sweden

FR-A5.3A.10 11:20
Advanced Directional Networking: Simulation Results and Prototype Measurements
Gui Chao Huang, Farhan A. Qazi, Magdy F. Iskander, Zhengping Yan, University of Hawaii at Manoa, United States

Reduction of Complex Structures
Session Co-Chairs: Makoto Sano, Toshiba Corporation; Maria Pour, University of Alabama in Huntsville

FR-A4.1P.1 13:20
Novel Technique for Enhancing RCS Reduction Bandwidth of Checkerboard Surfaces
Anuj Y. Modi, Constantine A. Balanis, Craig R. Birtcher, Arizona State University, United States

FR-A4.1P.2 13:40
Dual Frequency Band RCS Reduction Using Checkerboard Designs
Wengang Chen, Constantine A. Balanis, Craig R. Birtcher, Arizona State University, United States

FR-A4.1P.3 14:00
AMC Cells for Broadband RCS Reduction Checkerboard Surfaces
Anuj Y. Modi, Constantine A. Balanis, Craig R. Birtcher, Arizona State University, United States

FR-A4.1P.4 14:20
Wideband Low RCS Antenna Based on Absorbing Surface and Microstrip Resonators
Jingjing Xue, Shuxi Gong, Wen Jiang, Tao Hong, National Key Laboratory of Antennas and Microwave Technology Xidian University; Collaborative Innovation Center of Information Sensing and Understanding at Xidian University, China

FR-A4.1P.5 14:40
Broadband RCS Reduction by Gradient Index Meta-Surface Composed of Jerusalem-Shaped Patches
Haijian Hou, Junhang Wang, Zheng Li, Beijing Jiaotong University, China

Break 15:00

FR-A4.1P.6 15:20
Low-RCS Frequency Reconfigurable Antenna With Polarization Conversion Metasurface and Phase Tunable Reflector
Mao Long, Wen Jiang, Shuxi Gong, Tao Hong, National Key Laboratory of Antennas and Microwave Technology, Xidian University, China

FR-A4.1P.7 15:40
Low-RCS and High-Gain Broadband Circularly Polarized Antenna
Yongtao Jia, Ying Liu, Xidian University, China

FR-A4.1P.8 16:00
Backward RCS Reduction by Gradient Index Meta-surface Composed of Polarization Independent Ring-Shaped Patches
Haijian Hou, Junhang Wang, Zheng Li, Beijing Jiaotong University, China

FR-A4.1P.9 16:20
A Novel Checkerboard AMC Surface for X-, Ku- and K-band RCS Reduction
You-Feng Cheng, Xiao Ding, Wei Shao, Tu-Lu Liang, University of Electronic Science and Technology of China, China

FR-A4.1P.10 16:40
Facet Based Investigation on the Composite EM Scattering from Ship over Sea surface
Jinxing Li, Min Zhang, Xidian University, China
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<td>Validation of the Polynomial for RF Absorber Reflectivity for the Prediction of Anechoic Chambers</td>
<td>Vince Rodriguez, NSI-MI Technologies, United States</td>
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<td>Measurement and Simulation Comparison using Measured Source Antenna Representation of GNSS Antenna on Sentinel Satellite</td>
<td>Lars Jacob Foged, Maria Alberica Saporetti, Lucia Scialacqua, Francesco Seccardi, Microwave Vision Italy, Italy; Jan Zackrisson, RUAG Space AB, Sweden; Damiano Tinti, Luca Salghetti Drioli, European Space Agency, ESTEC, Netherlands</td>
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<td>FR-SP.3P</td>
<td>Verification of Feed Spillover Reduction using FF-MARS in a CATR Using Computational Electromagnetic Simulation</td>
<td>Stuart Geesong, Allen Newell, NSI-MI, United States; Clive Parini, Queen Mary University of London, United Kingdom</td>
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<td>FR-SP.5P</td>
<td>Reverberation Chambers for Flexible Over-the-Air Testing of Internet-of-Things Devices</td>
<td>Mats Kristoffersen, Christian Patrik Lööbäck, Derek Skausen, Blueteast AB, Sweden</td>
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<td>FR-SP.2P</td>
<td>Characterizing Antennas in the Time and Frequency Domains</td>
<td>Everett Farr, Farr Fields, LC, United States</td>
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<td>FR-SP.2P</td>
<td>Antenna Terms and Measurement Techniques for Active Receiving Arrays</td>
<td>Karl F. Warnick, Brigham Young University, United States</td>
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<td>FR-SP.3P</td>
<td>Active E-field Gain: Toward a Standard Description of MEAs</td>
<td>Nicholas Burz, NERENS, United States</td>
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<td>FR-SP.4P</td>
<td>Equivalent Isotropic Response as a Surrogate for Incident Field Strength</td>
<td>Daniel Kuester, Duncan McGilvray, John Ladbury, Adam Wunderlich, Adam Feldman, William Young, Sheryl Garco, National Institute of Standards and Technology, United States</td>
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<td>FR-SP.5P</td>
<td>Subsurface Conductivity Mapping using Controlled Source Electromagnetic Method</td>
<td>Jaiwee Goswami, C&amp;I Research and Technology, United States; Maokun Li, Tsinghua University, China; Ari Abdolakar, Schlumberger, United States; Tarek Hohashi, Schlumberger-Doll Research, United States</td>
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<td>FR-A2.1P</td>
<td>Design of Modulated Metasurface Antennas</td>
<td>Stefano Maci, University of Siena, Italy</td>
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<td>FR-A2.1P</td>
<td>“Phasenna” based on a Metasurface System</td>
<td>Guillaume Lavigne, Christophe Calaz, Polytechnique Montréal, Canada</td>
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<td>FR-A2.1P</td>
<td>Application of Near-Field Phase Transformation to Steer the Beam of High-Gain Antennas in Two Dimensions</td>
<td>Muhammad U. Afzal, Karu P. Esselle, Macquarie University, Australia</td>
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<td>FR-A2.1P</td>
<td>Improved Design of a Low Sidelobe Pyramidal Horn Antenna Loaded with a Metasurface Lens</td>
<td>Xuxiang Chen, Yuehe Ge, Huaqiao University, China; Travar Bird, Antengenuity, Australia</td>
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Design and Analysis of Metamaterials
Session Co-Chairs: Daniel Cavallo, Delft University of Technology; Quang Nguyen, U.S. Army Research Laboratory
FR-A2.2P.1 13:20
Systematic Development of a Robust Circuit-model Technique for Subwavelength Imaging with Wire-Medium Type Lenses
Gabriel Moreno, Ali Forouzmand, Alexander Yakovlev, University of Mississippi, United States; Mario Silveirinha, University of Lisbon, Portugal; George Hanson, University of Wisconsin - Milwaukee, United States
FR-A2.2P.2 13:40
Analytical Models for Artificial Dielectrics with Non-Aligned Layers
Daniele Cavallo, Cantika Felita, Delft University of Technology, Netherlands
FR-A2.2P.3 14:00
Local Thickness-Dependent Permittivity of Wire Media in CST Microwave Studio
Gabriel Moreno, Maziar Hedayati, Ali Forouzmand, Alexander Yakovlev, University of Mississippi, United States; Mario Silveirinha, University of Lisbon, United States; George Hanson, University of Wisconsin - Milwaukee, United States
FR-A2.2P.4 14:20
Novel Fishnet-like Chiral Metamaterial Structure with Negative Refractive Index and Low Losses
Oscar Fernandez, Álvaro Gómez, Angel Vegas, Universidad de Cantabria, Spain; Gregorio J. Molina-Cuberos, Universidad de Murcia, Spain; Angel J. García-Collado, Universidad Católica de San Antonio, Spain
FR-A2.2P.5 14:40
Green’s Function of Periodic Scatterers Applied to Scattering by Finite Periodic Arrays of Scatterers
Shurun Tan, Leung Tsang, University of Michigan, United States
Break 15:00
FR-A2.2P.6 15:20
Wide-Band High Permeability Metamaterials
Quang Nguyen, Amir Zaghloul, Steven Weiss, U.S. Army Research Laboratory, United States
FR-A2.2P.7 15:40
Polarizability Tensors of Highly Conductive Bodies
Lukas Jelinek, Czech Technical University in Prague, Czech Republic; Ondrej Kratky, Siemens Czech Republic Ltd, Czech Republic; Miloslav Capek, Czech Technical University in Prague, Czech Republic
FR-A2.2P.8 16:00
Dual-band Transmission Measurement in a Metamaterial
Xiantang Tang, Zhaoyun Duan, Fei Wang, Xinwu Ma, Zhanliang Wang, Yubin Gong, University of Electronic Science and Technology of China, China
FR-A2.2P.9 16:20
Comprehensive Analysis of Magnetoelastic Nonlinear Metamaterials
Wenran Lv, Yangjun Huang, Guangjun Wan, University of Electronic Science and Technology of China, China

Terahertz Antennas and Focal Plane Arrays
Session Co-Chairs: Cosan Caglayan, Ohio State University; Kubilay Sertel, Ohio State University
FR-UB.1P.1 13:20
Analysis and Design of Large-format THz Imaging Systems Using Conjugate Field Coupling
Panagiota Theofanopoulou, Georgios Theofanopoulos, Arizona State University, United States
FR-UB.1P.2 13:40
Fourier Optics Analysis for Quasi-Optical Imagers with Large Focal Plane Arrays
Shahab Oddin Babanezhadeh, Giorgio Carlucci, Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands
FR-UB.1P.3 14:00
On the Imaging Speed of Wideband Direct Detection FPAs
Sven van Benkel, Ozan Yurduseven, Delft University of Technology, Netherlands; Angelo Freni, Università degli studi Firenze, Italy; Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands
FR-UB.1P.4 14:20
Wide Field of View Dual-Lens Antenna at Sub-Millimeter Wave Frequencies
Erio Gandini, Nuria Llombart, Delft University of Technology, Netherlands; Aleks van Salm, Aalto University, Finland
FR-UB.1P.5 14:40
Non-Contact, On-Wafer Characterization of Schottky Diodes
Cosan Caglayan, The Ohio State University, United States; Jeffrey L. Hesler, Virginia Diodes Inc., United States; Kubilay Sertel, The Ohio State University, United States
Break 15:00
FR-UB.1P.6 15:20
Silicon Micromachined High-contrast Artificial Dielectrics for Millimeter-wave Transformation Optics Antennas
Nicholas Garcia, Wenlong Bai, Thibault Twahirwa, David Connelly, Jonathan Chisum, University of Notre Dame, United States
FR-UB.1P.7 15:40
Generation of Broadband Orbital Angular Momentum in Millimeter Wave Domain
Fan Bi, Xiang Wang, ShanghaiTech University, China
FR-UB.1P.8 16:00
Dense, Planar Arrays of Compact Resonant Cavity Antennas
Aslan Kyani, Raheal Hashmi, Karu P. Esselle, Macquarie University, Australia
Beam Scanning Antennas and Arrays
Session Chair: Arezoo Edalati, Ellumen Inc

FR-A1.1P.1 13:20
Grounded Colocated Antennas for Wideband Vector Sensor Applications
Johan Duploye, Christophe Morlaas, ENAC, France; Hervé Aubert, LAAS-CNRS, France; Patrick Potier, Philippe Pouliquin, Christopher Djoma, DGA, France

FR-A1.1P.3 14:00
Dual-band conical-scanning Yagi-Uda antenna
Chainaang Kittiyapunya, Mana Krairiksh, King Mongkut’s Institute of Technology Ladkrabang, Thailand

FR-A1.1P.4 14:20
A Beam Switching Antenna with Gain Enhancement
Jinxin Li, Qingsheng Zeng, Tayeb A. Denidni, National Institute for Scientific Research, Canada

FR-A1.1P.5 14:40
Reconfigurable Frequency Selective Surface for Fabry-Perot Cavity Antenna System
Chanjoon Lee, Robert Sainati, Rhonda Franklin, University of Minnesota, United States

FR-A1.1P.6 15:20
A Novel Dual-Band Beam-Switching Antenna Based on Active Frequency Selective Surfaces
Arezoo Edalati, William McCollough, Ellumen Inc, United States

FR-A1.1P.7 15:40
Influence of an Impedance Flange on the Radiation and Scattering Characteristics of a Plane Semi-Infinite Waveguide Array
Yury Yukhanov, Tetiana Pivdunova, Egor Privalov, Southern federal university, Russian Federation

FR-A1.1P.8 16:00
EMSICC-Based Compact Array Antenna Having Switchable Frequency Beam-Scanning Range in Microstrip Environment
Anirban Sarkar, Prasun Chongder, Abhishek Sharma, Moitreya Adhikary, A. M. Akhtar, Indian Institute of Technology Kanpur, India

FR-A1.1P.9 16:20
Design of a Ku-band 1-bit Reconfigurable Transmitarray with 16×16 Slot Coupled Elements
Min Wang, Shanhe Xu, Fan Yang, Maokun Li, Tsinghua University, China

Microwave to Millimeter Measurements and Standards
Session Chair: Seth McCormick, US Army Research Laboratory

FR-UA.1P.1 13:20
Thru-Load De-embedding Method for Millimeter Wave Transmission Lines
Vipin Velayudhan, Ayssar Serhan, Nicolas Carrao, Emmanuel Pistono, Jean-Daniel Arnould, IMEP-LAHC, France

FR-UA.1P.2 13:40
TTW Life Sign Detection by means of CW X-band Radar, Homeland security and rescue Applications
See Bash Chandra Debnath, University of Trento, Italy

FR-UA.1P.3 14:00
RCS Measurements: Statistical Characterization of the Impact of the Coupling Between a Calibration Sphere and a Styrofoam Positioner
Sylvain Morvan, Omar Fergui, CEA, France

FR-UA.1P.4 14:20
Measurement of High-Impedance Surface Backed Microstrip Structures Using Multimode TRL Calibration
Kevin Keegan, Kiersten Kerby-Patel, University of Massachusetts Boston, United States

FR-UA.1P.5 14:40
Canonical Target Response in a Reverberation Chamber
William Coburn, Seth McCormick, U.S. Army Research Laboratory, United States

FR-UA.1P.6 15:00
Statistical Characterization of Through-Wall Attenuation at 10 and 30 GHz
Anmol Bhardwaj, University of British Columbia, Canada; Guangkun Guo, University of Electronic Science and Technology of China, China; Yangyang Liu, Northwestern Polytechnical University, China; Siamak Bonyadi Ram, David Michelson, University of British Columbia, Canada

FR-UA.1P.7 15:20
Shaped Reflectors for Toroidal Beams
George Cheng, Yong Zhu, Jan Grzesik, Allwave Corporation, United States

FR-UA.1P.8 16:00
Practical Aspects and Design Considerations of Millimeter Wave Thin Lens
Jungseok Oh, Inha University, Republic of Korea

FR-UA.1P.9 16:20
A Novel Calculable Loop Antenna for Antenna Calibration Verification below 30 MHz
Xiaol Liu, Donglin Meng, National Institute of Metrology, China

FR-UA.1P.10 16:40
Accurate Complex Antenna Factor by Broadband Calculable Dipoles over 10 MHz to 1000 MHz
Donglin Meng, Yuling Kong, National Institute of Metrology, China
Advanced Concepts in Metamaterials
Session Co-Chairs: Andrea Alù, University of Texas at Austin; Loïc Markley, University of British Columbia

FR-UB.2P.1 13:20
On invisible bodies, nonradiating sources, and embedded eigenstates
Francesco Monticone, Cornell University, United States; Andrea Alù, The University of Texas at Austin, United States

FR-UB.2P.2 13:40
Microwave Pulse Compression Devices with Modal Degeneracy
Dmitry Oshmarin, Mohamed A. K. Othman, Filippo Capolino, University of California, Irvine, United States

FR-UB.2P.3 14:00
Frozen Modes in All-Dielectric 3-Way-Coupled Ridge Waveguides
Raed Almhmadi, Kubilay Sertel, The Ohio State University, United States

FR-UB.2P.4 14:20
Time Variant induced non-reciprocity enhanced by exceptional points of degeneracy
Mohd Yawi, Mohamed A. K. Othman, Hamidreza Kazemi, Filippo Capolino, University of California, Irvine, United States

FR-UB.2P.5 14:40
Recent Advances on Angular Momentum Magnet-Free Circulators
Ahmed Kord, Dimitrios Sounas, Younes Radi, Andrea Alù, The University of Texas at Austin, United States

Break 15:00

FR-UB.2P.6 15:20
Development of A Rigorous Equivalent Circuit Model for Nested Split-Ring Resonator Structures
Burak Ozbey, Ayhan Altintas, Hilmi Volkan Demir, Vakur B. Erturk, Bilkent University, Turkey

FR-UB.2P.7 15:40
Investigation of Propagation in Screw-Symmetric Structures
Oskar Dahlberg, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden

Break 15:00

FR-UB.2P.8 16:00
Perfect Transmission of Evanescent Waves Through Single-Negative Media
Spencer Bostock, Kenneth J. Chau, Loïc Markley, University of British Columbia, Canada

FR-UB.2P.9 16:20
Ideal Light Capturing by a Hermitian System
Alexander Krasnok, The University of Texas at Austin, United States; Denis Baranov, Chalmers University of Technology, Sweden; Andrea Alù, The University of Texas at Austin, United States

FR-UB.2P.10 16:40
Fiber-Optics Meta-tips for Light Manipulation and Sensing
Mania Principi, Marco Console, Alberto Micco, University of Sannio, Italy; Alessia Crescitelli, National Research Council, Italy; Giuseppe Castaldo, University of Sannio, Italy; Emanuela Esposito, National Research Council, Italy; Vera La Ferrara, ENEA, Italy; Antonello Cutolo, University of Sannio, Italy

FR-UB.2P.11 17:00
Electrically Small Antennas: Applications
Session Co-Chairs: Miloslav Capek, Czech Technical University in Prague; Giuseppe Mazzarella, Università di Cagliari

FR-A1.2P.1 13:20
An Electrically Small Antenna for Potential Aircraft Applications
Ana López-Yela, Fernando Alberane-Vargas, Daniel Segovia-Vargas, Charles III University of Madrid, Spain

FR-A1.2P.2 13:40
Parasitic Antennas for Small Metallic Platforms
Novad Barani, Behzad Yektakhah, Kamal Sarabandi, University of Michigan, United States

FR-A1.2P.3 14:00
A Navigation and Positioning System for Unmanned Underwater Vehicles Based on a Mechanical Antenna
Majid Maneghi, Virginia Tech, United States

FR-A1.2P.4 14:20
Novel Miniature Antenna for Biomedical Sensors
Mohammed Alharbi, Technical Affairs (Engineering Studies)/ Jeddah Islamic Port, Saudi Arabia; Sima Noghanian, Electrical Engineering Department, University of North Dakota, United States

FR-A1.2P.5 14:40
Characterization of miniature antenna for Sub-GHz on-body applications
Hajar Berrada, Université Côte d’Azur, France; Fabien Ferrero, Université Côte d’Azur - CNRS cote azur - LEAT - Universite Nice Sophia, France; Leonardo Lizzi, Université Nice Sophia Antipolis, France; Christophe Danches, Stephane Baudou, Abewray, France

Break 15:00

FR-A1.2P.6 15:20
A Robust Antenna for On-Body Clinical Applications
Giacomo Muntoni, Alessandro Fant, Giorgio Montisci, Giuseppe Mazzarella, Università degli Studi di Cagliari, Italy

FR-A1.2P.7 15:40
Miniaturized UHF Three-Element Sequential Rotation Array Antenna
Shanwei Liao, Quan Xue, City University of Hong Kong, Hong Kong SAR of China; Bin-Long Bu, Comba Telecom Systems Limited, China

FR-A1.2P.8 16:00
Miniaturized Vivaldi Antenna Based on Low Frequency Resonance for WLAN Application
Yunpeng Zhang, En Li, Jing Zhang, University of Electronic Science and Technology of China, China

FR-A1.2P.9 16:20
The low-profile end-fire antenna with circular polarization at S band
Jin Huang, Zhongxue Xue, Wu Ren, Weiming Li, Beijing Institute of Technology, China
Phased Array Antennas: Analysis, Synthesis and Optimization
Session Co-Chairs: Satish Sharma, San Diego State University; Paolo Rocca, University of Trento

FR-A1.3P.1  13:20
Fast Synthesis of Multiple Nulls in an Omnidirectional Pattern
Rashmi Mital, Mark Borsay, US Naval Research Laboratory, United States

FR-A1.3P.2  13:40
A Novel Analytic Beam Steering Approach for Clustered Phased Array Architectures
Paolo Rocca, Nicola Anselmi, Marco Salucci, Giorgio Gottardi, Lorenzo Pili, Andrea Massa, University of Trento, Italy

FR-A1.3P.3  14:00
Deterministic Synthesis of Conformal Linear Aperiodic Antenna Arrays
Diego Caratelli, The Antenna Company, Netherlands; Giovanni Toso, European Space Agency, Netherlands

FR-A1.3P.4  14:20
Innovative Optimization-based Design of UWB Planar Arrays for Grating Lobes Reduction
Lorenzo Tenuti, Paolo Rocca, Marco Salucci, Giorgio Gottardi, Andrea Massa, University of Trento, Italy

FR-A1.3P.5  14:40
A sparse forcing conformal array synthesis method
Daniele Pinchera, Marco Donald Migliore, Fulvio Schettino, Mario Lucido, Gaetano Panariello, University of Cassino and Southern Lazio, Italy

Break 15:00

FR-A1.3P.6  15:20
Optimized Dual-Linear Polarization Frequency Scanning Microstrip Array antenna for Cylindrical Polarimetric Phased Array Radar (CPPAR)
Hadi Saeidi-Manesh, Guifu Zhang, University of Oklahoma, United States

FR-A1.3P.7  15:40
On The Phase Center Analysis of Linear Phased-Array Antennas
Ahmed Nafe, Gabriel M. Rebeiz, University of California, San Diego, United States

FR-A1.3P.8  16:00
Tiling Optimization of Orthogonal-Polygon Shaped Aperture for Phased Array Antennas
Nicola Anselmi, Paolo Rocca, Giorgio Gottardi, Marco Salucci, Andrea Massa, University of Trento, Italy

FR-A1.3P.9  16:20
Advanced Time-Modulated Array Synthesis for Directional Modulation Optimization
Mohammad Abdul Hannan, Marco Salucci, Giorgio Gottardi, Lorenzo Pili, Paolo Rocca, University of Trento, Italy

Wireless Power Transfer and Energy Harvesting
Session Co-Chairs: Youssef Tawk, Notre Dame University Louaize; Anatoliy Boryssenko, AE Partnership

FR-AS.1P.1  13:20
Tightly Coupled Antennas for Low Cost and Highly Efficient Energy Harvesters
Thames Almaneet, Faruk Erkmen, Osman Ramaoh, University of Waterloo, Canada

FR-AS.1P.2  13:40
5.8 GHz Experimental Rectena Dipole Array
Anatoliy Boryssenko, Elen Boryssenko, AE Partnership, United States; David Crowell, Cev-Lunar Inc., United States

FR-AS.1P.3  14:00
Proposal of Multidirectional Power Transmission System using Monopole Antennas and Parasitic Elements
Masami Nakayama, Antenna gikan, Japan; Takafumi Hariguri, Nippon Institute of Technology, Japan; Tsutomu Mito, Ken'ya University of Technology, Japan; Takahiro Matsuda, Graduate School of Engineering, Osaka University, Japan; Kazuhiro Hirasawa, Yeap Kim Ha, Tsukuba University, Japan

FR-AS.1P.4  14:20
A Planar Dipole Array with High-Permittivity Superstrate for Efficient Electromagnetic Wireless Energy Harvesting
Ahmed Ashoor, Omar Ramahi, University of Waterloo, Canada

FR-AS.1P.5  14:40
A Broadband L-Probe Microstrip Patch Rectenna for Ambient RF Energy Harvesting
Shanpu Shen, Chi-Yuk Chiu, Ross D. Murch, The Hong Kong University of Science and Technology, Hong Kong SAR of China

Theory and Application of Guided Waves
Session Co-Chairs: Edward Rothwell, Michigan State University; Michael Havilla, Air Force Institute of Technology

FR-UB.3P.1  15:20
Ultra-deep-subwavelength Light Transport in Hybrid Nanowire-loaded Silicon Nano-rib Waveguides
Qiang Ren, Yusheng Bian, Ping Werner, Douglas H. Werner, The Pennsylvania State University, United States

FR-UB.3P.2  15:40
Third Order Modal Degeneracy in Waveguides: Features and Application in Amplifiers
Farshad Yazdi, Mohamed A. K. Othman, Mehdi Vaysi, Alexander Figotin, Filippo Capolino, University of California, Irvine, United States

FR-UB.3P.3  16:00
Evaluation of Anisotropic Overlay Materials for Use in the Free-Space, TEM, or Waveguide Characterization of Conductor-Backed Absorbers
Edward Rothwell, Michigan State University, United States; Raenita Fenner, Loyola University, United States

FR-UB.3P.4  16:20
Waveguide Calibration and Material Characterization under Common and Differential Excitation
Michael Havilla, Air Force Institute of Technology, United States

FR-UB.3P.5  16:40
Fabrication of a Triaxial Applicator for the Characterization of Conductor-Backed Absorbing Materials
Saranraj Karuppuswami, Jonathan Frasch, Edward Rothwell, Prem Chahal, Michigan State University, United States; Michael Havilla, Air Force Institute of Technology, United States
**Propagation Phenomena and Scattering of EM Waves**

Session Co-Chairs: Ramakrishna Janaswamy, University of Massachusetts Amherst; Prasant Sahu, Indian Institute of Technology, Bhubaneswar

**FR-UB.4P.1** 13:20
Numerical Estimation of Propagation Path Loss for Smart Gas Meters in Built-up Areas Based on Large-Scale FDTD Simulation
Takashi Hikage, Masakazu Yonaga, Toshihiko Nomura, Hokkaido University, Japan; Sota Tsuchiya, Tokuwa Kawata, Tokyo Gas Co., Ltd., Japan

**FR-UB.4P.2** 13:40
From Physics-Based Propagation Modeling to Network Design for Train Communication Systems in Tunnels
Neeraj Sood, Jorg Liebeherr, Costas D. Sarris, University of Toronto, Canada

**FR-UB.4P.3** 14:00
Parameter analysis of propagation attenuation characteristics for 1-6 GHz in the open environment
Jae-Won Choi, Chosun University, Republic of Korea; Hwo choon Lee, Chogang University, Republic of Korea; Young Chul Lee, Mokpo National Maritime University, Republic of Korea; Donggeun Choi, Sung Won Park, National Radio Research Agency, Republic of Korea; Soon-Soo Oh, Chosun University, Republic of Korea

**FR-UB.4P.4** 14:20
Oblique Scattering by Penetrable Cylinders of Arbitrary Cross Section
Piergiorgio L. E. Uslenghi, University of Illinois at Chicago, United States

**FR-UB.4P.5** 14:40
Comparison of Methods for Layered Spheroid Scattering Analysis: Application to BioEM Problems
Chang Liu, Ali E. Yilmaz, The University of Texas at Austin, United States

**FR-UB.4P.6** 15:00
Reduction of Radar Cross Section Using Active Microstrip Antenna Elements
Sohini Sengupta, David R. Jackson, Daniel Onofrei, Henry Council, University of Houston, United States

**FR-UB.4P.7** 15:20
Approximative Computation Methods for Electromagnetic Scattering Reduction
Andreas Ericsson, Daniel Sjöberg, Christer Larsson, Torleif Martin, Lund University, Sweden

**FR-UB.4P.8** 15:40
Numerical Analysis of Brillouin Precursor Formation Through Wet Loamy Soil-filled Waveguide
Muhammad Dawood, Kaining Li, New Mexico State University, United States; Ana Alajos, New Mexico State University/University of Vigo, Spain

**FR-UB.4P.9** 16:00
High-Frequency Analysis of Diffraction within the Tubes of an Interferometric Detector of Gravitational Waves
Giuseppe Pelosi, University of Florence, Italy; Innocenzo M. Pinto, University of Sannia, Italy; Leonardo Passenti, Stefano Selleri, University of Florence, Italy

**FR-UB.4P.10** 16:20
A study on Free Space Optical Communication for Bhubaneswar City
Suman Malik, Prasanta Kumar Sahu, Indian Institute of Technology Bombay Bhubaneswar, India

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**High Frequency and Asymptotic Methods**

Session Co-Chairs: Robert Paknys, Concordia University; Yaniv Brick, University of Texas at Austin

**FR-A3.1P.1** 13:20
Convergence Analysis for Iterative Physical Optics Algorithms
Igor Gershenzon, Amir Boag, Tel Aviv University, Israel; Yaniv Brick, The University of Texas at Austin, United States

**FR-A3.1P.2** 13:40
Comparison of Exact Solution and High Frequency Asymptotic Methods in the Canonical Wedge Diffraction Problem
Herman Triana, Andrés Navarro, Universidad Icesi, Calambría

**FR-A3.1P.3** 14:00
Physical Optics Method Over High-order Triangular Element for Complex Source Beam Applications
Min Gao, Xuewu Cui, Zhipeng Liang, Feng Yang, University of Electronic Science and Technology of China, China

**FR-A3.1P.4** 14:20
Electromagnetic Scattering from a PEC Target over a Random Rough Sea Surface using Hybrid KA-PO-PTD Method
Mahdi Behdani, Parisa Dehkhoda, Akhoj Tavakoli, Mohammad Zohreghani, Amirkabir University of Technology, Iran
Novel Reflectarray Designs and Applications
Session Co-Chairs: Shenheng Xu, Tsinghua University; Ahmed Abdelrahman, University of Colorado Boulder

FR-A1.4P.1 13:20
Simultaneous Transmit And Receive Reflectarray Antennas on Low Cost UAV Platforms
Aman Samayyar, Ahmed Abdelrahman, Dejan Filipovic, University of Colorado Boulder, United States

FR-A1.4P.2 13:40
Passive Repeater for Removal of Blind Spot in NLOS Path for 5G Fixed Wireless Access (FWA) System
Dohyuk Ha, Dongkyu Choi, Hyunjin Kim, JunSung Kim, Jongyoub Lee, YoungJu Lee, Samsung Electronics, Republic of Korea

FR-A1.4P.3 14:00
Design of a Single-Layer Dual-Band Metal-Only Reflectarray
Ruyuan Deng, Shenheng Xu, Fan Yang, Maokun Li, Tsinghua University, China

FR-A1.4P.4 14:20
A Novel Ku/Ka Dual-Band Reflectarray Antenna With Arbitrary Polarization
Jianing Zhao, Hao Li, Wei Mao, Keping Zhao, Qian Li, University of Electronic Science and Technology of China, China

FR-A1.4P.5 14:40
Mode Analysis of 1-Bit Reflectarray Element Using p-i-n Diode at W-band
Xiatian Pan, Fan Yang, Shenheng Xu, Maokun Li, Tsinghua National Laboratory for Information Science and Technology, China

Wave-guiding Devices and Applications
Session Chair: Vakur Erturk, Bilkent University

FR-UB.SP.1 15:20
Radially-polarized Few-Cycle Terahertz Pulse Emission, In-Coupling and Propagation in Coaxial Waveguides
Miguel Navarro-Cía, University of Birmingham, United Kingdom; Liu Huiyun, Oleg Mitrofanov, University College London, United Kingdom

FR-UB.SP.2 15:40
Metal Cap Antenna with Two Slots Fed by the Post-wall Waveguide
Jiro Hirokawa, Haruhisa Hirayama, Makoto Ando, Tokyo Institute of Technology, Japan

FR-UB.SP.3 16:00
Low Temperature, Micromachined, Rotated Rectangular Waveguides at Y-band for Leaky Wave Antenna Applications
Amr Ibrahim, Kamal Sarabandi, University of Michigan, United States; Hussein Shayan, King Abdullah University of Science and Technology, Saudi Arabia

FR-UB.SP.4 16:20
Implementation of Three-Way Power Divider Based on Substrate Integrated Waveguide
Orçun Kiris, Volkan Akan, Mesut Gokten, Lokman Kazu, TUBITAK Space Technologies Research Institute, Turkey

Microwave Imaging
Session Co-Chairs: David Smith, Duke University; Hakan Bagci, King Abdullah University of Science and Technology (KAUST)

FR-UB.JP.1 15:20
Dynamic Metasurface Antennas for Computational Microwave Imaging
Mohammadreza F. Irani, Timothy Sleasman, Michael Boyarsky, Laura Pulido-Mancera, Duke University, United States; Thomas Friementze, University of Limerick, France; Jonathan N. Golub, David R. Smith, Duke University, United States

FR-UB.JP.2 15:40
Improving Discontinuous Galerkin Method Contrast Source Inversion Microwave Imaging using a Hybridizable Forward Solver Formulation
Nicholas Geddart, Kevin Brown, Ian Jeffrey, University of Manitoba, Canada

FR-UB.JP.3 16:00
Data Hopping and Convergence Criteria for Microwave Imaging
Joe Loveti, Cameron Kaye, Anastasia Baran, Ian Jeffrey, University of Manitoba, Canada

FR-UB.JP.4 16:20
A Projected Steepest Descent Accelerated Contrast-Source Inversion Scheme for Nonlinear Electromagnetic Imaging
Ali Imran Sandhu, King Abdullah University of Science and Technology, Saudi Arabia; Abdulla Desmal, Tufts University, United States; Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia
Interactive Forum

Interactive Forum Reception
Tuesday, July 11, 16:00 - 18:00, Grand Hall A/C
Antenna Arrays with Non-Uniform Feeding
Session Co-Chairs: Bilgehan Avser, University of California, San Diego; Hiroyuki Arai, Yokohama National University

TUP-A1.1P.1 Board A.1
Non-uniform Feeding Networks for Limited-Scan Phased Array Systems
Bilgehan Avser, Gabriel M. Rebeiz, University of California, San Diego, United States

TUP-A1.1P.2 Board A.2
Substrate Integrated Waveguide Slotted Antenna Array with Amplitude Weighting and Integrated Monopulse Feed
Daniel Lawrence, Technology Service Corporation, United States

TUP-A1.1P.3 Board A.3
Exploiting the Non-uniformity for Circularly Polarized Antenna Arrays at Ku-Band
Luz Idalia Balderas, Alberto Reyna, Universidad Autónoma de Tamaulipas, Mexico; Marco A. Panduro, Centro de Investigación Científica y de Educación Superior de Ensenada, Mexico

TUP-A1.1P.4 Board A.4
Beam Steering System using Rotman lens for 5G Applications at 28 GHz
Mohamed A. Hassanan, Michael Jenning, Dirk Plettemeier, TU Dresden, Germany

TUP-A1.1P.5 Board A.5
Linearily Polarized Slotted Patch Antenna Array Fed by Power Weighting Distribution
Ahmad Munir, Yassi Pardana Saputra, Institut Teknologi Bandung, Indonesia; Fakhrulami Komiawan, Jogeshart Tetuko Sri Sumenyo, Chiba University, Japan

TUP-A1.1P.6 Board A.6
Experiment of Ka-band Orbital Angular Momentum Steering Technique
Minghao Liu, Penghao Liu, Jinhua Lu, National University of Defense Technology, China; Yue Guo, Queen Mary University of London, United Kingdom

TUP-A1.1P.7 Board A.7
Minimizing gain roll-off in Rotman lens antenna using phase gradient transmission lines
Jianping Li, Weiren Zhu, Bin Zhou, Jianping Li, Yifeng Chen, Weiren Zhu, Xianling Liang, Junping Geng, Shangzhen Jiao, Shanghai Jiao Tong University, China

TUP-A1.1P.8 Board A.8
Synthesis of Sparse Antenna Arrays with Concurrently Weighted Inter-element Spacings and Amplitude Excitation Coefficients
V S Gangwar, A K Singh, Defence Research and Development Organization (DRDO), India; S P Singh, Indian Institute of Technology (IIT-BHU), India

TUP-A1.1P.9 Board A.9
Plate-laminated slotted-waveguide fed 2×3 Planar Inverted F Antenna Array
Badar Muneer, Waseem Shabbir, Faisal Shaikh, Mehran University of Engineering & Technology, Jamshoro, Pakistan; Qi Zhu, University of Science & Technology of China

TUP-A1.1P.10 Board A.10
Array-antenna Decoupling Surfaces for Quasi-Yagi Antenna Arrays
Changning Wei, Ke-Li Wu, The Chinese University of Hong Kong, Hong Kong SAR of China

Feeding Networks and Arrays
Session Co-Chairs: Mohammad Akbari, Concordia University; Can Ding, University of Technology, Sydney (UTS)

TUP-A1.2P.1 Board A.11
A Sequential-Phase Feed Antenna Subarray Based on Ridge Gap Waveguide
Mohammad Akbari, Concordia University, Canada; Ali Farahbakhsh, Iran University of Science and Technology, Iran; MohammadMahdi Farahani, Institute National De La Recherche Scientifique, Canada; Abdel Razik Sebak, Concordia University, Canada; Tayeb A. Denidni, Institute National De La Recherche Scientifique, Canada

TUP-A1.2P.2 Board A.12
Dual-Polarized X-Band Microstrip Sub-array with Hybrid Feed Network for SAR Payload on Small Satellite
Xing Zhao, Swee Ping Yeo, National University of Singapore, Singapore; L. C. Michael Ong, Mohammad Faezy Karim, Institute for Infocomm Research, Singapore

TUP-A1.2P.3 Board A.13
Compact Antenna System Fed by Dual-layer Rotman Lens to Support Millimeter Wave Devices
Toan Vo Dai, Toan Nguyen, Ozlem Kiele, The Catholic University of America, United States

TUP-A1.2P.4 Board A.14
Wideband Feeding Method for Full-Wave Dipole
Can Ding, Bevan Jones, Hakan Sun, Pei-Quan Qin, Jay Guo, University of Technology Sydney, Australia; Luyang Ji, Northwestern Polytechnical University, China

TUP-A1.2P.5 Board A.15
On Systematic Design of Corporate Feeds for Chebyshev Microstrip Linear Antenna Arrays
Sławomir Kuziel, Stanisław Ogurtsov, Rzeszów University, Poland

TUP-A1.2P.6 Board A.16
Series-Fed Antenna System Featuring Dual-Circular Polarization with Integrated Feeding Network
Szczepan Odobina, Izabela Stomian, Sławomir Gruszczynski, Krzysztof Wincza, AGH University of Science and Technology, Poland

TUP-A1.2P.7 Board A.17
Performance Validation of the 19-element Multibeam Feed for the Five-hundred-metre Aperture Spherical Radio Telescope
Stephanie Smith, Alex Dunning, Ken Smart, Robert Shaw, Simon Mackay, Mark Bowen, Douglas Hayman, CSIRO, Australia

TUP-A1.2P.8 Board A.18
A Novel Passive Feeding Network for Isolation Enhancement of Dual-polarized Antenna
Xinlin Li, Shiwen Yang, Mengkui Shen, Zaiping Nie, University of Electronic Science and Technology of China, China; William Thomas Joines, Duke University, China

TUP-A1.2P.9 Board A.19
A Compact SIW Butler Matrix with Straight Delay Lines at 60 GHz
Zhengan Chen, Xiaofang Wei, Fan Yang, Zhejiang University, China

TUP-A1.2P.10 Board A.20
A T-Shaped Feed Structure to Enhance the Performance of a Polarization Diversity Antenna
Guanshen Chenhu, Xianling Liang, Bin Zhou, Jianping Li, Yifeng Chen, Weiren Zhu, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China; Richard Mowalki Zolkowski, University of Technology Sydney, Australia
Gain Enhancement Techniques for Planar Antennas
Session Chair: Ashraf Badawi, Zewail City of Science and Technology

TUP-A1.3P.1 Board A.21
Gain Enhancement of Suspended Miniaturized Antenna on High-loss Paper Substrate
Do Hanh Ngoc Bui, Tan-Phu Vuong, University of Grenoble-Alpes, France; Jacques Verdier, Bruno Allard, University of Lyon, INSA, France; Philippe Benne, University of Grenoble-Alpes, France

TUP-A1.3P.2 Board A.22
A Modified Square Loop Antenna Radiating a Circularly Polarized Conical Beam — Its Application to Tilted Beam Formation with Enhanced Gain
Kazuhide Hirose, Takuya Yoshida, Shibaura Institute of Technology, Japan; Hisamatsu Nakano, Hosei University, Japan

TUP-A1.3P.3 Board A.23
High Gain Enhancement Off-body Antenna for Underground Mining Communications
Amine Habani, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue, Canada; Tayeb A. Denidni, Instituit National de la Recherche Scientifique (INRS), Canada; Labi Talbi, Université du Québec en Outaouais, Canada

TUP-A1.3P.4 Board A.24
Gain Enhancement of Dual-band Antenna Using Square Loop FSS
Francisco Lucena, Crislane Silva, Tuílio Pedrosa, Universidade Federal de Pernambuco, Brazil

TUP-A1.3P.5 Board A.25
Two-Layered Ground Radiation Antenna for High Efficiency Applications
Hyunwoong Shin, Longyue Qu, Jihoon Kim, Hongkoo Lee, Min-Gi Kim, Hanyang University, Republic of Korea; Hyung Hoon Kim, Kwangju Women’s University, Republic of Korea; Hyeongdong Kim, Hanyang University, Republic of Korea

TUP-A1.3P.6 Board A.26
A High-gain Printed Antenna Loaded by Plane Dielectric Based on Substrate integrated waveguide Technology
Shu Lin, Yandi Bi, Yu Mao, Maowei Zhang, Harbin Institute of Technology, China

TUP-A1.3P.7 Board A.27
A High Gain Patch Antenna Using Near Zero-Index Metamaterial Coating
Kai Yu, Yangsong Li, Harbin Engineering University, China; Xiaoguang “Leo” Liu, University of California, Davis, United States

TUP-A1.3P.8 Board A.28
A Gain-enhanced Rectangular Patch Antenna with Artificial Magnetic Conductor Ground
Wei Li, Ying Suo, Xiaopeng Xu, Yan Liu, Harbin Institute of Technology, China

TUP-A1.3P.9 Board A.29
A Compact Substrate Integrated Waveguide Antenna Array for W-band applications
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Session Co-Chairs: Ryan Adams, University of North Carolina at Charlotte; Mahmoud Abdalla, Military Technical College

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Kathryn Smith, Ryan Adams, University of North Carolina at Charlotte, United States

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Soumava Mukherjee, Indian Institute of Technology Jodhpur, India; Animesh Biswas, Indian Institute of Technology Kanpur, India

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Abdulrahdi E. Abdulrahdi, Zoubir Bizar, Teyeb A. Dadoun, Institut National de la Recherche Scientifique (INRS), Canada; Yassin Belaiz, Arnaud Vena, Briac Sohli, Université de Montpellier, France

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Karthik T Chandrasekaran, NTU, Singapore; Muhammad Faeyz Karim, Institute for Infocomm Research, Singapore; Arokiaswami Alphones, NTU, Singapore; Nasimuddin Nasimuddin, L. C. Michael Ong, Institute for Infocomm Research, Singapore

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Han Bao, XiongYing Liu, South China University of Technology, China

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ZuZhang Wang, XiongYing Liu, School of Electronic and Information Engineering South China University of Technology, China

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On the Backscattering From RFID Tags Installed on Vehicular Glasses
John J. Pantoja, Angelica Parra, Ernesto Neira, Félix Vega, Departamento de Ingeniería Eléctrica y Electrónica, Facultad de Ingeniería. Universidad Nacional de Colombia., Colombia

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Guo Chun Wan, Quan Gu, Xin Ru Zhang, Mei Song Tong, Tongji University, China
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**Session Co-Chairs:** Loic Markley, University of British Columbia; Jacob Adams, North Carolina State University

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Session Co-Chairs: Mike Potter, University of Calgary; Dan Jiao, Purdue University

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Xiao-Kun Wei, University of Electronic Science and Technology of China, China; Xingqi Zhang, University of Toronto, Canada; Nectaria Diamanti, Sensors & Software Inc., Canada; Costas D. Sarris, University of Toronto, Canada

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Gary Junkin, Universidad Autónoma de Barcelona, Spain; Alan Tennant, The University of Sheffield, United Kingdom

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Wei-Jun Chen, Qi-Yuan Zhu, Lingnan Normal University, China; Tu-Lu Liang, Li-Ye Xiao, University of Electronic Science and Technology of China, China

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Brandon Dowd, Rodolfo Díaz, Arizona State University, United States

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Mohamed Bakr, McMaster University, Canada; Atef Elsherbeni, Colorado School of Mines, United States; Veysal Demir, Northern Illinois University, United States

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Zaifang Yang, Eng Leong Tan, Nanyang Technological University, Singapore

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Tu-Lu Liang, Wei Shao, Li-Ye Xiao, University of Electronic Science and Technology of China, China

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Fei Wang, Xidian University, China; Qingsheng Zeng, Shanxi University, China

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Fatih Kaburcu, Erzurum Technical University, Turkey; Atef Elsherbeni, Colorado School of Mines, United States

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Ata Zadehgol, University of Idaho, United States

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Qian Yang, Bing Wei, Linqian Li, Runxian Li, Debiao Ge, Xidian University, China

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Inverse Scattering and Imaging: Methods II
Session Chair: Hiroyuki Arai, Yokohama National University

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Xiao Han Dong, Alex Wong, George Eleftheriades, University of Toronto, Canada

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Yoshiki Sugimoto, Hiroyuki Arai, Yokohama National University, Japan

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Michael Richardson, Matthias Rotha, Stellenbosch University, South Africa

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Aslan Etminan, Mahta Moghaddam, University of Southern California, United States

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Ozlem Ozgun, Hacettepe University, Turkey; Mustafa Kuzuoglu, Middle East Technical University, Turkey

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Chun Xia Yang, Jian Zhang, Yao Lin Qi, Mei Song Tong, Tongji University, China
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Session Chair: Mohammad Sharawi, King Fahd University of Petroleum and Minerals

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Abhijit Bhattacharya, Rodney G Vaughan, Simon Fraser University, Canada

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Kwok Kee Chan, Chan Technologies Inc., Canada

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Syed Shahanghe, Mohammad Said Sharawi, King Fahd University of Petroleum and Minerals, Saudi Arabia; Muhammad Umar Khan, National University of Sciences & Technology, Pakistan

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Hsin Cho Bi, Hiroshi Shinh, Graduate School of Science and Engineering, Chuo University, Japan

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Kwame Oteng Gyasi, Yongjiun Huang, Guangjun Wen, Affum Emmanuel Ampoma, Hu Wei, University of Electronic Science and Technology of China, China

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Hasan Radibi, Mohammad Rizwan, Johanna Vekki, Leena Ukkonen, Tampere University of Technology, Finland

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Yasumitsu Ban, Manabu Kari, Fujitsu Laboratories Limited, Japan

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Kamran Sockolov, Maxim Integrated, United States; Dean Arakaki, California Polytechnic State University, United States

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Iyadh Gamoudi, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue, Canada; Teyeb A. Dendini, INRS, Canada; Lerb Tabb, UQO, Canada

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Chao-Yu Liao, Hwa-Ming Chen, National Kaohsiung University of Applied Sciences, Taiwan; Chao-Yen-Desmond Sim, Feng Chia University, Taiwan; Yi-Fong Liu, National Kaohsiung University of Applied Sciences, Taiwan

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Yun Jing Zhang, Mei Song Tong, Tongji University, China
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Session Co-Chairs: Jorge Costa, Instituto Superior de Ciências do Trabalho e da Empresa - Instituto Universitário de Lisboa; George Shaker, University of Waterloo

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Hsin-Lung Su, National Pingtung University, Taiwan; Sung-Lin Chen, China Steel Corporation, Taiwan; Hong-Sheng Huang, National Pingtung University, Taiwan; Chou-Ver Desmond Sim, Feng Chia University, Taiwan

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Pouya Allaki, George Xiao, National Research Council of Canada, Canada; Aidin Taeb, University of Waterloo, Canada; Yao Ye, Christophe Py, National Research Council of Canada, Canada

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Kumud Jha, Shri Mata Vaishno Devi University, India; Ghanasyam Mishra, Satish Kumar Sharma, San Diego State University, United States

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Jian Li, Yangjun Huang, Guangjun Wen, University of Electronic Science and Technology of China, China

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Wei Hu, Daniele Inserra, Yangjun Huang, Guangjun Wen, University of Electronic Science and Technology of China, China

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Chie-Ts Liao, National Kaohsiung University of Applied Sciences, Taiwan; Yi-Ying Chen, National Cheng Kung University, Taiwan; Yang-Kai Wang, Advanced Connection Technology Inc, Taiwan; Hua-Ming Chen, National Kaohsiung University of Applied Sciences, Taiwan

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Yunja Zeng, Institute for Infocomm Research, Singapore; Zhi Ning Chen, National University of Singapore, Singapore; Xanning Qing, Institute for Infocomm Research, Singapore; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

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Fezza Haider, George Shaker, University of Waterloo, Canada

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Jamil Zaid, Mohammad Mohaddos Farahani, Aron Resavan, Tayeb A. Denidni, Institut National de la Recherche Scientifique (INRS), Canada

Inverse Scattering and Imaging: Systems

Session Co-Chairs: Yoshihiko Kuwahara, Shizuoka University; Miguel Navarro-Cia, University of Birmingham

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Okan Yurduseven, Jonah N. Gollub, Daniel L. Marks, David R. Smith, Duke University, United States

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Okan Yurduseven, Daniel L. Marks, Jonah N. Gollub, David R. Smith, Duke University, United States

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Yuuki Ono, Yoshihiko Kuwahara, Shizuoka University, Japan

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Wenyi Shao, Arash Ebrahimi, Todd McCollough, William McCollough, Ellume Inc, United States

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Mohammad Abdul Hannan, Nicola Anselmi, Giacomo Oliveri, Paolo Roccia, University of Trento, Italy
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Session Co-Chairs: Giacomo Oliveri, University of Trento; Jiang Xiong, University of Electronic Science and Technology of China

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Felisberto Pereira, Pedro Pinho, Ricardo Gonçalves, Nuno B. Carvalho, Instituto de Telecomunicações, Portugal; João Lobato, FEUP - Faculty of Engineering of the University of Porto, Portugal; Sérgio I. Lopes, Instituto Politécnico de Viana do Castelo, Portugal

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Navid Rezazadeh, Lotfollah Shafai, University of Manitoba, Canada

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Fabrizio Robol, Giorgio Gottardi, Marco Salucci, Giacomo Oliveri, University of Trento, Italy

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Andrea Costa, Ricardo Gonçalves, Instituto de Telecomunicações, Portugal; Pedro Pinho, Instituto Superior de Engenharia de Lisboa, Portugal; Nuno B. Carvalho, Instituto de Telecomunicações, Portugal

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Sameer Sharma, Indian Institute of Technology Kanpur, India; Mahmoud A. Abdalla, Military Technical College, Egypt

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Mahmoud A. Abdalla, Military Technical College, Egypt; Sameer Sharma, Indian Institute of Technology Kanpur, India; Zhiyun Hu, University of Manchester, United Kingdom

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M. F. Ahmed, Electronics Research Institute, Egypt; M. F. Ahmed, A. A. Shaalan, Zagazig University, Egypt

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Fe Huang, Jiang Xiong, University of Electronic Science and Technology of China, China

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Session Chair: Ahmed Kishk, Concordia University

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Senglee Foo, Huawei Technologies Canada, Canada

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Ghaith Elzawwi, Mohamad Mantash, Tayeb A. Denidni, Institut National de la Recherche Scientifique (INRS), Canada

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Seongkyu Lee, Jaehoon Choi, Hanyang University, Republic of Korea

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Yuchu He, George Eleftheriades, University of Toronto, Canada

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Ali Fouadz, Kristen M. Donnell, Missouri University of Science and Technology, United States

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Alistair Hassan, Ahmad Almutawa, Filippo Capolino, University of California, Irvine, United States; David R. Jackson, The University of Houston, United States

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Bradley Allen, Nathan Jastram, Dejan Filipovic, University of Colorado Boulder, United States

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Sara Manafi, Muhannad Al-Tarifi, Dejan Filipovic, University of Colorado Boulder, United States

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Nima Bayat-Makou, Ahmed A. Kishk, Concordia University, Canada

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Abbas Vosoogh, Chalmers University, Sweden; Mhod Sharif Sookhehiz, Concordia University, Canada; Ashraf Uz Zaman, Jian Yang, Chalmers University, Sweden; Ahmed A. Kishk, Concordia University, Canada
**mmWave and Subwavelength Antennas**

Session Co-Chairs: Nader Behdad, University of Wisconsin-Madison; Kirill Klionovski, King Abdullah University of Science and Technology (KAUST)

**THP-A5.11P**

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Low Frequency Surface Plasmon Waves Guided on Metal Structured Surface with Periodic Subwavelength Rectangular Grooves Partially Loaded with an Optically Plasma Induced Semiconductor

Kazuo Nishimura, Ryukoku University, Japan

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Back Radiation Suppression through a Semi-Transparent Round Ground Plane for a mm-Wave Monopole Antenna

Kirill Klionovski, Muhammad Fahad Farooqui, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia

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Design of Photoconductive Antenna Using Spatially Dispersive Graphene Strips

Ramin Emadi, Reza Safian, Abolghasem Zeidabadi Nazhad, Isfahan University of Technology, Iran; Navid Barani, University of Michigan, United States

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Pharaonic Ankh-Key Millimeter Wave Broadband Antenna Design and Fabrication for 5G Applications

Noha Rashad, October University for Modern Sciences and Arts, Egypt; Wael Swelam, Mohamed Hassan Abd El Azeem, Arab Academy for Science, Technology & Maritime Transport, Egypt

**Wideband Antennas for High Frequency Communications**

Session Co-Chairs: Mohammad Ali, University of South Carolina; Deb Chatterjee, University of Missouri, Kansas City

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Center-fed Traveling-wave Microstrip Array Antenna Using Elliptically-shaped Radiating Elements in Quasi millimeter-wave Band

Koito Sakakihara, Kazumasa Shida, Yuta Mouri, Nabajoshi Kikoma, Nagoya Institute of Technology, Japan

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Ultra-Broadband V-band Fractal T-Square Antenna

Ousama Abu Safia, University of Quebec, Canada; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue, Canada

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16x8 Wideband Microstrip Planar Array Antenna for E-Band Millimeter-Wave 5G High Speed WLAN and Broadband Internet Applications

Ahmed Hassanien, Misr University for Science and Technology, Egypt; Wael Swelam, Mohamed Hassan Abd El Azeem, Arab Academy for Science, Technology & Maritime Transport, Egypt

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Improved Design of Balanced Antipodal Vivaldi for MMW Applications

Nannan Wang, Mu Fang, Jinghui Qiu, Liyi Xiao, Harbin Institute of Technology, China

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A 28 GHz Beam-Switching Yagi-Uda Array Using Rotman Lens for 5G Wireless Communications

Mohammadreza Ranjbar Naeini, Mohammad Fakharzadeh, Sharif University of Technology, Iran
60 GHz Radars and Communications
Session Co-Chairs: Yoshihiko Kuwahara, Shizuoka University; Emilio Arnieri, University of Calabria

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Marcus Walden, Plextek, United Kingdom

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Nour Nachabe, Cyril Luxey, Diane Titz, University Nice-Sophia Antipolis, France; Jorge R. Costa, Sérgio A. Matos, Instituto Universitário de Lisboa (ISCTE-IUL), Portugal; Frédéric Gianesello, STMicroelectronics, France; Carlos A. Fernandes, Universidade de Lisboa, Portugal

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Abdolmehdi Dadgarpour, Ahmed A. Kishk, Mostafa Sharifi Sorkherizi, Concordia University, Canada; Teyeb A. Denidni, Institut National de la Recherche Scientifique (INRS), Canada; Abdel Razik Sebak, Concordia University, Canada

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Emilio Arnieri, Grandamanico Amendola, Luigi Boccia, University of Calabria, Italy

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Ta-Yeh Lin, Tsenchieh Chiu, National Central University, Taiwan; Chaoping Hsieh, Da-Chiang Chang, Chip Implementation Center, Taiwan

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Session Co-Chairs: Jorge Costa, Instituto Superior de Ciências do Trabalho e da Empresa - Instituto Universitário de Lisboa; Vesna Radisic, Northrop Grumman Corporation

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Lee Hade, John Papapolymerou, Michigan State University, United States

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Jimmy G.D. Hester, Evan Nguyen, Jesse Tice, Vesna Radisic, Northrop Grumman Corporation, United States

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Jorge P. Teixeira, Instituto de Telecomunicações, Instituto Universitário de Lisboa (ISCTE-IUL), Portugal; Sérgio A. Matos, Jorge R. Costa, Instituto de Telecomunicações, Instituto Universitário de Lisboa (ISCTE-IUL), Portugal; Carlos A. Fernandes, Instituto de Telecomunicações, Universidade de Lisboa, Portugal; Nour Nachabe, Cyril Luxey, Diane Titz, EpOC, Université Nice-Sophia, France; Frédéric Gianesello, STMicroelectronics, France

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Karina Hoel, Stein Kristoffersen, FFI, Norway

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[Yannis] Vardaxoglou, Shiya Zhang, William Whittow, Darren Cadman, Loughborough University, United Kingdom

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Cheng Guo, University of Birmingham, United Kingdom; Jin Li, Jin Xu, University of Electronic Science and Technology of China, China; Hongjun Li, The 13th Research Institute of China Electronics Technology Group Corporation, China

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Jin Li, Cheng Guo, University of Electronic Science and Technology of China, China; Lijian Mao, Shanghai Reeyun Electronics Co., Ltd., China; Jin Xu, University of Electronic Science and Technology of China, China
Additively Manufactured Antennas
Session Co-Chairs: Pedram Mousavi, University of Alberta; Sima Noghianian, University of North Dakota

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Hossein Saghlatoon, Mohammad Mahdi Honari, Rashid Mirzavand, Pedram Mousavi, Amit Kumar, Thang Giang La, Hyun-Joong Chung, University of Alberta, Canada

THP-A5.6P.2
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Shiyu Zhang, Darren Cadman, William Whittow, Yiannis Vardaxoglou, Loughborough University, United Kingdom

THP-A5.6P.3
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Ramiro Ramirez, University of South Florida, United States; Marcia Galmohamadi, University of Vermont, United States; Denise Lugo, University of South Florida, United States; Jeff Frollk, University of Vermont, United States; Thomas Weller, University of South Florida, United States

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Michel Chatou, Youssef Tawk, Notre Dame University, Lebanon; Joseph Costantine, American University of Beirut, Lebanon; Christos Christodoulou, University of New Mexico, United States

THP-A5.6P.5
Inkjet Printed Dual-Band Origami Frog Antenna
Sung Yun Jun, Anshuman Shastri, Benito Sanz-Izquierdo, University of Kent, United Kingdom; Alan McClelland, The Centre for Process Innovation, United Kingdom

THP-A5.6P.6
3D Printed Antenna Using Biocompatible Dielectric Material and Graphene
Milad Mirzoe, Sima Noghianian, University of North Dakota, United States

THP-A5.6P.7
Analysis of Structural Effects on Conformal Antenna Performance
David Zeppettella, U.S. Air Force Research Laboratory, United States; Mohammed Ali, University of South Carolina, United States

THP-A5.6P.8
A 3D Printed Low Profile Magnetic Dipole Antenna
Myeongjun Kong, Ick-Jae Yoon, Chungnam National University, Republic of Korea

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Experimental Verification of Ground-Plane Cloak Composed of Random Pattern Unit-Cell Fabricated by 3D Printer
Hyunsoo Lee, Il-Suek Koh, Inha University, Republic of Korea; Yongjune Kim, National University of Singapore, Singapore; Yongsik Lee, Yonsei University, Republic of Korea; Ilsoon Seo, Agency for Defense Development, Republic of Korea

THP-A5.6P.10
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Wonbin Hong, Pohang University of Science and Technology (POSTECH), Republic of Korea; Sangho Lim, Agency for Defense Development, Republic of Korea; Seungtae Koo, Youngtae Kim, Samsung Electronics, Republic of Korea

Antennas for THz and 5G Communications
Session Co-Chairs: John Volokis, Ohio State University; Stavros Koulouridis, University of Patras

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