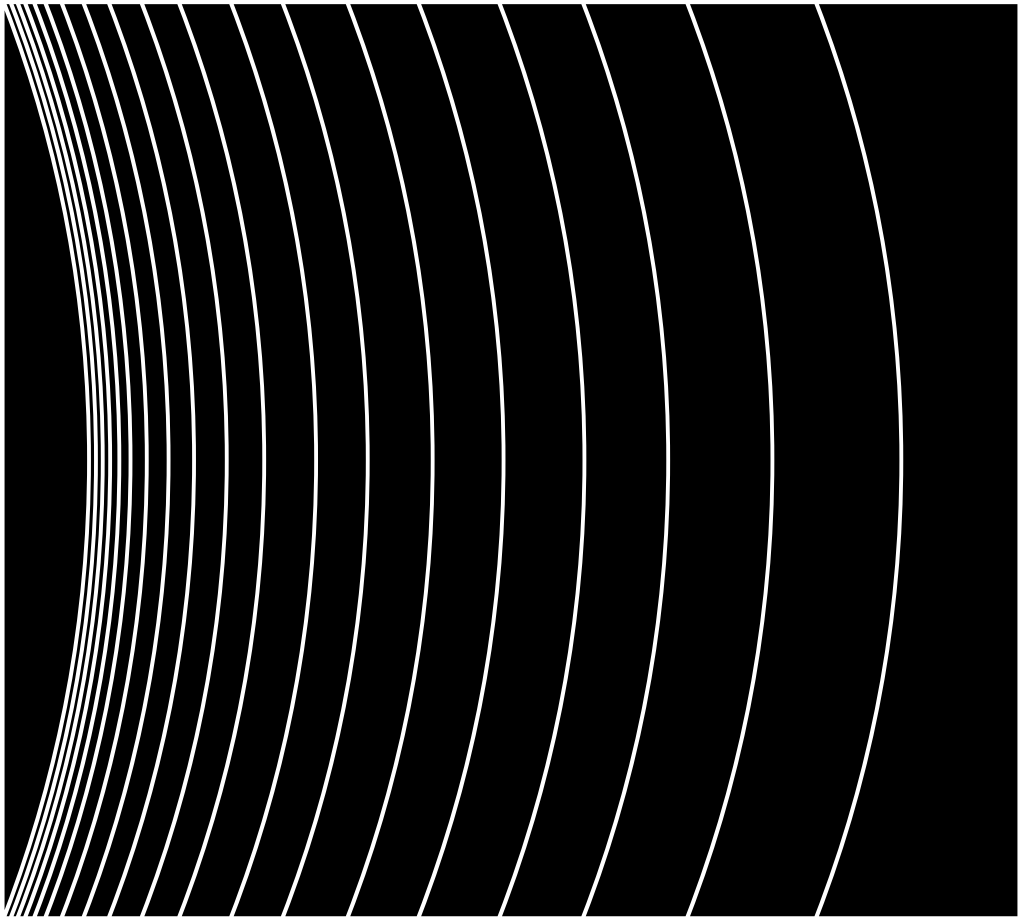
USNC-URSI National Radio Science Meeting

The National Academies of SCIENCES ENGINEERING MEDICINE

Board on International Scientific Organizations
U.S. National Committee for the International Union of Radio Science
National Academy of Sciences



10–14 January 2023

Boulder, Colorado, USA

Sponsored by the US National Committee for the

International Union of Radio Science

and CU Conference Services,

University of Colorado Boulder

www.nrsmboulder.org

UNITED STATES NATIONAL COMMITTEE
INTERNATIONAL UNION OF RADIO SCIENCE

National Radio Science Meeting
10–14 January 2023
University of Colorado Boulder

Meetings and Events Overview

[All times are in MST.]

TUESDAY, 10 January 2023

08:30 – 11:30	NRSM Short Course, Tutorial & Workshop – Morning Session
13:00 – 16:00	NRSM Short Course, Tutorial & Workshop – Afternoon Session
17:00 – 21:00	USNC-URSI Business Meeting - Invitation Only

WEDNESDAY, 11 January 2023

08:00 – 08:10	NRSM Welcome & Opening Remarks
08:15 – 17:00	Vendor Booths
08:20 – 12:00	Technical Sessions
12:10 – 13:10	Women in Radio Science (WIRS) Business Meeting
13:20 – 14:20	Student Paper Competition (SPC)
15:00 – 16:00	Commission Business Meetings (C, E, F, J)
16:00 – 17:00	Commission Business Meetings (A, D, G, K)
17:30 – 19:30	Reception for On–Site Attendees

THURSDAY, 12 January 2023

08:45 – 11:20	WIRS Speaker & Plenary Session, SPC & USNC-URSI Awards
11:20 – 12:50	Student Mentoring Lunch
13:00 – 17:00	Vendor Booths
13:00 – 17:00	Technical Sessions
17:00 – 18:00	Commission Business Meetings (B, H)
18:00 – 20:00	WIRS Reception (Ticket Required)

FRIDAY, 13 January 2023

08:00 – 08:10	Closing Day Remarks
08:15 – 17:00	Vendor Booths
08:20 – 12:00	Technical Sessions
12:10 – 13:00	Tenth Hans Liebe Lecture
13:10 – 17:10	Technical Sessions

SATURDAY, 14 January 2023

08:00 – 11:00	USNC–URSI Executive Council Meeting – Invitation Only

2023 USNC-URSI National Radio Science Meeting

Tuesday, 10 January	08:30–11:30	Workshop 1: Millimeter and Submillimeter On-Wafer Characterization (265) Tutorial 1: Biological Effects of Electric and Magnetic Fields, From a Mechanistic Point of View (1B40)						
	13:00–16:00	Tutorial 2: Successful Proposal Writing for Sutainable, and Impactful Research—From Tenure-Track Through the Long-Game (265) Short Course 1: System-level Engineering of Broadband Transmit Phased Arrays Beamforming Networks (1B40) Tutorial 3: Joint Radar-Communications for Beyond 5G Era (200)						
Time [MST] \ Room		150	151	155	200	245	265	1B40
Wednesday, 11 January	08:00–08:10	Opening Welcome (Streamed from Math 100 to All Session Rooms)						
	08:20–12:00	B1* - Antennas for Planetary Exploration B2* - Novel Electrically Small Antennas and Matching Networks	FGH1* - GNSS and Radio Beacon Remote Sensing	H1* - Physics of the Radiation Belts I	F1 - Propagation and Remote Sensing in Complex and Random Media	G1 - Ionospheric Physics K1 - Applications of Bioelectromagnetics	J1* - Millimeter/ Sub-millimeter Receiver Technologies	B3* - Low-Profile Millimeter-Wave/ Terahertz Antennas for Mobile and Space Applications
	12:10–13:10	Women in Radio Science (WIRS) Business Meeting (Math 100)						
	13:20–14:20	Student Paper Competition (Math 100)						
	15:00–16:00		Commission C&E		Commission F		Commission J	
	16:00–17:00	Commission A		Commission D		Commission G		Commission K
	17:30–19:30	Reception at the Byron R. White Stadium Club						
Thursday, 12 January	08:45–11:20	Plenary Session (Math 100) WIRS and Plenary Talks Student Paper Competition & USNC-URSI Awards Ceremony						
	11:20–12:50	Student Mentoring Luncheon (KOBL S100) Lunch provided for all students, UNSC-URSI Officers, and Commission Chairs						
	13:00–17:00	B4 - Antenna Theory and Design	H2 - Wave-Wave and Wave-Particle Interactions	H3* - Physics of the Radiation Belts II D1 - Wideband and Reconfigurable Electronics	A1 - Antennas and Propagation G2 - Ionospheric Modeling and Space Weather	K2* - Wireless Power Transfer Techniques for Biomedical Applications E1 - Electromagnetic Interference	J2 - New Telescopes, Techniques, and Technologies I	BK1* - Wearable Antennas for WiFi, IoT, and 5G Applications
	17:00–18:00	Commission B	Commission H					
	18:00–20:00	WIRS Reception (Embassy Suites)						

Time [MST] \ Room		150	151	155	200	245	265	1B40
Friday, 13 January	08:00–08:10	**Closing Day Remarks (Streamed from Math 100 to All Session Rooms)**						
	08:20–12:00	B5 - Numerical Electromagnetics	H4* - Heliospheric Observations of Waves in Plasmas	H5* - Active Experiments in Space and Laboratory Plasmas I	F2 - Microwave and Millimeter-Wave Remote Sensing	C1 - Machine Learning in Radar, Remote Sensing, and Antennas	J3 - New Telescopes, Techniques, and Technologies II	B6* - Antennas and Systems for Specialized Platforms and Environments
	12:10–13:00	**Tenth Hans Liebe Lecture (Math 100)**						
	13:10–17:10	K3* - Electro-magnetic-based Technologies for Health: Treatment, Detection, and Monitoring	GH1* - Machine Learning Techniques for Near-Earth Space Sciences	H6* - Active Experi-ments in Space and Laboratory Plasmas II	F3 - Point to Point Propagation Effects and Remote Sensing	F4 - Machine Learning Applications for Remote Sensing	J4* - Intensity Mapping at Millimeter and Sub-millimeter Wavelengths	B7* - Multiscale and Stochastics Modeling in Computational Electromagnetics
		C2 - Advances in Software Defined and Adaptive Radio Systems		GH2* - Meteors, Orbital Debris and Dusty Plasmas		J5* - Space-based Radio Astronomy on Small Platforms		B8* - Complex EM and Meta Structures
* Denotes a special session								

International Union of Radio Science / Union Radio-Scientifique Internationale

Founded in 1919, the International Union of Radio Science (URSI) coordinates studies, research, applications, scientific exchange, and communication in all fields of radio science from telecommunications and radio astronomy to medicine. For further information on URSI, please visit www.ursi.org.

Both URSI and the U.S. National Committee (USNC) for URSI are organized into ten commissions:

Electromagnetic Metrology (Commission A)
Fields and Waves (Commission B)
Radiocommunication Systems and Signal Processing (Commission C)
Electronics and Photonics (Commission D)
Electromagnetic Environment and Interference (Commission E)
Wave Propagation and Remote Sensing (Commission F)
Ionospheric Radio and Propagation (Commission G)
Waves in Plasmas (Commission H)
Radio Astronomy (Commission J)
Electromagnetics in Biology and Medicine (Commission K)

About the USNC–URSI

The U.S. National Committee for URSI (USNC–URSI) is appointed by the National Academies of Sciences, Engineering, and Medicine, and represents U.S. radio scientists in URSI. It encourages studies in radio science, provides a forum for the dissemination of research findings, and provides an organizational infrastructure for the radio science community in the United States. Individuals may become members of one or more USNC-URSI Commissions through nominations by an existing Commission member and vote by the Commission members. For more information about USNC-URSI membership, including requirements for Full, Associate and Early Career membership levels, please visit www.usnc-ursi-archive.org/membership or contact the appropriate Commission Chair(s) listed below.

The USNC–URSI hosts the National Radio Science Meeting (NRSM) each January in Boulder, Colorado. This meeting is technically co–sponsored by the Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers (IEEE/AP–S). The IEEE International Symposium on Antennas and Propagation and USNC–URSI Radio Science Meeting (RSM), co–sponsored by the IEEE/AP–S and USNC–URSI, is held each summer. Every five to eight years, a North American Radio Science Meeting (NARSM) is organized, co–sponsored by the U.S. and Canadian National Committees for URSI. The last NARSM was held virtually in Montreal, Quebec, Canada on 4–11 July 2020; the next NARSM is planned for August 2025 in Ottawa, Canada.

The international URSI General Assembly and Scientific Symposium (GASS) is held every three years in locations around the world. The 33rd URSI GASS was held in Rome, Italy, on 28 August –4 September 2021. Over 1000 papers were presented in technical sessions covering the areas of all ten URSI Commissions. The 34th URSI GASS will be held in Sapporo, Japan, on 19–23 August 2023.

In addition to the GASS, URSI holds two other flagship meetings every three years, the Atlantic Radio Science Conference (AT–RASC) and the Asia–Pacific Radio Science Conference (AP–RASC). Please visit www.ursi.org for more information on these URSI conferences.

For further information on USNC–URSI please visit www.usnc–ursi.org.

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USNC–URSI would like to thank the following Special Session Organizers:

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Updates for 2023

In order to provide maximum flexibility for our community, the 2023 NRSM is again being held in a hybrid environment due to the lingering effects of the COVID–19 pandemic and related restrictions on travel. USNC–URSI and CU Boulder will again be using the award–winning Whova Mobile Event App to provide a seamless, interactive agenda of meeting events for both in–person and online attendees, including the NRSM short course and tutorials, technical sessions, Plenary and Invited Speakers, Student Paper Competition and Virtual Exhibitor Booths. IMPORTANT NOTE: online access to the NRSM is only available through Whova; full instructions for access will provided after registration.

Authors have the option to have summaries archived in IEEE Xplore (subject to standard IEEE processing) through the technical co–sponsorship of the meeting by the IEEE Antennas and Propagation Society (IEEE/AP–S).

USNC–URSI would like to thank the following Sponsors for their support of the 2023 NRSM

Platinum ($5000)

APL
JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

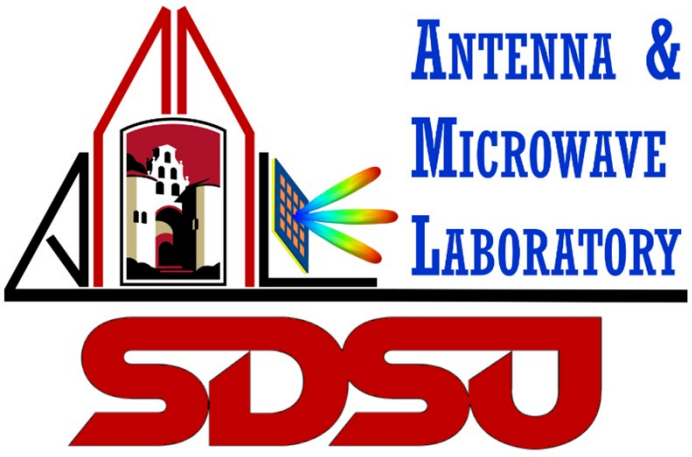
Coffee Break ($1,250)

FIU Engineering & Computing
FLORIDA INTERNATIONAL UNIVERSITY

WIRS Reception

U.R.S.I.

Exhibitors



Invited Speakers

WIRS and Plenary Speaker

Radio Science Meets Smart Medicine and Smart Agriculture

Susan C. Hagness

Philip D. Reed Professor and Chair, Department of Electrical and Computer Engineering
University of Wisconsin-Madison, Madison, WI

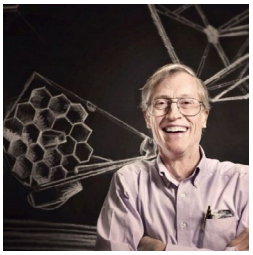
Abstract: Innovations that leverage the interactions of electromagnetic waves with human and plant tissue are at the heart of an impressive array of both diagnostic and therapeutic applications in medicine, and short-range remote sensing applications in agriculture. In this Women in Radio Science Plenary Session, we will explore recent advances in microwave technologies, ranging from microwave theranostics for image-guide thermal ablation of tumors to backscatter-based microwave sensing of cranberry crop yield, that have the potential to transform smart medicine and smart agriculture of the future.

Plenary Speaker

Opening the Infrared Treasure Chest with JWST

John Mather

Senior Project Scientist, JWST
NASA Goddard Space Flight Center, Greenbelt, MD



Abstract: The James Webb Space Telescope (JWST) was launched on December 25, 2021. With its 6.5 m golden eye, and cameras and spectrometers covering 0.6 to 28 μm, Webb will observe the first objects that formed after the Big Bang, the first black holes (primordial or formed in galaxies), the growth of galaxies, the formation of stars and planetary systems, individual exoplanets through coronography and transit spectroscopy, and all objects in the Solar System from Mars on out. It could observe a 1 cm2 bumblebee at the Earth-Moon distance, in reflected sunlight and thermal emission. I will show how we built the Webb and discuss the most recent discoveries. Webb is a joint project of NASA with the European and Canadian space agencies.

Tenth Liebe Lecture

How Water Shapes Climate

Stefan Buehler

Director of the Meteorological Institute
University of Hamburg, Hamburg, Germany

Abstract: Water shapes climate much more than most people realize. It is at the root of all four of the dominant fast global climate feedbacks. Besides its unique thermodynamical properties, the reason for its importance is its strong interaction with radiation. Together with carbon dioxide, water vapor shapes Earth's clear-sky outgoing longwave radiation spectrum, creating large spectral areas of near-neutral radiative feedback.
But our knowledge of the water vapor absorption spectrum is imperfect, in particular in the spectral windows far from strong absorption lines, where we need empirical corrections to achieve a good match between observations and simple line-by-line absorption calculations. The Liebe model was among the first to address this from a practical point of view, specifically for the microwave spectrum region, by adding a continuum term to the line spectrum.
The talk will discuss the climate implications of the water vapor spectrum, including continua, from a broad perspective, with most emphasis on the thermal infrared and far infrared spectral regions.

Workshop

Millimeter and Submillimeter On-Wafer Characterization

Bobby Weikle, University of Virginia

This workshop will focus on the current state-of-the-art in on-wafer measurements for characterizing millimeter and submillimeter-wave devices and circuits. The design and implementation of micromachined wafer probes will be described, including methods for heterogenous integration of sensors and measurement components onto the wafer probe platform. Presentations will include development and use of micromachined wafer probes for (1) cryogenic measurements, (2) on-wafer noise characterization, (3) wideband s-parameter measurements on (4) on-wafer power sensing.

Tutorial

Successful Proposal Writing for Sustainable, and Impactful Research – from Tenure-Track Through the Long-Game

Jonathan Chisum, University of Notre Dame
Chris Anderson, United State Naval Academy
Ana Ferreras, National Academies of Science, Engineering, and Medicine

Whether you are a graduate student or a post-doc seeking your first faculty appointment, a tenure-track assistant professor working to establish a research group, or a full professor looking to increase your impact, successful proposal writing is an essential skill. Unfortunately, proposal writing is often learned by immersion or, when taught, is treated in such a general manner that it lacks relevance. This tutorial panel will provide concrete examples of both funded and unfunded proposals to share the "do's and don'ts" of proposal writing. The panel comprises researchers at various stages in their career, spanning a variety of disciplines, with experience in academia, government labs, and non-profits. They will provide concrete suggestions that are immediately useful for attendees. The discussion will present a systematic approach to proposal writing that can not only lead to a sustainable flow of funding, but will also help generate original ideas, refine research plans, establish vibrant collaborations, and make an impact. Our panelists will discuss: the funding landscape including NSF, DoD, industry, non-profit, and international organizations; how to pursue small, medium, and large research programs; how to contact program managers, how to construct white papers and survive a visit (or virtual meeting) to DC; the key elements of a proposal and how to make your proposal irresistible (a "must fund" proposal); telling a compelling and complete story (leaving no major doubts); developing a cadence for proposal writing, execution, and paper writing; and more. Example of successful proposals will be presented.

Tutorial

Biological Effects of Electric and Magnetic Fields, From a Mechanistic Point of View

Frank Barnes, University of Colorado Boulder

This review will begin with a review of some of the manmade and natural sources of electric and magnetic fields to provide a basis for estimating the sizes of the fields that are likely to sources of human exposures. These will be referenced to current exposure guidelines. This will be followed by a discussion of the effects of electric field on the movement of charged particles and changes in the concentration of important signaling molecules such as calcium and changes in membrane potentials. The effects of magnetic fields will be introduced with a discussion of magnetic dipole moments and radical pair theory with an emphasis on importance of nuclear spins. The biological effects of magnetic fields chemical rate equations and changes in the concentrations of important signaling molecules such as O2-,H2O2, NOx will be introduced. This will be followed by a discussion of feedback repair and the importance of timing on the effects of these fields on biological processes. Some examples of the effects of electric and magnetic field exposures on cancer cell growth rates will be presented.

Tutorial

Joint Radar-Communications for Beyond 5G Era

Kumar Vijay Mishra, United States DEVCOM Army Research Laboratory

Today's cellular networks are at a crossroads while moving from the current 4G cellular networks used for content delivery to the upcoming 5G networks that will provide services with low latency, high security, and high throughput. At the same time, a crunch in spectrum usage implies that such high bandwidth data networks must coexist with the radar sensing systems of the future. In this tutorial, we present fundamental challenges in enabling a crucial tradeoff between sensing/radar and communications functionalities in beyond 5G (B5G) systems. In particular, the automotive sector has recently witnessed concerted and intense efforts towards realizing the joint radar-communications (JRC) systems for efficient utilization of limited electromagnetic spectrum at millimeter-wave (mm-Wave). This band is characterized by severe penetration losses, short coherence times, and the availability of wide bandwidth. While wide bandwidth is useful in attaining high vehicular communications data rates and high-resolution automotive radar, the losses must be compensated by using a large number of antennas at the transmitter and receiver. In this context, there is also recent research focus on joint multiple-input multiple-output (MIMO)-Radar-MIMO-Communications (MRMC) systems, where the antenna positions of radar and communications are shared with each other. These synergistic approaches that exploit the interplay between state sensing and communication are both driving factors and opportunities for many current signal processing and information-theoretic techniques. For example, while there are still many open challenges at mm-Wave JRC, it is already a precursor to sub-mm-Wave or Terahertz (THz) JRC, where futuristic short-range THz communications would coexist with low-THF (.1-1THz) automotive and imaging radars. At present, THz band is witnessing developments such as ultra-massive-MIMO systems which employ thousands of antennas in a few cm of aperture. Imaging with low-THz automotive radar is currently being investigated. Joint sensing-communications is also a growing area for unmanned aerial vehicles (UAVs) such as drones. Building on the existing approaches, the tutorial focuses on highlighting emerging scenarios in collaborative and joint sensing and communications systems, particularly at mm-Wave and THz frequencies, highly dynamic vehicular environments, distributed radar-communications networks, and aerial channels, that would benefit from information exchange between the two systems. It presents the architectures, possible methodologies for mutually beneficial co-existence as separate entities or as a joint module and presents some recent results. The avenues discussed in the tutorial offer rich research potential while also enabling innovative plug-and-play methodologies for co-existence and co-design.

Short Course

System-level Engineering of Broadband Transmit Phased Arrays Beamforming Networks

Laila Marzall, University of Colorado Boulder

Integrated broadband transmit phased array design challenges engineers due to the many variables involved, e.g., evaluation of performance metrics and different component tuning ranges. The antenna elements' active impedance and the active devices' nonlinearities will propagate through the front-end chain, affecting array performance over scanning directions, frequencies, and power levels. Nonetheless, integrated broadband transmit phased arrays present unique challenges for experimental characterization. Due to the difficulty of accessing terminals of individual components and the impossibility of adding sensors at key points of the beamforming circuits, designers must rely on simulation results for debugging/troubleshooting their prototypes. Co-simulation techniques must be considered to tackle this complex design problem, including using full-wave, harmonic balance, and system-level tools. However, a comprehensive analysis of each component's performance and model limitations must be considered. Also, an initial understanding of component performance sensitivity versus resulting mismatch is key for a reliable simulation and resilient design. Of course, all this also depends on the operating power level. This lecture will cover the main concepts used to evaluate the effect of nonlinearities on broadband transmit phased-array figures of merit, namely EIRP, overall efficiency, and linearity, using co-simulations as a framework. The analysis is described in the context of scanning directions, bandwidth, and power variation. Different modulation schemes are considered, and a slow power amplifier (PA) supply voltage variation is included.

Tuesday, January 10 08:30 - 11:30
WS1 Event Room 265

Workshop 1: Millimeter and Submillimeter On-Wafer Characterization

Bobby Weikle

Tuesday, January 10 08:30 - 11:30
T1 Event Room 1B40

Tutorial 1: Biological Effects of Electric and Magnetic Fields, From a Mechanistic Point of View

Frank Barnes

Tuesday, January 10 13:00 - 16:00
T2 Event Room 265

Tutorial 2: Successful Proposal Writing for Sutainable, and Impactful Research—From Tenure-Track Through the Long-Game

Jon Chisum, Ana Ferreras, Chris Anderson

Tuesday, January 10 13:00 - 16:00
SC1 Event Room 1B40

Short Course 1: System-level Engineering of Broadband Transmit Phased Arrays Beamforming Networks

Laila Marzall

Tuesday, January 10 13:00 - 16:00
T3 Event Room 200

Tutorial 3: Joint Radar-Communications for Beyond 5G Era

Kumar Vijay Mishra

Wednesday, January 11 08:00 - 08:10
Event Math 100

Opening Welcome (Streamed from Math 100 to All Session Rooms)

Wednesday, January 11 08:20 - 10:00
B1 Special Session Room 150

Antennas for Planetary Exploration

Session Co-Chairs: Avinash Sharma, Johns Hopkins University Applied Physics Laboratory; Matthew Bray, Johns Hopkins Applied Physics Laboratory

B1.1 **08:20**
Design, Development and Testing of NASA's DART Radial Line Slot Array Antenna
Matthew Bray, Johns Hopkins University Applied Physics Laboratory, United States

B1.2 **08:40**
Additive Manufactured Antenna for NASA's Interstellar Mapping and Acceleration Probe (IMAP)
Avinash Sharma, Carl Carpenter, Steve Szczesniak, Johns Hopkins University Applied Physics Laboratory, United States

B1.3 **09:00**
Design, Development and Testing of NASA's Europa Clipper High Gain Antenna
Matthew Bray, Johns Hopkins University Applied Physics Laboratory, United States

B1.4 **09:20**
All-Metal Antennas for Lunar Exploration
Rainee N. Simons, Michael Zemba, Marie Piasecki, Taylor Pember, Sarah M. Dever, Felix Miranda, NASA, United States

B1.5 **09:40**
Low Cost High Gain Antenna Fabrication and Testing for Mars EscaPADE
Katherine Wolff, Matthew Bray, John Schellhase, Christopher Haskins, Johns Hopkins University Applied Physics Laboratory, United States

Wednesday, January 11 08:20 - 12:00
FGH1 Special Session Room 151

GNSS and Radio Beacon Remote Sensing

Session Co-Chairs: Scott Gleason, DAAXA LLC; Clara Chew, University Corporation for Atmospheric Research; Mohammad Al-Khaldi, The Ohio State University; Yang Wang, University of Colorado Boulder

FGH1.1 **08:20**
The NASA CYGNSS Mission Status and Recent Ocean and Terrestrial Results
Christopher Ruf, Rajeswari Balasubramaniam, University of Michigan, United States; Clara Chew, University Corporation for Atmospheric Research, United States; Scott Gleason, DAAXA LLC, United States; Zhaoxia Pu, University of Utah, United States

FGH1.2 **08:40**
On the incorporation of CYGNSS wind data in storm surge modeling
Ethan Kubatko, Younghun Kang, Mohammad Al-Khaldi, Joel Johnson, The Ohio State University, United States

FGH1.3 **09:00**
Time Series Retrieval of Surface Soil Moisture with CYGNSS BNRCS
Jeffrey Ouellette, Tanish Himani, US Naval Research Laboratory, United States; Mohammad Al-Khaldi, The Ohio State University, United States

FGH1.4 **09:20**
Characterizing Surface Roughness Properties Using Airborne Lidar Digital Elevation Models for CYGNSS Land Cal/Val
Tianlin Wang, Joel Johnson, Yuchan Yi, Mohammad Al-Khaldi, The Ohio State University, United States; Alexandra Bringer, NASA Goddard Space Flight Center, United States

FGH1.5 **09:40**
An Assessment and Intercomparison of CYGNSS Soil Moisture Products
Erik Hodges, Mahta Moghaddam, University of Southern California, United States; Ruzbeh Akbar, Xiaolan Xu, Rashmi Shah, Simon Yueh, Akiko Hayashi, Ian Colwell, Stephen Lowe, Jet Propulsion Laboratory, California Institute of Technology, United States; Clara Chew, University Corporation for Atmospheric Research, United States; Eric Small, University of Colorado Boulder, United States; Mohammad Al-Khaldi, Joel Johnson, The Ohio State University, United States; Fangni Lei, University of Connecticut, United States; Mehmet Kurum, Ali Gurbuz, Volkan Senyurek, Mississippi State University, United States; Paulo T. Setti Jr., Sajad Tabibi, University of Luxembourg, Luxembourg; Emanuele Santi, Simone Pettinato, National Research Council - Institute of Applied Physics (CNR-IFAC), Italy; T. Max Roberts, Muon Space; Jet Propulsion Laboratory, California Institute of Technology, United States

Break **10:00**

FGH1.6 **10:20**
On The Mapping of Inland Water Using NASA's CYGNSS Mission
Mohammad Al-Khaldi, Joel Johnson, The Ohio State University, United States; Scott Gleason, University Corporation For Atmospheric Research, United States

FGH1.7 **10:40**
Estimation of ionospheric irregularity drifts using spaced low-cost scintillation monitors
Josemaria Gomez Socola, University of Texas at Dallas, United States

FGH1.8 **11:00**
Spatial Interpolation and Statistical Confidence Assessment for GNSS-R Land Surface Reflectivity Maps with Sparse Measurements
Brian Magee, Erin DeCarlo, Danielle Wyrick, Southwest Research Institute, United States

FGH1.9 **11:20**
Airborne P-band Signals of Opportunity Observations Acquired over Mountainous Terrain
Simon Yueh, Rashmi Shah, Javier Bosch-Lluis, Mario Chaubell, Garth Franklin, Xiaolan Xu, California Institute of Technology, United States

FGH1.10 **11:40**
The Muon Space Deep-Learning Framework for Generalized Retrievals from GNSS-R
Max Roberts, Dallas Masters, Dan McCleese, Muon Space, United States

Wednesday, January 11 08:20 - 12:00
H1 Special Session Room 155

Physics of the Radiation Belts I

Session Co-Chairs: Lauren Blum, University of Colorado Boulder; Oleksiy Agapitov, University of California Berkeley

H1.1 **08:20**
Statistical properties of lower band rising tone chorus
Jiabei He, Lunjin Chen, Zhiyang Xia, University of Texas at Dallas, United States

H1.2 **08:40**
Understanding the Role of Drift Orbit Bifurcation in Rapid Dropouts of Van Allen Radiation Belt Electrons
Weichao Tu, Jinbei Huang, Xingzhi Lyu, West Virginia University, United States

H1.3 **09:00**
Intense Sub-Relativistic Electron Precipitation as Revealed by ELFIN: Role of Oblique Whistler-Mode Waves
Xiao-Jia Zhang, University of Texas at Dallas, United States; Anton Artemyev, Xu Zhang, Vassilis Angelopoulos, Ethan Tsai, Colin Wilkins, University of California, Los Angeles, United States; Didier Mourenas, CAE, France

H1.4 **09:20**
Dependence of Nonlinear Effects on Whistler-mode Chorus Wave Bandwidth and Amplitude: A Perspective from Diffusion Coefficients
Longzhi Gan, Wen Li, Qianli Ma, Boston University, United States; Anton Artemyev, University of California, Los Angeles, United States; Jay Albert, Air Force Research Laboratory, United States

H1.5 **09:40**
Modeling chorus-driven and EMIC-driven electron precipitation
Lunjin Chen, University of Texas at Dallas, United States

Break **10:00**

H1.6 **10:20**
The properties and drivers of MeV electron microbursts: A direct comparison between microburst and chorus wave repetition periods
Hamdan Kandar, Lauren Blum, University of Colorado Boulder, United States; Mykhaylo Shumko, University of Maryland, United States

H1.7 **10:40**
Quantification of Electron Microburst Precipitation as an Outer Radiation Belt Loss Process
Sadie Elliott, Christopher Colpitts, Cynthia Cattell, University of Minnesota, United States; Aaron Breneman, Alexa Halford, Mykhaylo Shumko, NASA Goddard Space Flight Center, United States; Joshua Pettit, George Mason University/NASA Goddard, United States; John Sample, Arlo Johnson, Montana State University, United States; Yoshizumi Miyoshi, Satoko Nakamura, Tomoaki Hori, Kazuo Shiokawa, Nagoya University, United States; Yoshiya Kasahara, Shoya Matsuda, Mitsunori Ozaki, Kanazawa University, United States; Christopher Cully, University of Calgary, United States; Takefumi Mitani, Iku Shinohara, ISAS/JAXA, United States; Martin Connors, Athabasca University, United States; Jyrki Manninen, Sodankylä Geophysical Observatory, United States

H1.8 **11:00**
High-energy electron flux enhancement pattern in the outer radiation belt in response to the interplanetary coronal mass ejections
Ligia Alves Da Silva, Jose Paulo Marchezi, Laysa Cristina Resende, Juliano Moro, State Key Laboratory of Space Weather/ National Institute for Space Research, Brazil; Jiankui Shi, Chi Wang, Hui Li, Zhengkuan Liu, State Key Laboratory of Space Weather, China; David Sibeck, NASA Goddard Space Flight Center, United States; Livia Ribeiro Alves, Luis Eduardo Vieira, Vinicius Deggeroni, Joaquim Costa, Alisson Dal Lago, Karen Julia Ferreira, Ana Maria Inostroza, National Institute for Space Research, Brazil; Oleksiy Agapitov, University of California, Berkeley Space Sciences Lab, United States

H1.9 **11:20**
Analyses of ULF Waves in the Radiation Belts During HILDCAAs Events and their correlation with AE index and IMF orientation
Daiene Schaefer, Universidade Tecnológica Federal do Paraná, Brazil; Lívia Alves, Instituto Nacional de Pesquisas Espaciais, Brazil; Lígia Silva, Instituto Nacional de Pesquisas Espaciais and State Key Laboratory of Space Weather - Chinese Academy of Sciences, Brazil

H1.10 **11:40**
Statistical Characterization of Ionospheric ULF Wave Propagation and Joule Heating using SuperDARN Measurements
Xueling Shi, Shibaji Chakraborty, Joseph Baker, Michael Ruohoniemi, Kevin Sterne, Virginia Tech, United States; Michael Hartinger, Space Science Institute, United States; Dong Lin, Wenbin Wang, High Altitude Observatory, United States

Wednesday, January 11 08:20 - 12:00
F1 Room 200

Propagation and Remote Sensing in Complex and Random Media

Session Co-Chairs: Saba Mudaliar, Air Force Research Laboratory; Gary S. Brown, Virginia Tech

F1.1 **08:20**
Some Thoughts on Classical EM, Radiative Transfer, and Quantum Optics
Akira Ishimaru, University of Washington, United States

F1.2 **08:40**
Scattering From Two-Dimensional Conducting Rough Surfaces: Setup
Gary S. Brown, Virginia Tech, United States

F1.3 **09:00**
3-D Bistatic Scattering from Fractal Surface Using Extended Boundary Condition Method
Ming Li, Roger Lang, George Washington University, United States; Rafael Rincon, National Aeronautics and Space Administration, United States

F1.4 **09:20**
A Study of the Kirchoff Approximation for the Coherent Reflection Coefficient of a 1-D Perfectly Conducting Rough Surface
Ethan Raines, Joel Johnson, The Ohio State University, United States

F1.5 **09:40**
Off-Axis detection of pulsed laser beams based on intensity interferometry
Elizabeth Bleszynski, Thomas Jaroszewicz, Monopole Research, United States

Break **10:00**

F1.6 **10:20**
Multiple Scattering, Radiative Transfer, and Parameter Regimes
Saba Mudaliar, Air Force Research Laboratory, United States

F1.7 **10:40**
A note on a non-contact soil moisture probe
Alexander Voronovich, Paul Johnston, NOAA/ESRL, United States; Richard Lataitis, NOAA/Science and Technology Corporation, United States

F1.8 **11:00**
3-Layer Radar Sounder Model for the Detection of Buried Ice Deposits under Martian Regolith
Jiaxing Yang, Roger Lang, George Washington University, United States; Rafael Rincon, James Garvin, David Hollibaugh-Baker, NASA, United States

F1.9 **11:20**
Introducing a 3-D FDTD Global Courant Limit Model of the Earth
Yisong Zhang, Jamesina J. Simpson, University of Utah, United States; Dallin R. Smith, Air Force Research Laboratory, United States

F1.10 **11:40**
A Discontinuous Galerkin Method for Solving Radiative Transfer Equation with Semitransparent Boundary Conditions
Md Ershadul Haque, Hang Wang, Reza Abedi, University of Tennessee Space Institute, United States; Saba Mudaliar, Air Force Research Laboratory, Wright-Patterson AFB, United States

Wednesday, January 11 08:20 - 10:00
G1 Room 245

Ionospheric Physics

Session Co-Chairs: Shane Rightley, Sandia National Laboratories; Pavel Budnikov, Quantectum

G1.1 **08:20**
Detection of Earthquake precursors in the Low Latitude Ionosphere with Machine Learning.
Pavel Budnikov, Sergey Pulinets, Quantectum, Slovenia

G1.2 **08:40**
Imaging Sporadic E with the Long Wavelength Array
Kenneth Obenberger, Air Force Research Laboratory, United States; Gregory Taylor, University of New Mexico, United States

G1.3 **09:00**
A machine-learning approach to detecting and analyzing meteor radar data
Yanlin Li, Julio Urbina, Freddy Galindo, Penn State University, United States; Qihou Zhou, Miami University, United States; Tai-Yin Huang, Penn State University Lehigh Valley, United States

G1.4 **09:20**
Wave Propagation Through a Random Medium in the Short-Wavelength Limit: A Scintillation Model Without Phase Screens
Shane Rightley, Daniel Barton, Sandia National Laboratories, United States

G1.5 **09:40**
Modeling the effects of electron precipitation associated with the plasma instabilities on the wave propagation in the auroral ionosphere.
Pralay Raj Vaggu, Matthew Zettergren, Kshitija Deshpande, Embry-Riddle Aeronautical University, United States

Wednesday, January 11 08:20 - 12:00
J1 Special Session Room 265

Millimeter/Sub-millimeter Receiver Technologies

Session Co-Chairs: Gopal Narayanan, University of Massachusetts; Christopher Groppi, Arizona State University

J1.1 **08:20**
A New 1.2mm / 0.9mm Dual-Band Receiver for the Arizona Radio Observatory Submillimeter Telescope
Eugene Lauria, Daniel Marrone, Lucy Ziurys, David Forbes, George Reiland, Martin McColl, University of Arizona, United States; Anthony Kerr, Joseph Lambert, National Radio Astronomy Observatory, United States; Arthur Lichtenberger, Michael Cyberey, University of Virginia, United States

J1.2 **08:40**
Progress Towards Wide-Band Superconducting Amplifiers for Millimeter Wavelengths
Ryan Stephenson, Shibo Shu, California Institute of Technology, United States; Nikita Klimovich, Oxford University, United States; Farzad Faramarzi, Arizona State University, United States; Henry LeDuc, Peter Day, Jet Propulsion Laboratory, United States

J1.3 **09:00**
Novel front-end for THz heterodyne system
Boris Karasik, Chris Curwen, Daniel Cunnane, Jonathan Kawamura, Jet Propulsion Laboratory, United States; Ke Chen, Xiaoxing Xi, Temple University, United States; Anthony Kim, Benjamin Williams, University of California, Los Angeles, United States

J1.4 **09:20**
ALMA Band6v2 SIS Receiver Development Status
Joseph Lambert, Alessandro Navarrini, Anthony Kerr, John Effland, Philip Dindo, Kamaljeet Saini, Sivasankaran Srikanth, Dustin Vaselaar, Patricio Mena, Claudio Jarufe, National Radio Astronomy Observatory, United States; Arthur Lichtenberger, Michael Cyberey, University of Virginia, United States

J1.5 **09:40**
345 GHz SIS Junction Development for the ngEHT
Jacob Kooi, Jet Propulsion Laboratory, United States

Break **10:00**

J1.6 **10:20**
A New Dual-band Heterodyne Receiver System for the Submillimeter Array
Paul Grimes, Raymond Blundell, Scott Paine, John Test, Edward Tong, Robert Wilson, Lingzhen Zeng, Center for Astrophysics | Harvard & Smithsonian, United States; Ming-Jye Wang, Academia Sinica Institute of Astronomy and Astrophysics, Taiwan

J1.7 **10:40**
The TolTEC Millimeter-Wave Camera: First Light, Status and Performance
Jason Austermann, National Institute of Standards and Technology, United States; TolTEC Collaboration, Various, United States

J1.8 **11:00**
Kinetic Inductance Detectors for the Terahertz Intensity Mapper
Reinier Janssen, Bruce Bumble, Matt Bradford, Jet Propulsion Laboratory, United States; Rong Nie, Jeff Filippini, Hrushi Athreya, Brock Brendal, Jianyang Fu, Mikolaj Kowalik, Vesal Razavimaleki, Joaquin Vieira, University of Illinois Urbana-Champaign, United States; Lun-Jun Liu, Joe Redford, Steve Hailey-Dunsheath, California Institute of Technology, United States; Shubh Agrawal, James Aguirre, Justin Bracks, Anthony Corso, University of Pennsylvania, United States; Chris Groppi, Dylan Joralmon, Phil Mauskopf, Talia Saeid, Arizona State University, United States; Ryan Keenan, Ian Lowe, Dan Marrone, Evan Mayer, University of Arizona, United States; Isaac Trumper, ELE Optics, United States

J1.9 **11:20**
Design and validation of the Simons Observatory 90/150 GHz receivers for observations of the CMB
Nicholas Galitzki, University of Texas at Austin, United States

J1.10 **11:40**
An Overview of the Current Status of the Prime-Cam receiver for the Fred Young Submillimeter Telescope
Yaqiong Li, Cornell University, United States

Wednesday, January 11 08:20 - 12:00
B3 Special Session Room 1B40

Low-Profile Millimeter-Wave/Terahertz Antennas for Mobile and Space Applications

Session Co-Chairs: Satish K. Sharma, SDSU; Goutam Chattopadhyay, NASA-Jet Propulsion Laboratory

B3.1 **08:20**
3D Printed, Dual-polarized, Millimeter-wave Lens Loaded Horn Antenna
Dong-Chan Son, Mohamed Elmansouri, Ljubodrag Boskovic, Dejan Filipovic, University of Colorado Boulder, United States

B3.2 **08:40**
A Wideband Dual Linear/Circular Polarized 64-Element Phased Array Antenna for SATCOM Applications
Rudraishwarya Banerjee, Satish K. Sharma, San Diego State University, United States; Seth W. Waldstein, James M. Downey, Bryan L. Schoenholz, Sarah M. Dever, James A. Nessel, NASA Glenn Research Center (GRC), United States

B3.3 **09:00**
A New Analytically Designed UWB Microstrip Patch Antenna for Future 5G and 6G Applications
Asif Iftekhar Omi, Md. Samiul Islam Sagar, Bachir Younes, Tutku Karacolak, Praveen Sekhar, Washington State University Vancouver, United States; M Mahmudul Hasan Sajeeb, University of California, Irvine, United States

B3.4 **09:20**
Flat-Panel Wideband Dual-Circularly Polarized 8x8 Phased Array Antenna for SATCOM Applications
Sanghamitro Das, Satish K. Sharma, Rudraishwarya Banerjee, San Diego State University, United States; Seth W. Waldstein, James M. Downey, Bryan L. Schoenholz, Sarah M. Dever, James A. Nessel, NASA Glenn Research Center (GRC), United States

B3.5 **09:40**
Programmable Liquid Microwave GRIN Lens
Jonathan Lundquist, Lauren Linkous, Erdem Topsakal, Virginia Commonwealth University, United States

Break **10:00**

B3.6 **10:20**
Narrow-Beam Null Patterns with a 2-D Leaky-Wave Antenna
Walter Fuscaldo, Consiglio Nazionale delle Ricerche, Italy; David Jackson, University of Houston, United States; Alessandro Galli, Sapienza University of Rome, Italy

B3.7 **10:40**
A Dual-CP Mechanical Beam Steering Antenna Design Using Two Element and Three Element Risley Prism with Phase Correcting Surface
Kaushik Debbarma, Satish K. Sharma, San Diego State University, United States; Jia-Chi S. Chieh, Naval Information Warfare Center - Pacific, United States

B3.8 **11:00**
Reconfigurable THz 1-D Leaky-Wave Antenna Based on Liquid Crystals and a Partially Reflecting Surface
Elahehsadat Torabi, Danilo Erricolo, University of Illinois Chicago, United States; Dimitrios C. Zografopoulos, Romeo Beccherelli, Walter Fuscaldo, National Research Council of Italy, Italy; Francesca Imperato, Azure Cloud and AI, Microsoft, Italy; Paolo Burghignoli, Alessandro Galli, Sapienza University of Rome, Italy

B3.9 **11:20**
3D Printable, Ultra-Wideband, Tightly Coupled Dipole Array (TCDA) with 20:1 Bandwidth (2 to 40 GHz) with 45◦ Scanning
Md Rakibul Islam, Satheesh Venkatakrishnan, John L. Volakis, Florida International University, United States; Gregory Mitchel, U.S. Army Research Laboratory, United States

B3.10 **11:40**
Fabrication of Fully Additive Manufactured RF Systems
Ellen Gupta, Colin Bonner, Kyle McParland, Faheem Muhammed, Mark Mirotznik, University of Delaware, United States

Wednesday, January 11 10:20 - 12:00
B2 Special Session Room 150

Novel Electrically Small Antennas and Matching Networks

Session Co-Chairs: Ting-Yen Shih, University of Idaho; Kai Ren, Wentworth Institute of Technology

B2.1 **10:20**
Helicopter-Based Single-Antenna HF Direction Finding Using the Characteristic Mode Theory
Kai Ren, Wentworth Institute of Technology, United States

B2.2 **10:40**
Monte Carlo Simulation and Stability Analysis of Non-Foster Matched Electrically-Small Antennas
Phillip Hagen, Ting-Yen Shih, University of Idaho, United States

B2.3 **11:00**
A Numerical Investigation on Relationship between Bandwidth, Number of Electrically-Small Antennas, and Number of Non-Foster Elements
Damo Wang, Ting-Yen Shih, University of Idaho, United States

B2.4 **11:20**
Increasing the Efficiency-Bandwidth of Small Antennas by Coupling Radiative and Non-Radiative Modes Using Time-Variation
Zachary Fritts, Steve Young, Anthony Grbic, University of Michigan, United States; Cody Scarborough, University of Colorado Boulder, United States

B2.5 **11:40**
Non-LTI Electrically Small Antenna System to Transmit an Arbitrary Waveform
Majid Manteghi, Virginia Tech, United States

Wednesday, January 11 10:20 - 12:00
K1 Room 245

Applications of Bioelectromagnetics

Session Co-Chairs: Susan Hagness, University of Wisconsin Madison; Asimina Kiourti, Ohio State University

K1.1 **10:20**
A Study on Applicability of Using Ferromagnetic Materials to Reduce RF-Induced Heating in External Fixation Systems
Ananya Nandikanti, Jianfeng Zheng, Wei Hu, Ji Chen, University of Houston, United States

K1.2 **10:40**
High-Contrast Low-Loss Antenna: Design and Applications
Allyanna Rice, Asimina Kiourti, The Ohio State University, United States

K1.3 **11:00**
Textile-Based RF Coils for Magnetic Resonance Imaging
Deion Sanchez-Viafara, Erdem Topsakal, Virginia Commonwealth University, United States

K1.4 **11:20**
Tools for studying electromagnetic-induced traumatic brain injuries: Design and simulation of a TEM cell for pulsed microwave dosimetry
Carissa Roper, Chu Ma, Susan Hagness, University of Wisconsin Madison, United States

K1.5 **11:40**
The mitochondrial signaling in human cells modified by externally applied Radio Frequency Fields
Hakki Gurhan, University of Colorado, United States

Wednesday, January 11 12:10 - 13:10
Event Math 100

Women in Radio Science (WIRS) Business Meeting

Wednesday, January 11 13:20 - 14:20
Event Math 100

Student Paper Competition

Session Chair: Erdem Topsakal

Dual-Layer Magnetoinductive Waveguide for Wearable Wireless Body Area Networks
Connor Jenkins, Asimina Kiourti, The Ohio State University

Opening the Black Box of the Radiation Belt Machine Learning Model
Donglai Ma, Jacob Bortnik, Seth Claudepierre, Qianli Ma, Adam Kellerman, University of California, Los Angeles

Temporal Scattering at Passive Time-Interfaces
Shixiong Yin, Gengyu Xu, Andrea Alù, City University of New York

Wednesday, January 11 15:00 - 16:00
Event Room 151

Commission Business Meetings (C & E)

Wednesday, January 11 15:00 - 16:00
Event Room 265

Commission Business Meetings (J)

Wednesday, January 11 15:00 - 16:00
Event Room 200

Commission Business Meetings (F)

Wednesday, January 11 16:00 - 17:00
Event Room 150

Commission Business Meetings (A)

Wednesday, January 11 16:00 - 17:00
Event Room 1B40

Commission Business Meetings (K)

Wednesday, January 11 16:00 - 17:00
Event Room 245

Commission Business Meetings (G)

Wednesday, January 11 16:00 - 17:00
Event Room 155

Commission Business Meetings (D)

Wednesday, January 11		17:30 - 19:30
	Event	Byron R. White Stadium Club

Reception

Thursday, January 12 08:45 - 11:20
Event Math 100

Plenary Session

Plenary Session: Radio Science - From Bioelectromagnetics to Deep Space Exploration
Plenary Introduction
Michael Newkirk

Women in Radio Science (WIRS) Invited Speaker
Radio Science Meets Smart Medicine and Smart Agriculture
Susan Hagness, University of Wisconsin – Madison

Student Paper Competition Awards

USNC-URSI Awards
Chair's Award: George Uslenghi
Distinguished Radio Science Award: Raj Mittra
Outstanding Educator Award: Yahya Rahmat-Samii
Impact Award: Danilo Erricolo

Plenary
Opening the Infrared Treasure Chest with JWST
John Mather, NASA, Senior Project Scientist for the James Webb Space Telescope

Thursday, January 12 11:20 - 12:50
Event KOBL S100

Student Mentoring Luncheon

Thursday, January 12 13:00 - 16:40
B4 Room 150

Antenna Theory and Design

Session Co-Chairs: Danilo Erricolo, University of Illinois Chicago; Karl F. Warnick, Brigham Young University

B4.1 **13:00**
Modified Cosine-q Pattern Formulation Applicable to Highly Elongated Rectangular Aperture Antennas
Junbo Wang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

B4.2 **13:20**
Investigation of Feeding, Shaping, and Stacking Techniques on Circularly Polarized Patch Antennas
Anastasiia Rozhkova, Alex Christopher Stutts, Danilo Erricolo, University of Illinois Chicago, United States

B4.3 **13:40**
Implementation and Validation of an In-Situ Measurement Technique for Antenna Input Current in a Reconfigurable-Circuit Array
Adam Goad, Trevor Van Hoosier, Austin Egbert, Charles Baylis, Robert Marks, Baylor University, United States; Albin Gasiewski, Aravind Venkitasubramony, University of Colorado Boulder, United States

B4.4 **14:00**
A Study of the Fields Excited in a Cylindrical Cavity by a Longitudinal Aperture
Secil E. Dogan, Joel Johnson, Robert J. Burkholder, The Ohio State University, United States

B4.5 **14:20**
A Comparison of Two Methods for Defining the Reflection Coefficient
Raymond Sprungle, University of Colorado Boulder / Battelle Memorial Institute, United States; Edward Kuester, University of Colorado Boulder, United States

Break **14:40**

B4.6 **15:00**
Tailored Electromagnetic Properties of Light Weight Nanocomposites
Kate Duncan, United States Army, Armament Graduate School, United States; John Burpo, United States Military Academy, United States

B4.7 **15:20**
Narrowband Tunable Filter and True Time Delay Hadamard Projection for Interference Cancellation in Passive Array Sensing Applications
Devon Ward, Karl F. Warnick, Brigham Young University, United States; Aminul Hoque, Soumen Mohapatra, Deuk Heo, Washington State University, United States

B4.8 **15:40**
The use of Digital Light Processing for Leaky-wave Antenna Fabrication
Andrew Barrett, Mark Mirotznik, University of Delaware, United States; Kelvin Nicholson, Defence Science and Technology Group, Australia; Phil Lambert, 3D Fortify Inc., United States

B4.9 **16:00**
Enhanced Self-Interference Cancellation in a Dual-Fed Circularly Polarized Antenna Array via Hybrid and Quadrature Coupling
Alex Stutts, Anastasiia Rozhkova, Seiran Khaledian, Farhad Farzami, Danilo Erricolo, University of Illinois Chicago, United States

B4.10 **16:20**
Novel Design of Polar Space Filling Curves for the Additive Manufacture of Graded Index RF Structures
Theodore Fessaras, Mark Mirotznik, University of Delaware, United States

Thursday, January 12 13:00 - 15:40
H2 Room 151

Wave-Wave and Wave-Particle Interactions

Session Co-Chairs: Mark Golkowski, University of Colorado Denver; Poorya Hosseini, Applied Physics Laboratory

H2.1 **13:00**
Ionospheric Feedback Mechanism in the Non-Symmetrical Magnetospheric Resonator
Anatoly Streltsov, Embry-Riddle Aeronautical University, United States; Evgeny Mishin, Air Force Research Laboratory, United States

H2.2 **13:20**
Generalized Analytical Treatment of Nonlinear Wave-Particle Interactions
Jay Albert, Air Force Research Laboratory, United States; Anton Artemyev, University of California, Los Angeles, United States

H2.3 **13:40**
Nonlinear whistler wave generation, in low beta plasmas, by induced scattering: 2D PIC simulations.
Rualdo Soto-Chavez, Chris Crabtree, Guru Ganguli, Alex Fletcher, US Naval Research Laboratory, United States

H2.4 **14:00**
Whistler Mode Chirped-Solitons as the Building Blocks of Chorus
Chris Crabtree, Guru Ganguli, Rualdo Soto, Alex Fletcher, US Naval Research Laboratory, United States

H2.5 **14:20**
A new generation mechanism for highly oblique chorus waves enabled by cold electrons
Gian Luca Delzanno, Justin Holmes, Los Alamos National Laboratory, United States; Vadim Roytershteyn, Space Science Institute, United States

Break **14:40**

H2.6 **15:00**
Whistler Waves Generation Mechanism at Switchback Boundaries in the Young Solar Wind: Hybrid Particle-in-Cell Model and Parker Solar Probe Measurements
Hoyoung Kim, Oleksiy Agapitov, Scott Karbashewski, Space Sciences Laboratory, University of California, Berkeley, United States

H2.7 **15:20**
Simulational Investigation of the Nonlinear Bounce Resonance Effect between Energetic Electrons and Magnetosonic Waves: A Parametric Study
Shujie Gu, Lunjin Chen, University of Texas at Dallas, United States

Thursday, January 12 13:00 - 14:40
H3 Special Session Room 155

Physics of the Radiation Belts II

Session Co-Chairs: Lauren Blum, University of Colorado Boulder; Oleksiy Agapitov, University of California Berkeley

H3.1 **13:00**
The Van Allen Probes Results about the Relationship Between Relativistic Electron Flux and Solar Wind Speed.
Livia Alves, National Institute for Space Research (INPE), Brazil; Fernanda Prianti, Unifesp, Federal University of Sao Paulo, Brazil; Ligia Silva, Graziela Silva, Claudia Medeiros, Jose Marchezi, National Institute for Space Research (INPE) and State Key Laboratory for Space Weather, Brazil; Daiene Schaeffer, UTFPr Federal Technical University of Parana, Brazil; Karen Coldebella, National Institute for Space Research, United States; David Sibeck, Shrikanth Kanekal, NASA Goddard Space Flight Center, United States

H3.2 **13:20**
Chorus Growth Rates Mapping from Multi-Spacecraft Measurements by the Cluster Project
Oleksiy Agapitov, Andrii Voshchepinets, University of California, Berkeley, United States

H3.3 **13:40**
Guiding of Whistler-Mode Weaves by the "Shelf-Like" Density Structures in the Equatorial Magnetosphere
Anatoly Streltsov, Embry-Riddle Aeronautical University, United States

H3.4 **14:00**
MMS Observations of Compressed Current Sheets: Importance of the Ambipolar Electric Field
Ami DuBois, Chris Crabtree, Gurudas Ganguli, U.S. Naval Research Laboratory, United States; David Malaspina, University of Colorado Boulder, United States

H3.5 **14:20**
The energy content of pulsating aurora: implications for M-I coupling
Allison Jaynes, Riley Troyer, University of Iowa, United States

Thursday, January 12 13:00 - 14:40
A1 Room 200

Antennas and Propagation

Session Co-Chairs: Christopher Anderson, USNA; Steven Weiss, DEVCOM Army Research Lab

A1.1 **13:00**
Antenna Development using Engineered Materials and Additive Manufacturing
Steven Weiss, Gregory Mitchell, DEVCOM Army Research Laboratory, United States

A1.2 **13:20**
Investigation of the Optimal Sampling Criteria for Antenna Measurements in the Reactive Nearfield Region
William Dykeman, Ryan Green, Mississippi State University, United States

A1.3 **13:40**
A Novel Genetic Algorithm Based Method for Measuring Complex Permittivity of Thin Samples in the Compact Radar Frequency Band
Sunny Zhang, Magdy Iskander, Zhengqing Yun, Edmond Chong, Yuanzhang Xiao, Matthew Nakamura, Joseph Brown, Benjamin Jones, University of Hawaii at Manoa, United States

A1.4 **14:00**
Land Use and the Character of Urban Radio-frequency Noise in a Small City
Daniel Breton, Aaron Meyer, U.S. Army Engineer Research and Development Center, United States

A1.5 **14:20**
Characterization of Atmospheric Variability on Long Range 3.4 GHz Propagation
Ann Vanleer, Christopher Anderson, United States Naval Academy, United States

Thursday, January 12 13:00 - 14:40
K2 Special Session Room 245

Wireless Power Transfer Techniques for Biomedical Applications

Session Co-Chairs: Ifana Mahbub, The University of Texas at Dallas; Abas Sabouni, Wilkes University

K2.1 **13:00**
Meta-surface Design for Improving the Power Transfer in a Hybrid Wireless Power Transfer System
Sima Noghanian, CommScope Ruckus Networks, United States; Reem Shadid, Applied Science Private University, Jordan

K2.2 **13:20**
Extended Range Wireless Power Transfer With Inkjet Printed Thin-film Flexible Loop Coils
Bashir Morshed, Mst Moriom Momota, Mahfuzur Rahman, Texas Tech University, United States

K2.3 **13:40**
A Wirelessly Powered Novel Smart Bandage for Chronic Wound Monitoring
Dieff Vital, University of Illinois Chicago, United States; Pulak Bhushan, Md Khadimul Islam, Vladimir Pozdin, John L. Volakis, Florida International University, United States; Pawan Gaire, Shubhendu Bhardwaj, University of Nebraska-Lincoln, United States; Shashikant Lahade, University of Notre Dame, United States; Shekhar Bhansali, National Science Foundation, United States

K2.4 **14:00**
A Magnetic Sensor based Automatic Beam Tracking system for 2.4 GHz Near-field Phased-Array based Wireless Power Transfer System in Neuromodulation Applications
Nabanita Saha, Ifana Mahbub, University of Texas at Dallas, United States; Erik Pineda-Alvarez, University North Texas, United States

K2.5 **14:20**
Design of a Self-Compensating Rectifier for Low-Power RF Energy Harvesting System
Dilruba Parvin, Twisha Titirsha, Syed Islam, University of Missouri, United States

Thursday, January 12 13:00 - 17:00
J2 Room 265

New Telescopes, Techniques, and Technologies I

Session Co-Chairs: Alyson Ford, University of Arizona; David DeBoer, University of California

J2.1 **13:00**
TONE: A CHIME/FRB Outrigger Pathfinder To Localize Fast Radio Bursts Using Very Long Baseline Interferometry
Pranav Sanghavi, Yale University, United States; Kevin Bandura, West Virginia University, United States

J2.2 **13:20**
Updates on the Array of Long Baseline Antennas for Taking Radio Observations from the Seventy-ninth parallel (ALBATROS)
Lawrence Herman, McGill University, Canada

J2.3 **13:40**
Development of Offline Correlation Pipeline for Independently Clocked Antennas of ALBATROS
Mohan Agrawal, McGill University, Canada

J2.4 **14:00**
Report on Hydrogen Epoch of Reionization Array recent results and current operations
Daniel Jacobs, Arizona State University, United States; HERA Collaboration, HERA, United States

J2.5 **14:20**
A Digital Calibration Source for 21 cm Cosmology Telescopes
Kalyani Bhopi, Pranav Sanghavi, Kevin Bandura, West Virginia University, United States; Will Tyndall, Laura Newburgh, Yale University, United States; Jason Gallicchio, Harvey Mudd College, United States

Break **14:40**

J2.6 **15:00**
A Water Vapor Radiometer for the CO Mapping Array Project (COMAP)
Junhan Kim, Kieran Cleary, Sandra O'Neill, Delaney Dunne, Jonathon Kocz, Timothy Pearson, Anthony Readhead, California Institute of Technology, United States; James Lamb, David Woody, Morgan Catha, Richard Hobbs, Travis Powell, Owens Valley Radio Observatory, United States; Andrew Harris, University of Maryland, United States; Liju Philip, Jet Propulsion Laboratory, United States

J2.7 **15:20**
Image-Plane Self-Calibration in Interferometry
Chris Carilli, NRAO, United States; Nithyananda Thyagarajan, CSIRO, Australia; Bojan Nikolic, Cavendish Astrophysics, United Kingdom

J2.8 **15:40**
Using the Global Navigation Satellite System Satellites for Beam Calibration with the CHORD Pathfinder
Sabrina Berger, Jonathan Sievers, Eamon Egan, McGill University, Canada; Arianna Lasinski, University of Toronto, Canada

J2.9 **16:00**
Drone Beam Mapping of Prototype HIRAX Dishes
Emily Kuhn, NASA JPL, United States; Will Tyndall, Anna Polish, Maile Harris, Laura Newburgh, Yale University, United States; Benjamin Saliwanchik, Brookhaven National Lab, United States

J2.10 **16:20**
Nearfield to Farfield Methods for Drone Beam Mapping
Will Tyndall, Laura Newburgh, Yale University, United States

J2.11 **16:40**
The MIST Experiment: Recent Observations and Ionosphere Model
Vadym Bidula, McGill University, Canada

Thursday, January 12 13:00 - 16:40
BK1 Special Session Room 1B40

Wearable Antennas for WiFi, IoT, and 5G Applications

Session Co-Chairs: Sima Noghanian, CommScope Ruckus Networks; Yahya Rahmat-Samii, UCLA

BK1.1 **13:00**
Wearable Textile Antenna Design for Continuous Monitoring Systems
Michael Nguyen, Benjamin Wilkinson, Ryan Green, Mississippi State University, United States; Lauren Linkous, Jonathan Lundquist, Erdem Topsakal, Virginia Common Wealth University, United States

BK1.2 **13:20**
Design and SAR Analysis of a Meander Slot Antenna for Backscattering RFID Applications
Karthik Kakaraparty, Ifana Mahbub, University of Texas at Dallas, United States

BK1.3 **13:40**
Dual-Layer Magnetoinductive Waveguide for Wearable Wireless Body Area Networks
Connor Jenkins, Asimina Kiourti, The Ohio State University, United States

BK1.4 **14:00**
Powering IoT Devices Through Misalignment Resilient Anchor-Shaped Antennas
Shubhendu Bhardwaj, University of Nebraska-Lincoln, United States; Dieff Vital, University of Illinois Chicago, United States

BK1.5 **14:20**
Textile Patch Antenna Surrogate-based Optimization: Kriging Surrogate Modeling on Equivalent Circuit Components
Botian Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States; Lingnan Song, Beihang University, China

Break **14:40**

BK1.6 **15:00**
A Battery-less and Wireless Neural Recording System with Additive Manufacturing
Melany Gutierrez-Hernandez, Carolina Moncion, Satheesh Bojja-Venkatakrishnan, John L. Volakis, Florida International University, United States

BK1.7 **15:20**
Textile-Based Frequency Selective Surface for mmWave 5G Applications
Amber Nunnally, Erdem Topsakal, Virginia Commonwealth University, United States

BK1.8 **15:40**
Ultra Thin Dual-Polarized Flexible Cavity Slot Antenna for the 5G Communication
Behzad Ashrafi Nia, Franco De Flaviis, University of california, Irvine, United States; Soheil Saadat, Mflex, United States

BK1.9 **16:00**
A Triple-Band Omni-directional Textile Antenna for WiFi 7 Applications
Sima Noghanian, CommScope Ruckus Networks, United States

BK1.10 **16:20**
Near Field Effects on Biological Systems
Frank Barnes, Hakki Gurhan, University of Colorado, United States

Thursday, January 12 15:00 - 16:40
D1 Room 155

Wideband and Reconfigurable Electronics

Session Co-Chairs: Jonathan Chisum, University of Notre Dame; Charles Baylis, Baylor University

D1.1 **15:00**
Ultra-Wideband Photonic Spectrometer for PBL Sensing
Mehmet Ogut, Sidharth Misra, Shannon Brown, Siamak Forouhar, Eric Kittlaus, Pekka Kangaslahti, Jet Propulsion Laboratory, United States; Janusz Murakowski, Phase Sensitive Innovations, United States; Michael Gehl, Sandia National Laboratories, United States

D1.2 **15:20**
Solid-State Travelling Wave Amplifier at 100 GHz
Michail Anastasiadis, John L. Volakis, Florida International University, United States; Shubhendu Bhardwaj, University of Nebraska-Lincoln, United States

D1.3 **15:40**
Optimizing Directionally Modulated Power-Amplifier Array Transmissions with Impedance Tuning and Signal Equalization
Samuel Haug, Austin Egbert, Adam Goad, Charles Baylis, Robert Marks, Baylor University, United States; Anthony Martone, DEVCOM Army Research Laboratory, United States

D1.4 **16:00**
Improving High-Power Handling on a Real-Time Switched-Network Impedance Tuner
Justin Roessler, Austin Egbert, Trevor Van Hoosier, Charles Baylis, Robert Marks, Baylor University, United States; Alden Fisher, Dimitrios Peroulis, Mohammad Khater, Purdue University, United States

D1.5 **16:20**
Incognito Wearable RFID
Michael Suche, Erdem Topsakal, Virginia Commonwealth University, United States

Thursday, January 12 | 15:00 - 17:40
G2 | Room 200

Ionospheric Modeling and Space Weather

Session Co-Chairs: Wayne Scales, Virginia Tech; Amir Zaghloul, Virginia Tech

G2.1 **15:00**

3D Numerical and 2D Analytical Scintillation Modeling

James Conroy, Larry Paxton, Johns Hopkins University Applied Physics Laboratory, United States; Kshitija Deshpande, Embry-Riddle, United States; Roger Varney, Leslie Lamarche, SRI International, United States; Wayne Scales, Amir Zaghloul, Virginia Tech, United States

G2.2 **15:20**

Over-the-horizon (OTH) Ray Trace Model Anchoring

James Conroy, Sean Ellison, John Outwater, Aram Vartanyan, Johns Hopkins University Applied Physics Laboratory, United States

G2.3 **15:40**

An LSTM-based Neural Network Model for Ionospheric Scintillation and TEC Prediction

Maxwell Lu, James Conroy, Johns Hopkins University Applied Physics Laboratory, United States

G2.4 **16:00**

An examination of the dynamics of North American mid-latitude sporadic-E

Bharat Kunduri, Joseph Baker, Michael Ruohoniemi, Virginia Tech, United States; Philip Erickson, MIT Haystack Observatory, United States

G2.5 **16:20**

Study of eclipse effects on radio propagation using observations and modeling framework

Shibaji Chakraborty, Xueling Shi, Joseph Baker, Michael Ruohoniemi, Kevin Sterne, Virginia Tech, United States; Liying Qian, High Altitude Observatory, United States; Gareth Chisham, British Antarctic Survey, United Kingdom; Evan Thomas, Dartmouth College, United States

Break **16:40**

G2.6 **17:00**

Impacts of Ionospheric Space Weather at Mid-latitudes on GNSS Positioning

Sebastijan Mrak, University of Colorado Boulder, United States; Toshi Nishimura, Joshua Semeter, Boston University, United States; Anthea Coster, Massachusetts Institute of Technology, United States; Fabiano Rodrigues, University of Texas Dallas, United States

G2.7 **17:20**

Modeling and validating a SuperDARN radar's Poynting flux profile

Gareth Perry, New Jersey Institute of Technology, United States; Kyle Ruzic, Andrew Howarth, Andrew Yau, University of Calgary, Canada; Kevin Sterne, Virginia Polytechnic Institute and State University, United States

Thursday, January 12 | 15:00 - 17:20
E1 | Room 245

Electromagnetic Interference

Session Co-Chairs: Robert Gardner, Georgia Tech Research Institute; David Giri, Protech

E1.1 **15:00**

Electromagnetic Coupling to Systems Using Modelica

Robert Gardner, Georgia Tech Research Institute, United States

E1.2 **15:20**

Development of a Regulatory Solution for Extending Real-Time Spectral Brokering to Novel Frequency Bands

Samuel Hussey, Andrew Clegg, Trevor Van Hoosier, Adam Goad, Austin Egbert, Charles Baylis, Robert Marks, Baylor University, United States; Albin Gasiewski, Aravind Venkitasubramony, University of Colorado Boulder, United States

E1.3 **15:40**

Aircraft Wireless Systems Coexistence with 5G Using Air Traffic Control Spectral Coordinator

Charles Baylis, Austin Egbert, Andrew Clegg, Robert Marks, Baylor University, United States; Dennis Roberson, Roberson and Associates, United States

E1.4 **16:00**

Potential of Multiple Software Defined Radio Receivers for Coherent Spectrum Sensing

Evariste Some, Albin Gasiewski, University of Colorado Boulder, United States

E1.5 **16:20**

LTCC-Based High Isolation STA-RF-Front End for Ku Band Operation

Md Rakibur Rahman, Satheesh Venkatakrishnan, Markondeyaraj Pulugurtha, John L. Volakis, Florida International University, United States

E1.6 **16:40**

Software Defined Radios for Absolute Radiometric Measurements of the Radio-Frequency Interference Environment in the Vicinity of a Radio Telescope

Arvind Aradhya, Albin Gasiewski, University of Colorado Boulder, United States; Alexander Pollak, SETI Institute, United States

E1.7 **17:00**

Test and Analysis of Electromagnetic Sensitive Effects in Resolver System

Peng Huang, Bing Li, Zongfei Zhou, Donglin Su, Beihang University, China; Weimin Li, China Academy of Launch Vehicle Technology, China

Thursday, January 12 | 18:00 - 20:00
Event | Embassy Suites

WIRS Reception (Ticket Required)

Friday, January 13 | 08:00 - 08:10
Event | Math 100

Closing Day Remarks
(Streamed from Math 100 to All Session Rooms)

Friday, January 13 | 08:20 - 12:00
B5 | Room 150

Numerical Electromagnetics
Session Co-Chairs: Majid Manteghi, Virginia Tech; Branislav Notaros, Colorado State University

B5.1 **08:20**
Frequency Beamforming-Enhanced DBIM for Limited-Aperture Quantitative Imaging
Scott Ziegler, Matthew Burfeindt, Naval Research Laboratory, United States

B5.2 **08:40**
Spectral Recursive Approach to the Time-Domain Inverse Kernel
Thomas Liebau, Majid Manteghi, Virginia Tech, United States

B5.3 **09:00**
Higher Order Parameter Sampling Used in Radar Cross-Section Uncertainty Predictions
Stephen Kasdorf, Jake Harmon, Branislav Notaros, Colorado State University, United States

B5.4 **09:20**
Simulating a computer-generated waveguide hologram scattering problem with an artificial 2D Gaussian beam source
Ligang Sun, David De Vocht, Roeland Dilz, Martijn van Beurden, Eindhoven University of Technology, Netherlands

B5.5 **09:40**
Temporal Scattering at Passive Time-Interfaces
Shixiong Yin, Gengyu Xu, Andrea Alù, City University of New York, United States

Break **10:00**

B5.6 **10:20**
Exact Scattering by Metallic Cylinders of Polygonal Cross Section Illuminated by Multiple Plane Waves
Piergiorgio L. E. Uslenghi, University of Illinois Chicago, United States

B5.7 **10:40**
Using Gaussian Regression for Reconstruction of Probability Distribution Function in Scattering Uncertainty Prediction
Stephen Kasdorf, Jake Harmon, Branislav Notaros, Colorado State University, United States

B5.8 **11:00**
RF-FE Analysis and Optimization of an UWB Spread Spectrum Transceiver
Arnaldo Sans, John Willis, John L. Volakis, Satheesh Venkatakrishnan, Florida International University, United States; Wilfredo Rivas-Torres, Keysight Technologies, United States

B5.9 **11:20**
Parametric Decay Instabilities of Whistler Waves: Darwin Particle-in-Cell Simulations
Scott Karbashewski, Oleksiy Agapitov, University of California, Berkeley, United States; Richard Sydora, University of Alberta, Canada

B5.10 **11:40**
Experimental Validation of a Long-Wavelength Near-Field Scattering Calculator
Clint Snider, Robert Moore, University of Florida, United States

Friday, January 13 | 08:20 - 12:00
H4 | Special Session | Room 151

Heliospheric Observations of Waves in Plasmas
Session Co-Chairs: J. LaBelle, Dartmouth College; David Malaspina, University of Colorado

H4.1 **08:20**
Experiment to Observe Conjugate LF/MF/HF Radio Emissions of Auroral Origin
James LaBelle, D. McGaw, T. Kovacs, Dartmouth College, United States; A. Kashcheyev, P.T. Jayachandran, University of New Brunswick, Canada

H4.2 **08:40**
LF/HF Interferometry in Low Earth Orbit Using Electromagnetic Vector Sensors: The AERO-VISTA Mission
Philip Erickson, Frank Lind, Mary Knapp, Ryan Volz, John Swoboda, Allan Weatherwax, Rebecca Masterson, Nicholas Belsten, Cadence Payne, Kristen Ammons, Massachusetts Institute of Technology, United States; James LaBelle, Dartmouth College, United States; Alan Fenn, Frank Robey, Brad Perry, Mark Silver, MIT Lincoln Laboratory, United States; Benjamin Malphrus, Morehead State University, United States

H4.3 **09:00**
Quantifying Terrestial VLF Energy Input into the Earth's Magnetosphere with the CANVAS CubeSat
James Cannon, Robert Marshall, David Malaspina, Riley Reid, Scott Palo, University of Colorado Boulder, United States; Thierry Dudok de Wit, Guillaume Jannet, University of Orleans, France

H4.4 **09:20**
Atmospheric Electrodynamics probe for THERmal plasma (AETHER) for the GDC mission: an instrument to observe the ionosphere
Laila Andersson, University of Colorado, United States

H4.5 **09:40**
Counter-Streaming Whistler Waves in the Solar Wind: Observations from Parker Solar Probe
Scott Karbashewski, Oleksiy Agapitov, Hoyoung Kim, University of California, Berkeley, United States

Break **10:00**

H4.6 **10:20**
Electron Bernstein Waves and Other Plasma Waves near the Electron Cyclotron Frequency Driven by Interaction with a Spacecraft Plasma Wake
David Malaspina, University of Colorado, United States; Sabrina Tigik, Andris Vaivas, KTH Royal Institute of Technology, Sweden

H4.7 **10:40**
Evolution of Switchbacks in the Yong Solar Wind: Parker Solar Probe Observations
Oleksiy Agapitov, Scott Karbashewski, Hoyoung Kim, University of California, Berkeley, United States; James Drake, Marc Swisdak, University of Maryland, United States

H4.8 **11:00**
PSP Measurements of Electron Shot Noise on a Current Biased Antenna
Winry Ember, Marc Pulupa, Stuart D. Bale, University of California, Berkeley Space Sciences Lab, United States

H4.9 **11:20**
The Effects of Supercritical Near Perpendicular Interplanetary Shockwaves on ULF Wave Activity and Outer Radiation Belt Variability During the IMF's North Oriented Bz Component Periods
Karen Júlia Coldebella Ferreira, Lívia Ribeiro Alves, Vinícius Deggeroni, INPE, Brazil; Lígia Alves da Silva, INPE; State Key Laboratory for Space Weather, Brazil; José Paulo Marchezi, State Key Laboratory for Space Weather, Beijing, Brazil

H4.10 **11:40**
Plasma Waves and Solitary Structures in the Interaction Region of the Solar Wind and the Martian Upper Atmosphere
Hassan Akbari, NASA GSFC, United States; David Newman, University of Colorado Boulder, United States; Christopher Fowler, West Virginia University, United States

Friday, January 13 | 08:20 - 12:00
H5 | Special Session | Room 155

Active Experiments in Space and Laboratory Plasmas I

Session Co-Chairs: Bill Amatucci, Naval Research Laboratory; Erik Tejero, US Naval Research Laboratory

H5.1 **08:20**
Cold-Plasma Measurement Techniques in the Earth's Magnetosphere
Pedro Alberto Resendiz Lira, Gian Luca Delzanno, Carlos Maldonado, Los Alamos National Laboratory, United States; Joseph Borovsky, Space Science Institute, United States

H5.2 **08:40**
Measurements of plasma and dusty plasma response to driven, low frequency plasma oscillations under scaled, ionospheric conditions in the MDPX device
Edward Thomas, Saikat Chakraborty Thakur, Auburn University, United States; Jeremiah Williams, Wittenberg University, United States

H5.3 **09:00**
Experimental Investigation of Techniques to Measure Cold Electrons in the Magnetosphere
Carlos Maldonado, Gabriel Wilson, Pedro Resendiz Lira, Gian Luca Delzanno, Los Alamos National Laboratory, United States

H5.4 **09:20**
Clues to Antenna Performance from the Boomerang Signals Observed by the DSX Mission
Michael Starks, Wm. Robert Johnston, Air Force Research Laboratory, United States; Dave Lauben, Umran Inan, Stanford University, United States; Ivan Galkin, Paul Song, University of Massachusetts - Lowell, United States

H5.5 **09:40**
Thermal Mode Radiation from VLF Antennas in the Inner Magnetosphere
Patrick Colestock, Space Science Institute, United States; Gian Luca Delzanno, Los Alamos National Laboratory, United States

Break **10:00**

H5.6 **10:20**
Recent Progress Towards a Radiation Belt Remediation Strategy Based on Artificial Injection of Plasma Waves
Gian Luca Delzanno, Los Alamos National Laboratory, United States

H5.7 **10:40**
The Magnetosphere-Ionosphere Observatory (MIO) Mission Concept
Joe Borovsky, Space Science Institute, United States

H5.8 **11:00**
B-SPICE: The Beam-Spacecraft Plasma Interaction and Charging Experiment
Omar Leon, Brian Gilchrist, Grant Miars, University of Michigan, United States; Gian Luca Delzanno, Los Alamos National Laboratory, United States; John Williams, Colorado State University, United States

H5.9 **11:20**
NRL SPADE plasma impedance probe measurements from the International Space Station
Bill Amatucci, Erik Tejero, George Gatling, Dave Blackwell, Ami DuBois, Naval Research Laboratory, United States

H5.10 **11:40**
HAARP dual use experiments as an HF radar and ionospheric modification facility
Stan Briczinski, Carl Siefring, Joe Coombs, Mark Sletten, Naval Research Lab, United States; William Bristow, Penn State University, United States; Andrew Howarth, Gordon James, University of Calgary, Canada

Friday, January 13 | 08:20 - 12:00
F2 | Room 200

Microwave and Millimeter-Wave Remote Sensing

Session Co-Chairs: Steven C. Reising, Colorado State University; David Kunkee, Aerospace Corporation

F2.1 **08:20**
Forward-Looking Millimeter-Wave Radiometers for Small Aircraft to Improve Advance Warning of Aircraft Icing Potential in Clouds
Renish Thomas, Yuriy Goncharenko, Steven C. Reising, Chaehyeon C. Nam, Michael Bell, Jonah Smith, Samantha Williams, Colorado State University, United States; James McDonald, Eric Pahlke, Richard Bateman, FIRST RF Corporation, United States

F2.2 **08:40**
Smart Ice Cloud Sensing (SMICES) SmallSat Instrument
Mehmet Ogut, Pekka Kangaslahti, Isaac Ramos, Xavier Bosch-Lluis, Omkar Pradhan, Joan Munoz-Martin, Joelle Cooperrider, William Chun, Akim Babenko, Jason Swope, Peyman Tavallali, Steve Chien, Jet Propulsion Laboratory, United States; William Deal, Caitlyn Cooke, Northrop Grumman Corporation, United States

F2.3 **09:00**
High Spectral Resolution V-band Digital Correlating Spectrometer for Climate Monitoring - RF Front End Characterization and Brightness Temperature Spectra Estimation
Aravind Venkitasubramony, Albin Gasiewski, University of Colorado Boulder, United States

F2.4 **09:20**
Miniaturized Metamaterial Targets for Next-Generation Microwave Radiometer Calibration for Atmospheric Remote Sensing from Small Satellites
Steven C. Reising, Jonah A. Smith, Colorado State University, United States; Omar Khatib, Natalie Rozman, Willie J. Padilla, Duke University, United States; Dazhen Gu, National Institute of Standards and Technology, United States; William Deal, Katalin Balogh, Northrop Grumman Corporation, United States

F2.5 **09:40**
Field Testing a Deployable Membrane Antenna for Multi-Frequency Signals of Opportunity (SoOp) Remote Sensing in P- and I-Bands
Eric Smith, James Garrison, Archana Choudhari, Benjamin Nold, Seho Kim, Purdue University, United States; Keith Kelly, Agile RF Systems, LLC, United States; Susan Tower, Manuel Vega, MMA Design, LLC, United States

Break **10:00**

F2.6 **10:20**
Use of a SMAP-Based Climatology in S-Band Time-Series Soil Moisture Retrieval for the NISAR Mission
Dustin Horton, Joel Johnson, The Ohio State University, United States; Jeonghwan Park, Rajat Bindlish, Goddard Space Flight Center, United States

F2.7 **10:40**
Precipitation Retrieval Using ABI and GLM Measurements on the GOES-R Series
Yifan Yang, Haonan Chen, Kyle Hilburn, Colorado State University, United States

F2.8 **11:00**
Simultaneous Observations of Precipitation from a Vertically Pointing S-Band Profiler Radar and a Horizontally Looking C-Band Dual Polarization Radar: A Microphysical Perspective
Sounak Biswas, Adubi Tunde, V Chandrasekar, Colorado State University, United States; Robert Cifelli, NOAA Physical Sciences Laboratory, United States

F2.9 **11:20**
Uncertainty Quantification of Multi-Satellite Precipitation Products with Deep Learning: A Case Study over Taiwan
Liping Wang, Haonan Chen, Colorado State University, United States; Yun-Lan Chen, Chia-Rong Chen, CWB, Taiwan; Wen-Wei (Tony) Liao, NOAA, United States

F2.10 **11:40**
Improved Accuracy of Snowflake Characterizations Using the Snowflake Measurement and Analysis System
Hein Thant, Branislav Notaros, Colorado State University, United States; Mikhail Zhizhin, Colorado School of Mines, United States

Friday, January 13 08:20 - 11:20
C1 Room 245

Machine Learning in Radar, Remote Sensing, and Antennas

Session Co-Chairs: Danilo Erricolo, University of Illinois Chicago; Erdem Topsakal, Virginia Commonwealth University

C1.1 **08:20**
A Compact and Light-Weight Ground Penetrating Radar System for Unmanned Aerial Vehicles
Alan Salari, Danilo Erricolo, University of Illinois Chicago, United States; Giuseppe Esposito, Ilaria Catapano, Francesco Soldovieri, Institute for Electromagnetic Sensing of the Environment, Italy

C1.2 **08:40**
Implementing a Hybrid Data Storage Technique within a Cognitive Radar to Allow for Pulse-to-Pulse Optimizations
Trevor Van Hoosier, Jordan Alexander, Austin Egbert, Justin Roessler, Charles Baylis, Robert Marks, Baylor University, United States; Alden Fisher, Dimitrios Peroulis, Purdue University, United States; Anthony Martone, Benjamin Kirk, DEVCOM Army Research Laboratory, United States

C1.3 **09:00**
Enabling Low-power Radiometers with Machine Learning Calibration
John Bradburn, Mustafa Aksoy, University at Albany, SUNY, United States; Paul Racette, NASA Goddard Space Flight Center, United States

C1.4 **09:20**
Optimizing Machine Learning Algorithms for Dynamic Direction Finding
John Willis, Satheesh Venkatakrishnan, Florida International University, United States; John L. Volakis, Dean/Florida International University, United States

C1.5 **09:40**
Generalized Machine-Learning Particle Swarm Optimization Antennas for CBRS
Erwin Karincic, Lauren Linkous, Erdem Topsakal, Virginia Commonwealth University, United States

Break **10:00**

C1.6 **10:20**
Automated Antenna Calculation, Design and Tuning Tool for HFSS
Lauren Linkous, Erwin Karincic, Erdem Topsakal, Virginia Commonwealth University, United States

C1.7 **10:40**
Design of Antennas with Greater Sensitivity to Ultra-High Energy Neutrinos
Bryan Reynolds, Alex Machtay, Dennis Calderon, Chi-Chih Chen, Amy Connolly, Ryan Debolt, Ethan Fahimi, Ben Sipe, Dylan Wells, Audrey Zinn, The Ohio State University, United States; Julie Rolla, Jet Propulsion Laboratory, NASA, United States; Wolfgang Banzhaf, Michigan State University, United States; Nick King, San Jose State University, United States; Ezio Melotti, , United States; Alex Patton, Massachusetts Institute of Technology, United States; Kai Staats, University of Arizona, United States; Stephani Wissel, Pennsylvania State University, United States

C1.8 **11:00**
Application of Artificial Neural Networks in Antennas: A Review
Sembiam Rengarajan, California State University, Northridge, United States

Friday, January 13 08:20 - 12:00
J3 Room 265

New Telescopes, Techniques, and Technologies II

Session Co-Chairs: Alyson Ford, University of Arizona; David DeBoer, University of California

J3.1 **08:20**
CURRENT AND FUTURE CHALLENGES TO PASSIVE RADIO SPECTRUM USES FOR RADIO ASTRONOMY
Frank K. Schinzel, NRAO/UNM, United States; Nathaniel J. Livesey, Jet Propulsion Laboratory, United States; Scott Paine, Center for Astrophysics | Harvard & Smithsonian, United States; Nancy L. Baker, Naval Research Laboratory, United States; Laura B. Chomiuk, Michigan State University, United States; Dara Entekhabi, Massachusetts Institute of Technology, United States; Philip Erickson, Haystack Observatory/MIT, United States; Kelsey E. Johnson, University of Virginia, United States; Christopher Kidd, University of Maryland/NASA, United States; Karen L. Masters, Haverford College, United States; Mahta Moghaddam, University of Southern California, United States; Darrel Emerson, Steward Observatory, United States; Thomas E. Gergely, Retired, United States; Paul J. Feldman, Fletcher, Heald & Hildreth, United States

J3.2 **08:40**
Techniques for Observing through Satellite Interference
Steven Ellingson, R. Michael Buehrer, Virginia Tech, United States

J3.3 **09:00**
Spectrum Characterization and Sharing Activities at the Hat Creek Radio Observatory
David DeBoer, Andrew Siemion, University of California, United States; Kevin Gifford, Arvind Aradhya, Mark Lofquist, Stefan Tschimben, Georgiana Weihe, University of Colorado, United States; Andrew Clegg, Google, United States; Wael Farah, Alexander Pollak, SETI Institute, United States

J3.4 **09:20**
Real-time RFI excision at the Very Large Array
Brian Svoboda, Paul Demorest, Ken Sowinski, Emmanuel Momjian, Vivek Dhawan, Bruce Rowen, Rich Moeser, NRAO, United States

J3.5 **09:40**
Current Status of the Deep Dish Development Array
Kit Gerodias, McGill University, Canada

Break **10:00**

J3.6 **10:20**
F-Engine Development for the Canadian Hydrogen Observatory and Radio transient Detector
Ian Hendricksen, McGill University, Canada

J3.7 **10:40**
An Ultra-Wideband, Low-Loss, Low-Cost Feed Design for Large-N, Small-D Observatories, and Implementation on CHORD
Vincent MacKay, University of Toronto, Canada

J3.8 **11:00**
Simultaneous X- and Ka band Receiver for Astrometry and navigation
Jacob Kooi, Jet Propulsion Laboratory, United States

J3.9 **11:20**
ASTHROS Six-Stage Low-Noise Amplifier Chain
Ricardo Rodriguez, Arizona State University, United States

J3.10 **11:40**
Design of an Ultra-Wideband Antenna Feed and Reflector for use in Hydrogen Intensity Mapping Experiments
John Podczerwinski, Peter Timbie, University of Wisconsin Madison, United States

Friday, January 13 | 08:20 - 12:00
B6 | Special Session | Room 1B40

Antennas and Systems for Specialized Platforms and Environments

Session Co-Chairs: Reyhan Baktur, Utah State University; David Jackson, University of Houston

B6.1 **08:20**
Impact of Dielectric Loading on Embedded Wideband Omnidirectional Antennas for Application in Spectrum Sensing
Jori Platt, Ljubodrag Boskovic, Dejan Filipovic, University of Colorado Boulder, United States

B6.2 **08:40**
Compact Spoof Surface Plasmon Polariton for Wearable Applications
Jose Alcala-Medel, Yang Li, Baylor University, United States

B6.3 **09:00**
CPW-Fed Compact Circularly Polarized Flexible Antenna for C Band Applications
Abdul Rakib Hossain, Tutku Karacolak, Washington State University Vancouver, United States

B6.4 **09:20**
UHF/VHF Tightly Coupled Dipole Array for CubeSat-based Spaceborne Ice Sounding Radar
Muhammad Mubasshir Hossain, Stavros Koulouridis, Satheesh Bojja-Venkatakrishnan, John L. Volakis, Florida International University, United States

B6.5 **09:40**
Deployable 18:1 Low-Profile Ultra-Wideband Tightly Coupled Dipole Array with Corporate Feed Network
Jorge A. Caripidis Troccola, Satheesh Venkatakrishnan, John L. Volakis, Florida International University, United States

Break **10:00**

B6.6 **10:20**
A Shorted-Annular-Ring GPS Antenna for Freight-Carrying Autonomous Rail Vehicles
Tianjian Huang, Anastasios Papathanasopoulos, Yahya Rahmat-Samii, University of California, Los Angeles, United States

B6.7 **10:40**
A Study on an Alternative Method for the Manufacturing of Optically Transparent Antennas for Smart City Applications
Benjamin Wilkinson, Michael Nguyen, Ryan Green, Mississippi State University, United States

B6.8 **11:00**
Reconfigurable Intelligent Surfaces for Adaptive Nulling and Beam Steering Using 1-bit Topology
Tatiana Valera, Satheesh Venkatakrishnan, Arjuna Madanayake, John L. Volakis, Florida International University, United States

B6.9 **11:20**
A Uniplanar Coplanar Waveguide to Twin-Wire Balun for Millimeter-Wave On-chip Applications
Yagmur Ozturk, Banaful Paul, Niru Nahar, Kubilay Sertel, The Ohio State University, United States

B6.10 **11:40**
Electric Characterization of Sandcast for use in Radio Frequency Imaging
Jamison Ehlers, Bryce Hill, Kevin Negus, Montana Technological University, United States

Friday, January 13 | 12:10 - 13:00
Event | Math 100

Tenth Hans Liebe Lecture

How Water Shapes Climate
Stefan Buehler
Director of the Meteorological Institute
University of Hamburg, Hamburg, Germany

Friday, January 13 | 13:10 - 14:50
K3 | Special Session | Room 150

Electromagnetic-based Technologies for Health: Treatment, Detection, and Monitoring

Session Co-Chairs: Emily Porter, University of Texas at Austin; Punit Prakash, Kansas State University

K3.1 **13:10**
Preliminary Investigation of Coaxial Probe-based Dielectric Mapping of Inhomogeneous Tissue Structures
Ali Farshkaran, Helen Liu, Emily Porter, University of Texas at Austin, United States

K3.2 **13:30**
Wearable Loop Sensors for Joint Flexion Monitoring: Validation on Human Subjects
Ian Anderson, Chris Cosma, Vigyanshu Mishra, Asimina Kiourti, The Ohio State University, United States

K3.3 **13:50**
Radiofrequency Thermal Therapies for Treatment of Cancer and Cardiac Arrhythmia
Dieter Haemmerich, Med. Univ. of South Carolina, United States

K3.4 **14:10**
Feedback Controlled Microwave Ablation: Simulation-Based Validation of Experiments in Ex Vivo Liver Tissue
Nooshin Zeinali, Jan Sebek, Punit Prakash, Kansas State University, United States

K3.5 **14:30**
Clinically Informed Hemorrhage Phantoms for Microwave-based Stroke Detection
Jared Culpepper, Spencer Denton, Gina Perkins, Ryan Liu, Hannah Lee, Emily Porter, University of Texas at Austin, United States

Friday, January 13 | 13:10 - 16:10
GH1 | Special Session | Room 151

Machine Learning Techniques for Near-Earth Space Sciences

Session Co-Chairs: Xiangning Chu, University of Colorado Boulder; Kshitija B. Deshpande, Embry-Riddle Aeronautical University; Vijay Harid, University of Colorado Denver

GH1.1 **13:10**
Automated Determination of Electron Density From In-situ Wave Receiver
Yi-Jiun Su, John Carilli, Air Force Research Laboratory, United States

GH1.2 **13:30**
A Methodology to Predict the Geomagnetic Field: A Preliminary Analysis using Data from Polar Zone in Canada
Kevin Forbes, Energy and Environmental Data Analysis, Ireland

GH1.3 **13:50**
Opening the Black Box of the Radiation Belt Machine Learning Model
Donglai Ma, Jacob Bortnik, Seth Claudepierre, Qianli Ma, Adam Kellerman, University of California, Los Angeles, United States; Xiangning Chu, University of Colorado Boulder, United States

GH1.4 **14:10**
The evolution and propagation of chorus waves by a machine learning-based model
Xiangning Chu, David Malaspina, University of Colorado Boulder, United States; Jacob Bortnik, Donglai Ma, Qianli Ma, University of California, Los Angeles, United States; Wen Li, Xiaochen Shen, Sheng Huang, Boston University, United States

GH1.5 **14:30**
Estimating Magnetic Flux Rope Orientations Robustly & Efficiently Using Physics-Informed Deep Learning
Hameedullah Farooki, SungJun Noh, Yasser Abduallah, Hyomin Kim, Youra Shin, George Bizos, Haimin Wang, Jason T. L. Wang, New Jersey Institute of Technology, United States

Break **14:50**

GH1.6 **15:10**
Evaluation of different Machine Learning Models in Identifications of Flares with CMEs
Hemapriya Raju, Saurabh Das, IIT Indore, India

GH1.7 **15:30**
The Response Of Equivalent Ionospheric Currents To The External Drivers Using A Machine Learning Method
Xin Cao, Xiangning Chu, University of Colorado Boulder, United States; Jacob Bortnik, James Weygand, Jinxing Li, Homayon Aryan, Donglai Ma, University of California, Los Angeles, United States

GH1.8 **15:50**
Classification of high-latitude ionospheric scintillation signatures according to source region through Machine Learning
Anna-Marie Bals, Kshitija Deshpande, Embry-Riddle Aeronautical University, United States

Friday, January 13 13:10 - 14:50
H6 Special Session Room 155

Active Experiments in Space and Laboratory Plasmas II

Session Co-Chairs: Bill Amatucci, Naval Research Laboratory; Erik Tejero, US Naval Research Laboratory

H6.1 **13:10**
Generation of Artificial Spread-F over Arecibo Utilizing HF HeaterEE846503
Salih Mehmed Bostan, Bursa Technical University, Turkey; Julio V. Urbina, John D. Mathews, Penn State University, United States

H6.2 **13:30**
Laboratory Simulation of Lower Hybrid Turbulence Generation by the SMART Sounding Rocket
Alexander Hyde, Bill Amatucci, Naval Research Laboratory, United States

H6.3 **13:50**
"Clumpy" Langmuir waves: results from electron beam experiments on LAPD and supporting simulations
Vadim Roytershteyn, Seth Dorfman, Space Science Institute, United States; Haoran Xu, Gian Luca Delzanno, Quinn Marksteiner, Los Alamos National Laboratory, United States; Cynthia Cattell, Christopher Colpitts, University of Minnesota, United States; Jesus Perez, University of California, Los Angeles, United States

H6.4 **14:10**
Laboratory Wave Generation Studies with Application to Active Experiments
Seth Dorfman, Vadim Roytershteyn, Space Science Institute, United States; Jesus Perez, University of California, Los Angeles, United States; Gian Luca Delzanno, Quinn Marksteiner, Haoran Xu, Los Alamos National Laboratory, United States; Cynthia Cattell, Christopher Colpitts, University of Minnesota, United States

H6.5 **14:30**
Laboratory Investigation of Nonlinear Sub-cyclotron Damping
Erik Tejero, Ami DuBois, Lon Enloe, Chris Crabtree, US Naval Research Laboratory, United States; Jim Schroeder, Wheaton College, United States; Fred Skiff, University of Iowa, United States; Vijay Harid, University of Colorado Denver, United States

Friday, January 13 13:10 - 16:30
F3 Room 200

Point to Point Propagation Effects and Remote Sensing

Session Co-Chairs: Abby Anderson, Naval Research Laboratory DC; Katherine Mulreany, Naval Postgraduate School

F3.1 **13:10**
Evaluating the Effects of Digital Elevation Models and Land Use Land Cover Models on Radio Frequency Electromagnetic Propagation Modeling for Over Land Applications
Abby Anderson, Naval Research Laboratory, United States

F3.2 **13:30**
Understanding Propagation in the Stable Atmospheric Surface Layer: A Sensitivity Study
Katherine Mulreany, Qing Wang, Naval Postgraduate School, United States

F3.3 **13:50**
Remote Sensing of Refractivity Profiles, Using Approximated Large Eddy Simulations
Kessen Barrett, University of California, San Diego, United States; Peter Gerstoft, Ted Rogers, Scripps Institution of Oceanography, United States

F3.4 **14:10**
Global Sensitivity of X-Band Propagation to Refractivity and Sea State in a Turbulent Heterogenous Marine Atmospheric Surface Layer
Douglas Pastore, Erin Hackett, Coastal Carolina University, United States

F3.5 **14:30**
Investigating Statistical Meteorological Solvers for Surface Duct Forecasts Using a Multi-Year Dataset in the Potomac River Test Range
Elliot Shiben, Matt Wilbanks, Victor Wiss, Naval Surface Warfare Center Dahlgren Division, United States; Abby Anderson, Naval Research Laboratory, United States

Break **14:50**

F3.6 **15:10**
Effects of the Arctic Environment on RF Propagation
Zachary Burchfield, Thomas Hanley, Benjamin Sheppard, Marshall Jose, Hayden Williams, Johns Hopkins University Applied Physics Laboratory, United States

F3.7 **15:30**
Retrieval of Antarctic Firn Properties using Multi-Frequency Microwave Radiometry
Rahul Kar, Mustafa Aksoy, Dua Kaurejo, University at Albany, SUNY, United States

F3.8 **15:50**
Intercepted Snow Impacts on Boreal Forest Transmission at 2.4 GHz
Daniel Breton, U.S. Army Cold Regions Research and Engineering Laboratory, United States

F3.9 **16:10**
Reflectometry SAR Processing Criteria Analysis at P-band for Application in Mountainous Snow Regions
Xiaolan Xu, Simon Yueh, Rashmi Shah, Charles Reynerson, Steve Franklin, Jet Propulsion Laboratory, United States; Steve Margulis, University of California, Los Angeles, United States

Friday, January 13 13:10 - 14:50
F4 Room 245

Machine Learning Applications for Remote Sensing

Session Co-Chairs: Haonan Chen, Colorado State University; Branislav Notaros, Colorado State University

F4.1 **13:10**
A Self-attention based Deep Learning Model for Hurricane Nowcasting
Shun Yao, Haonan Chen, Venkatachalam Chandrasekaran, Colorado State University, United States

F4.2 **13:30**
Machine Learning Based Classification of Snowflake Geometries in Multi-Camera Observation Systems
Hein Thant, Branislav Notaros, Colorado State University, United States; Mikhail Zhizhin, Colorado School of Mines, United States

F4.3 **13:50**
AtmoSense Background Characterization
Samuel Austin, Andrew Silberfarb, David Stoker, Pablo Reyes, Leslie LaMarche, Anthony van Eyken, SRI International, United States

F4.4 **14:10**
Weather Radar Beam Blockage Correction Using Deep Learning
Songjian Tan, Haonan Chen, Shun Yao, V. Chandrasekaran, Colorado State University, United States

F4.5 **14:30**
Machine Learning for Polarimetric Radar Quantitative Precipitation Estimation
Liangwei Wang, Haonan Chen, Colorado State University, United States

Friday, January 13 13:10 - 17:10
J4 Special Session Room 265

Intensity Mapping at Millimeter and Sub-millimeter Wavelengths

Session Co-Chairs: Abigail Crites, Cornell; Garrett Keating, Smithsonian Astrophysical Observatory

J4.1 **13:10**
Astrophysics of High-Redshift Galaxy Formation Through the Lens of Millimeter-Wave Intensity Mapping
Guochao Sun, Northwestern University, United States; Tzu-Ching Chang, Jet Propulsion Laboratory, United States; Steven Furlanetto, University of California, Los Angeles, United States

J4.2 **13:30**
Illuminating Cosmic Evolution with sub-millimeter Intensity Mapping
Christopher Anderson, Philippe Berger, Olivier Dore, Tzu-Ching Chang, Jet Propulsion Laboratory, California Institute of Technology, United States

J4.3 **13:50**
TIME Commissioning Efforts and Preparations for Science Observations
Victoria Butler, TIME Collaboration, Cornell University, United States

J4.4 **14:10**
TIME Data Analysis Results for TES Detector Performance
Sukhman Singh, Cornell University, United States

J4.5 **14:30**
SPT-SLIM: A Line Intensity Mapping Pathfinder for the South Pole Telescope
Kirit Karkare, University of Chicago, United States

Break **14:50**

J4.6 **15:10**
On-Chip, Integral Field Spectrometers for SPT-SLIM and Future Instruments
Erik Shirokoff, University of Chicago, United States

J4.7 **15:30**
The Terahertz Intensity Mapper (TIM)
James Aguirre, Justin Bracks, Anthony Corso, University of Pennsylvania, United States; Charles Bradford, Reinier Janssen, Jet Propulsion Laboratory, United States; Brockton Brendal, Jeff Filippini, Jianyang Fu, Rong Nie, Vesal Razavimaleki, Joaquin Vieira, University of Illinois Urbana-Champaign, United States; Christopher Groppi, Dylan Joralmon, Philip Mauskopf, Talia Saeid, Arizona State University, United States; Steve Hailey-Dunsheath, Lun-Jun Liu, California Institute of Technology, United States; Ryan Keenan, Ian Lowe, Daniel Marrone, Evan Mayer, University of Arizona, United States; Isaac Trumper, Airy Optics, Inc., United States

J4.8 **15:50**
Line intensity mapping (LIM) with SPHEREx in near-infrared and its cross correlation with LIM observations in mm wavelengths
Jae Hwan Kang, California Institute of Technology, United States

J4.9 **16:10**
The CO Mapping Array Project: Early Science Results and Prospects for the Future
Delaney Dunne, Kieran Cleary, California Institute of Technology, United States; Dongwoo Chung, University of Toronto, Canada; Patrick Breysse, New York University, United States; Havard Tveit Ihle, University of Oslo, Norway

J4.10 **16:30**
A highly scalable readout system for COMAP with SOFTS
Ritoban Basu Thakur, Junhan Kim, California Institute of Technology, United States

J4.11 **16:50**
COMAP Galactic Plane Survey and AME studies
Liju Philip, Todd Gaier, Charles Lawrence, Jet Propulsion Laboratory, United States; Thomas Rennie, Stuart Harper, Clive Dickinson, Roke Cepeda- Arroita, University of Manchester, United Kingdom; Kieran Cleary, Delaney Dunne, Roberta Paladini, Timothy Pearson, Anthony Readhead, California Institute of Technology, United States; Richard Bond, Dongwoo Chung, University of Toronto, Canada; Jowita Borowska, Hans Kristian Eriksen, Marie Foss, Håvard Ihle, Jonas Lunde, Maren Rasmussen, Nils-Ole Stutzer, Duncan Watts, Ingunn Kathrine Wehus, University of Oslo, Norway; Patrick Breysse, New York University, United States; Morgan Catha, Richard Hobbs, James Lamb, David Woody, Owens Valley Radio Observatory, United States; Sarah Church, Stanford University, United States; Joshua Gundersen, University of Miami, United States; Andrew Harris, University of Maryland, United States; Brandon Hensley, Princeton University, United States

Friday, January 13 13:10 - 14:50
B7 Special Session Room 1B40

Multiscale and Stochastics Modeling in Computational Electromagnetics

Session Co-Chairs: Ata Zadehgol, University of Idaho; Johannes Russer, Technical University of Munich

B7.1 **13:10**
Machine Learning for Rectangular Waveguide Mode-Identification, Using 2D Modal Field Patterns
Brian Guiana, Ata Zadehgol, University of Idaho, United States

B7.2 **13:30**
Width Confinement in 3D Dielectric Waveguides and Comparison to 2D Analytical Models
Brian Guiana, Ata Zadehgol, University of Idaho, United States

B7.3 **13:50**
Circuits for Josephson Parametric Amplification in Quantum Radar
Johannes Russer, Michael Würth, Wolfgang Utschick, Technical University of Munich, Germany; Florian Bischeltsrieder, Markus Peichl, German Aerospace Centre (DLR), Germany

B7.4 **14:10**
Near-Field Sampling Considerations for the Propagation of Stochastic Electromagnetic Fields
Michael Haider, Johannes Russer, Technical University of Munich, Germany

B7.5 **14:30**
The Significance of Nearby-term Approximation in Method of Moments: An Observation in 2D Electrodynamic Scenarios with TE Polarization
Yusheng Luo, Junbo Wang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

Friday, January 13 15:10 - 16:30
C2 Room 150

Advances in Software Defined and Adaptive Radio Systems

Session Co-Chairs: John L. Volakis, Florida International University; John Carilli, AFRL

C2.1 **15:10**
Digital receiver modernization using FPGA and JESD204B interface for SDR applications
Joaquin Verastegui, John Rojas, Isaac Tupac, Luis Gonzales, Jicamarca Radio Observatory, Peru

C2.2 **15:30**
Frequency Response Synthesis of Parametric Converters Using Field Programmable Josephson Amplifier
Jose Antonio Estrada, Florent Lecocq, Joe Aumentado, NIST, United States

C2.3 **15:50**
Digital Predistorter for Linearizing Digital-RF Transmitter/Receiver Using Radio-Frequency System-On-Chip (RFSoC) FPGA
Kefayet Ullah, Satheesh Venkatakrishnan, John L. Volakis, Florida International University, United States

C2.4 **16:10**
Deep Learning Based Oblique Ionogram Signal Extraction
John Carilli, Tyler Hussey, Eugene Dao, Air Force Research Laboratory, United States

Friday, January 13 15:10 - 17:10
GH2 Special Session Room 155

Meteors, Orbital Debris and Dusty Plasmas

Session Co-Chairs: Alex Fletcher, Naval Research Laboratory; Liane Tarnecki, University of Colorado Boulder

GH2.1 **15:10**
Interstellar Dust in Our Own Backyard
Shivank Chadda, University of Colorado Boulder, United States; David Malaspina, Laboratory for Atmospheric and Space Physics, United States

GH2.2 **15:30**
Solitons Generated by Orbital Debris and Meteoroids Immersed in Space Plasmas
Alex Fletcher, Chris Crabtree, Gurudas Ganguli, Naval Research Laboratory, United States

GH2.3 **15:50**
Investigating very-low-frequency radio emissions from meteors
Paraksh Vankawala, Robert Marshall, University of Colorado Boulder, United States; Denis Vida, Peter Brown, Western University, United States

GH2.4 **16:10**
Fully Polarimetric Meteor Radar
John Marino, Nicholas Rainville, Scott Palo, University of Colorado Boulder, United States

GH2.5 **16:30**
Initial Calibration and Operation of the Colorado Zephyr Meteor Radar Network
Nicholas Rainville, John Marino, Scott Palo, University of Colorado Boulder, United States

GH2.6 **16:50**
Improving the Physical Accuracy of 3D Meteor Plasma Simulation to Inform High-Power Radar Observations of Meteors
Trevor Hedges, Joseph Ferguson, Nicolas Lee, Sigrid Elschot, Stanford University, United States; Meers Oppenheim, Boston University, United States; Glenn Sugar, Johns Hopkins University Applied Physics Laboratory, United States

Friday, January 13 15:10 - 17:10
J5 Special Session Room 245

Space-based Radio Astronomy on Small Platforms

Session Co-Chairs: Joseph Lazio, Jet Propulsion Laboratory, California Institute of Technology; Kari Haworth, Harvard-Smithsonian Center for Astrophysics

J5.1 **15:10**
The Lunar Surface Electromagnetics Experiment – LuSEE 'Night'
Stuart Bale, University of California, Berkeley, United States

J5.2 **15:30**
AERO-VISTA: Observing Earth's Low Frequency Radio Aurora with Twin CubeSats, Laying the Groundwork for an In-Space Low Frequency Radio Observatory
Mary Knapp, Philip Erickson, Frank Lind, Ryan Volz, John Swoboda, Allan Weatherwax, MIT Haystack Observatory, United States; James LaBelle, Dartmouth College, United States; Frank Robey, Alan Fenn, Bradley Perry, Mark Silver, MIT Lincoln Laboratory, United States; Rebecca Masterson, Kerri Cahoy, Nicholas Belsten, Cadence Payne, Kristen Ammons, Massachusetts Institute of Technology, United States; Benjamin Malphrus, Morehead State University, United States

J5.3 **15:50**
A roadmap to experimental development of space-based low frequency cosmology instruments
Daniel Jacobs, Yifan Zhao, Judd Bowman, Titu Samson, Arizona State University, United States

J5.4 **16:10**
Absolute Flux Density Measurements Below 20 MHz: The Instrument Error Budget
Julie Rolla, Andrew Romero-Wolf, Joseph Lazio, Jet Propulsion Laboratory, United States

J5.5 **16:30**
Space-like testing of 21-cm cosmology instruments on balloons and beyond
Yifan Zhao, Daniel Jacobs, Judd Bowman, Titu Samson, Arizona State University, United States

J5.6 **16:50**
Adapting the EDGES receiver for space-based global 21cm measurements
Titu Samson, Judd Bowman, Daniel Jacobs, Nivedita Mahesh, Steven Murray, Akshatha Vydula, Arizona State University, United States; Alan Rogers, Rigel Cappallo, John Barrett, Massachusetts Institute of Technology, United States; Raul Monsalve, University of California, Berkeley, United States; Peter Sims, McGill University, Canada

Friday, January 13 15:10 - 16:50
B8 Special Session Room 1B40

Complex EM and Meta Structures

Session Co-Chairs: Filippo Capolino, University of California Irvine; Juan Gomez Diaz, University of California Davis

B8.1 **15:10**
Symmetric high-Q metasurface enabled by bound states in the continuum
Hayk Harutyunyan, Emory University, United States

B8.2 **15:30**
Hexagonal Pixels Facilitating Topological Design of 2-bit 2-switch Phase-Reconfigurable Unit Cells
Junbo Wang, Botian Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

B8.3 **15:50**
Inverse design of compound metagratings with asymmetric transmission through diffraction order engineering
Abbas Sheikh Ansari, Behrad Gholipour, Ashwin K. Iyer, University of Alberta, Canada

B8.4 **16:10**
Tailoring Cherenkov Radiation on Drift-biased Graphene-based Hyperbolic Metasurfaces
Luqi Wang, J. Sebastian Gomez-Diaz, University of California, Davis, United States

B8.5 **16:30**
Design and Investigation of a Quadratic Cross Fractal for Use as an Electromagnetic Bandgap Structure for Suppression of Surface Waves
Annette Droddy, Steven Weiss, Johns Hopkins Universtiy, United States

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