

**2023 United States National
Committee of URSI National
Radio Science Meeting
(USNC-URSI NRSM 2023)**

**Boulder, Colorado, USA
10 – 14 January 2023**



**IEEE Catalog Number: CFP23USN-POD
ISBN: 978-1-6654-7642-3**

**Copyright © 2023, U. S. National Committee for the International Union of Radio
Science (USNC-URSI)
All Rights Reserved**

****** This is a print representation of what appears in the IEEE Digital
Library. Some format issues inherent in the e-media version may also
appear in this print version.***

IEEE Catalog Number:	CFP23USN-POD
ISBN (Print-On-Demand):	978-1-6654-7642-3
ISBN (Online):	978-1-946815-18-7

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

B1* : ANTENNAS FOR PLANETARY EXPLORATION

B1*.1: DESIGN, DEVELOPMENT AND TESTING OF NASA'S DART RADIAL LINE SLOT ARRAY ANTENNA 1

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

B1*.2: ADDITIVE MANUFACTURED ANTENNA FOR NASA'S INTERSTELLAR MAPPING AND ACCELERATION PROBE (IMAP) 3

Avinash Sharma, Carl Carpenter, Steve Szczesniak, Johns Hopkins University Applied Physics Laboratory, United States

B1*.3: DESIGN, DEVELOPMENT AND TESTING OF NASA'S EUROPA CLIPPER HIGH GAIN ANTENNA 5

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

B1*.4: ALL-METAL ANTENNAS FOR LUNAR EXPLORATION 7

Rainee N. Simons, Michael Zemba, Marie Piasecki, Taylor Pember, Sarah M. Dever, Felix Miranda, NASA, United States

B1*.5: LOW COST HIGH GAIN ANTENNA FABRICATION AND TESTING FOR MARS ESCAPE 9

Katherine Wolff, Matthew Bray, John Schellhase, Christopher Haskins, Johns Hopkins University Applied Physics Laboratory, United States

F1: PROPAGATION AND REMOTE SENSING IN COMPLEX AND RANDOM MEDIA

F1.3: 3-D BISTATIC SCATTERING FROM FRACTAL SURFACE USING EXTENDED BOUNDARY CONDITION METHOD 33

Ming Li, Roger Lang, George Washington University, United States; Rafael Rincon, National Aeronautics and Space Administration, United States

F1.8: 3-LAYER RADAR SOUNDER MODEL FOR THE DETECTION OF BURIED ICE DEPOSITS UNDER MARTIAN REGOLITH 39

Jiaxing Yang, Roger Lang, George Washington University, United States; Rafael Rincon, James Garvin, David Hollibaugh-Baker, NASA, United States

F1.10: A DISCONTINUOUS GALERKIN METHOD FOR SOLVING RADIATIVE TRANSFER EQUATION WITH SEMITRANSSPARENT BOUNDARY CONDITIONS 42

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

B3* : LOW-PROFILE MILLIMETER-WAVE/TERAHERTZ ANTENNAS FOR MOBILE AND SPACE APPLICATIONS

B3*.2: A WIDEBAND DUAL LINEAR/CIRCULAR POLARIZED 64-ELEMENT PHASED ARRAY ANTENNA FOR SATCOM APPLICATIONS 60

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: A NEW ANALYTICALLY DESIGNED UWB MICROSTRIP PATCH ANTENNA FOR FUTURE 5G AND 6G APPLICATIONS	62
<i>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</i>	
B3*.4: FLAT-PANEL WIDEBAND DUAL-CIRCULARLY POLARIZED 8X8 PHASED ARRAY ANTENNA FOR SATCOM APPLICATIONS	64
<i>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</i>	
B3*.5: PROGRAMMABLE LIQUID MICROWAVE GRIN LENS	66
<i>Jonathan Lundquist, Lauren Linkous, Erdem Topsakal, Virginia Commonwealth University, United States</i>	
B3*.8: RECONFIGURABLE THZ 1-D LEAKY-WAVE ANTENNA BASED ON LIQUID CRYSTALS AND A PARTIALLY REFLECTING SURFACE	70
<i>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</i>	
B2* : NOVEL ELECTRICALLY SMALL ANTENNAS AND MATCHING NETWORKS	
B2*.4: INCREASING THE EFFICIENCY-BANDWIDTH OF SMALL ANTENNAS BY COUPLING RADIATIVE AND NON-RADIATIVE MODES USING TIME-VARIATION	77
<i>Zachary Fritts, Steve Young, Anthony Grbic, University of Michigan, United States; Cody Scarborough, University of Colorado Boulder, United States</i>	
B2*.5: NON-LTI ELECTRICALLY SMALL ANTENNA SYSTEM TO TRANSMIT AN ARBITRARY WAVEFORM	79
<i>Majid Manteghi, Virginia Tech, United States</i>	
K1: APPLICATIONS OF BIOELECTROMAGNETICS	
K1.1: A STUDY ON APPLICABILITY OF USING FERROMAGNETIC MATERIALS TO REDUCE RF-INDUCED HEATING IN EXTERNAL FIXATION SYSTEMS	81
<i>Ananya Nandikanti, Jianfeng Zheng, Wei Hu, Ji Chen, University of Houston, United States</i>	
B4: ANTENNA THEORY AND DESIGN	
B4.2: INVESTIGATION OF FEEDING, SHAPING, AND STACKING TECHNIQUES ON CIRCULARLY POLARIZED PATCH ANTENNAS	88
<i>Anastasiia Rozhkova, Alex Christopher Stutts, Danilo Erricolo, University of Illinois Chicago, United States</i>	
B4.5: A COMPARISON OF TWO METHODS FOR DEFINING THE REFLECTION COEFFICIENT	92
<i>Raymond Sprungle, University of Colorado Boulder / Battelle Memorial Institute, United States; Edward Kuester, University of Colorado Boulder, United States</i>	
B4.6: TAILORED ELECTROMAGNETIC PROPERTIES OF LIGHT WEIGHT NANOCOMPOSITES	94
<i>Kate Duncan, United States Army, Armament Graduate School, United States; John Burpo, United States Military Academy, United States</i>	

B4.9: ENHANCED SELF-INTERFERENCE CANCELLATION IN A DUAL-FED CIRCULARLY POLARIZED ANTENNA ARRAY VIA HYBRID AND QUADRATURE COUPLING	98
<i>Alex Stutts, Anastasiia Rozhkova, Seiran Khaledian, Farhad Farzami, Danilo Erricolo, University of Illinois Chicago, United States</i>	
A1: ANTENNAS AND PROPAGATION	
A1.3: A NOVEL GENETIC ALGORITHM BASED METHOD FOR MEASURING COMPLEX PERMITTIVITY OF THIN SAMPLES IN THE COMPACT RADAR FREQUENCY BAND	116
<i>Sunny Zhang, Magdy Iskander, Zhengqing Yun, Edmond Chong, Yuanzhang Xiao, Matthew Nakamura, Joseph Brown, Benjamin Jones, University of Hawaii at Manoa, United States</i>	
A1.4: LAND USE AND THE CHARACTER OF URBAN RADIO-FREQUENCY NOISE IN A SMALL CITY	118
<i>Daniel Breton, Aaron Meyer, U.S. Army Engineer Research and Development Center, United States</i>	
A1.5: CHARACTERIZATION OF ATMOSPHERIC VARIABILITY ON LONG RANGE 3.4 GHZ PROPAGATION	120
<i>Ann Vanleer, Christopher Anderson, United States Naval Academy, United States</i>	
K2* : WIRELESS POWER TRANSFER TECHNIQUES FOR BIOMEDICAL APPLICATIONS	
K2*.2: EXTENDED RANGE WIRELESS POWER TRANSFER WITH INKJET PRINTED THIN-FILM FLEXIBLE LOOP COILS	123
<i>Bashir Morshed, Mst Moriom Momota, Mahfuzur Rahman, Texas Tech University, United States</i>	
J2: NEW TELESCOPES, TECHNIQUES, AND TECHNOLOGIES I	
J2.6: A WATER VAPOR RADIOMETER FOR THE CO MAPPING ARRAY PROJECT (COMAP)	133
<i>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</i>	
BK1* : WEARABLE ANTENNAS FOR WIFI, IOT, AND 5G APPLICATIONS	
BK1*.2: DESIGN AND SAR ANALYSIS OF A MEANDER SLOT ANTENNA FOR BACKSCATTERING RFID APPLICATIONS	141
<i>Karthik Kakaraparty, Ifana Mahbub, University of Texas at Dallas, United States</i>	
BK1*.5: TEXTILE PATCH ANTENNA SURROGATE-BASED OPTIMIZATION: KRIGING SURROGATE MODELING ON EQUIVALENT CIRCUIT COMPONENTS	145
<i>Botian Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States; Lingnan Song, Beihang University, China</i>	
BK1*.8: ULTRA THIN DUAL-POLARIZED FLEXIBLE CAVITY SLOT ANTENNA FOR THE 5G COMMUNICATION	149
<i>Behzad Ashrafi Nia, Franco De Flaviis, University of California, Irvine, United States; Soheil Saadat, Mflex, United States</i>	

E1: ELECTROMAGNETIC INTERFERENCE

E1.7: TEST AND ANALYSIS OF ELECTROMAGNETIC SENSITIVE EFFECTS IN RESOLVER SYSTEM 171

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

B5: NUMERICAL ELECTROMAGNETICS

B5.1: FREQUENCY BEAMFORMING-ENHANCED DBIM FOR LIMITED-APERTURE QUANTITATIVE IMAGING 173

Scott Ziegler, Matthew Burfeindt, Naval Research Laboratory, United States

B5.2: SPECTRAL RECURSIVE APPROACH TO THE TIME-DOMAIN INVERSE KERNEL 175

Thomas Liebau, Majid Manteghi, Virginia Tech, United States

B5.4: SIMULATING A COMPUTER-GENERATED WAVEGUIDE HOLOGRAM SCATTERING PROBLEM WITH AN ARTIFICIAL 2D GAUSSIAN BEAM SOURCE 178

Ligang Sun, David De Vocht, Roeland Dilz, Martijn van Beurden, Eindhoven University of Technology, Netherlands

H4 *: HELIOSPHERIC OBSERVATIONS OF WAVES IN PLASMAS

H4 *.2: LF/HF INTERFEROMETRY IN LOW EARTH ORBIT USING ELECTROMAGNETIC VECTOR SENSORS: THE AERO-VISTA MISSION 187

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

H5 *: ACTIVE EXPERIMENTS IN SPACE AND LABORATORY PLASMAS I

H5 *.3: EXPERIMENTAL INVESTIGATION OF TECHNIQUES TO MEASURE COLD ELECTRONS IN THE MAGNETOSPHERE N/A

Carlos Maldonado, Gabriel Wilson, Pedro Resendiz Lira, Gian Luca Delzanno, Los Alamos National Laboratory, United States

F2: MICROWAVE AND MILLIMETER-WAVE REMOTE SENSING

F2.7: PRECIPITATION RETRIEVAL USING ABI AND GLM MEASUREMENTS ON THE GOES-R SERIES 214

Yifan Yang, Haonan Chen, Kyle Hilburn, Colorado State University, United States

F2.8: SIMULTANEOUS OBSERVATIONS OF PRECIPITATION FROM A VERTICALLY POINTING S-BAND PROFILER RADAR AND A HORIZONTALLY LOOKING C-BAND DUAL POLARIZATION RADAR: A MICROPHYSICAL PERSPECTIVE 216

Sounak Biswas, Adubi Tunde, V Chandrasekar, Colorado State University, United States; Robert Cifelli, NOAA Physical Sciences Laboratory, United States

F2.9: UNCERTAINTY QUANTIFICATION OF MULTI-SATELLITE PRECIPITATION PRODUCTS WITH DEEP LEARNING: A CASE STUDY OVER TAIWAN 218

Liping Wang, Haonan Chen, Colorado State University, United States; Yun-Lan Chen, Chia-Rong Chen, CWB, Taiwan; Wen-Wei (Tony) Liao, NOAA, United States

C1: MACHINE LEARNING IN RADAR, REMOTE SENSING, AND ANTENNAS

C1.1: A COMPACT AND LIGHT-WEIGHT GROUND PENETRATING RADAR SYSTEM FOR UNMANNED AERIAL VEHICLES 221

Alan Salari, Danilo Erricolo, University of Illinois Chicago, United States; Giuseppe Esposito, Ilaria Catapano, Francesco Soldovieri, Institute for Electromagnetic Sensing of the Environment, Italy

C1.3: ENABLING LOW-POWER RADIOMETERS WITH MACHINE LEARNING CALIBRATION 224

John Bradburn, Mustafa Aksoy, University at Albany, SUNY, United States; Paul Racette, NASA Goddard Space Flight Center, United States

C1.4: OPTIMIZING MACHINE LEARNING ALGORITHMS FOR DYNAMIC DIRECTION FINDING 226

John Willis, Satheesh Venkatakrishnan, Florida International University, United States; John L. Volakis, Dean/Florida International University, United States

C1.6: AUTOMATED ANTENNA CALCULATION, DESIGN AND TUNING TOOL FOR HFSS..... 229

Lauren Linkous, Erwin Karincic, Erdem Topsakal, Virginia Commonwealth University, United States

J3: NEW TELESCOPES, TECHNIQUES, AND TECHNOLOGIES II

J3.4: REAL-TIME RFI EXCISION AT THE VERY LARGE ARRAY..... 236

Brian Svoboda, Paul Demorest, Ken Sowinski, Emmanuel Momjian, Vivek Dhawan, Bruce Rowen, Rich Moeser, NRAO, United States

B6* : ANTENNAS AND SYSTEMS FOR SPECIALIZED PLATFORMS AND ENVIRONMENTS

B6*.3: CPW-FED COMPACT CIRCULARLY POLARIZED FLEXIBLE ANTENNA FOR C BAND APPLICATIONS 246

Abdul Rakib Hossain, Tutku Karacolak, Washington State University Vancouver, United States

B6*.4: UHF/VHF TIGHTLY COUPLED DIPOLE ARRAY FOR CUBESAT-BASED SPACEBORNE ICE SOUNDING RADAR 248

Muhammad Mubasshir Hossain, Stavros Koulouridis, Satheesh Bojja-Venkatakrishnan, John L. Volakis, Florida International University, United States

B6*.6: A SHORTED-ANNULAR-RING GPS ANTENNA FOR FREIGHT-CARRYING AUTONOMOUS RAIL VEHICLES 251

Tianjian Huang, Anastasios Papathanasopoulos, Yahya Rahmat-Samii, University of California, Los Angeles, United States

B6*.8: RECONFIGURABLE INTELLIGENT SURFACES FOR ADAPTIVE NULLING AND BEAM STEERING USING 1-BIT TOPOLOGY 254

Tatiana Valera, Satheesh Venkatakrishnan, Arjuna Madanayake, John L. Volakis, Florida International University, United States

B6*.10: ELECTRIC CHARACTERIZATION OF SANDCAST FOR USE IN RADIO FREQUENCY IMAGING 345

Jamison Ehlers, Bryce Hill, Kevin Negus, Montana Technological University, United States

K3* : ELECTROMAGNETIC-BASED TECHNOLOGIES FOR HEALTH: TREATMENT, DETECTION, AND MONITORING

K3*.1: PRELIMINARY INVESTIGATION OF COAXIAL PROBE-BASED DIELECTRIC MAPPING OF INHOMOGENEOUS TISSUE STRUCTURES 257

Ali Farshkaran, Helen Liu, Emily Porter, University of Texas at Austin, United States

K3*.5: CLINICALLY INFORMED HEMORRHAGE PHANTOMS FOR MICROWAVE-BASED STROKE DETECTION	262
<i>Jared Culpepper, Spencer Denton, Gina Perkins, Ryan Liu, Hannah Lee, Emily Porter, University of Texas at Austin, United States</i>	

GH1* : MACHINE LEARNING TECHNIQUES FOR NEAR-EARTH SPACE SCIENCES

GH1*.2: A METHODOLOGY TO PREDICT THE GEOMAGNETIC FIELD: A PRELIMINARY ANALYSIS USING DATA FROM POLAR ZONE IN CANADA	265
<i>Kevin Forbes, Energy and Environmental Data Analysis, Ireland</i>	

GH1*.4: THE EVOLUTION AND PROPAGATION OF CHORUS WAVES BY A MACHINE LEARNING-BASED MODEL	268
<i>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</i>	

GH1*.6: EVALUATION OF DIFFERENT MACHINE LEARNING MODELS IN IDENTIFICATIONS OF FLARES WITH CMES	N/A
<i>Hemapriya Raju, Saurabh Das, IIT Indore, India</i>	

F3: POINT TO POINT PROPAGATION EFFECTS AND REMOTE SENSING

F3.8: INTERCEPTED SNOW IMPACTS ON BOREAL FOREST TRANSMISSION AT 2.4 GHZ	289
<i>Daniel Breton, U.S. Army Cold Regions Research and Engineering Laboratory, United States</i>	

F4: MACHINE LEARNING APPLICATIONS FOR REMOTE SENSING

F4.1: A SELF-ATTENTION BASED DEEP LEARNING MODEL FOR HURRICANE NOWCASTING	292
<i>Shun Yao, Haonan Chen, Venkatachalam Chandrasekaran, Colorado State University, United States</i>	

F4.4: WEATHER RADAR BEAM BLOCKAGE CORRECTION USING DEEP LEARNING	296
<i>Songjian Tan, Haonan Chen, Shun Yao, V. Chandrasekaran, Colorado State University, United States</i>	

F4.5: MACHINE LEARNING FOR POLARIMETRIC RADAR QUANTITATIVE PRECIPITATION ESTIMATION	298
<i>Liangwei Wang, Haonan Chen, Colorado State University, United States</i>	

B7* : MULTISCALE AND STOCHASTICS MODELING IN COMPUTATIONAL ELECTROMAGNETICS

B7*.1: MACHINE LEARNING FOR RECTANGULAR WAVEGUIDE MODE-IDENTIFICATION, USING 2D MODAL FIELD PATTERNS	311
<i>Brian Guiana, Ata Zadehgo, University of Idaho, United States</i>	

B7*.2: WIDTH CONFINEMENT IN 3D DIELECTRIC WAVEGUIDES AND COMPARISON TO 2D ANALYTICAL MODELS	313
<i>Brian Guiana, Ata Zadehgo, University of Idaho, United States</i>	

B7*.3: CIRCUITS FOR JOSEPHSON PARAMETRIC AMPLIFICATION IN QUANTUM RADAR	315
<i>Johannes Russer, Michael Würth, Wolfgang Utschick, Technical University of Munich, Germany; Florian Bischeltsrieder, Markus Peichl, German Aerospace Centre (DLR), Germany</i>	

B7*.4: NEAR-FIELD SAMPLING CONSIDERATIONS FOR THE PROPAGATION OF STOCHASTIC ELECTROMAGNETIC FIELDS 317

Michael Haider, Johannes Russer, Technical University of Munich, Germany

B7*.5: THE SIGNIFICANCE OF NEARBY-TERM APPROXIMATION IN METHOD OF MOMENTS: AN OBSERVATION IN 2D ELECTRODYNAMIC SCENARIOS WITH TE POLARIZATION 319

Yusheng Luo, Junbo Wang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

C2: ADVANCES IN SOFTWARE DEFINED AND ADAPTIVE RADIO SYSTEMS

C2.1: DIGITAL RECEIVER MODERNIZATION USING FPGA AND JESD204B INTERFACE FOR SDR APPLICATIONS 321

Joaquin Verastegui, John Rojas, Isaac Tupac, Luis Gonzales, Jicamarca Radio Observatory, Peru

B8* : COMPLEX EM AND META STRUCTURES

B8*.2: HEXAGONAL PIXELS FACILITATING TOPOLOGICAL DESIGN OF 2-BIT 2-SWITCH PHASE-RECONFIGURABLE UNIT CELLS 339

Junbo Wang, Botian Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States