

# Program

## Session B01: Analytical and semi-analytical methods

Tuesday, May 28 08:20-09:40, Room B

Session Chairs: Silvestar Sesnic, *FESB, University of Split*; Gabriele Gradoni, *University of Nottingham*

### 08:20 B01-1 TRANSIENT IMPEDANCE OF THE HORIZONTAL GROUNDING ELECTRODE: SENSITIVITY ANALYSIS OF THE DIRECT TIME DOMAIN ANALYTICAL SOLUTION

Silvestar Sesnic\*<sup>1</sup>, Dragan Poljak<sup>1</sup>, Anna Susnjara<sup>1</sup>, Sebastien Lallechere<sup>2</sup>, Khalil El Khamlichi Drissi<sup>2</sup>

<sup>1</sup>*FESB, University of Split, Split, CROATIA*

<sup>2</sup>*Institut Pascal, Université Clermont Auvergne, Clermont-Ferrand, FRANCE*

### 08:40 B01-2 THEORETICAL AND EXPERIMENTAL INCIDENT FIELD DOSIMETRY FOR GSM BASE STATIONS

Marin Galic\*<sup>1</sup>, Dragan Poljak<sup>2</sup>

<sup>1</sup>*Environment Measurement Center LTD, Zagreb, CROATIA*

<sup>2</sup>*University of Split, Split, CROATIA*

### 09:00 B01-3 PHASE-SPACE REPRESENTATION OF THE WAVE FIELDS REFLECTED BY RANDOM ROUGH SURFACES

Valon Blakaj\*, Stephen C. Creagh, Gabriele Gradoni, Gregor Tanner

*Mathematical Sciences, University of Nottingham, Nottingham, UNITED KINGDOM*

### 09:20 B01-4 FUNDAMENTAL PROPERTIES OF MIE RESONANCES IN WATER CYLINDERS - TM AND TE CASE STUDIES

Rasmus E. Jacobsen\*<sup>1</sup>, Samel Arslanagic<sup>2</sup>, Andrei V. Lavrinenko<sup>1</sup>

<sup>1</sup>*Department of Photonics Engineering, Technical University of Denmark, Kongens Lyngby, DENMARK*

<sup>2</sup>*Department of Electrical Engineering, Technical University of Denmark, Kongens Lyngby, DENMARK*

## Session C01: Partial differential equation methods

Tuesday, May 28 09:20-10:40, Room C

Session Chairs: Stephane Lanteri, *Inria*; Thomas Rylander, *Chalmers University of Technology*

**09:20 C01-1 HYBRID TECHNIQUES FOR THE FINITE ELEMENT METHOD BASED ON NITSCHÉ'S METHOD**

Thomas Rylander\*

*Chalmers University of Technology, Göteborg, SWEDEN*

**09:40 C01-2 SPECTRAL NUMERICAL GREEN'S FUNCTION BASED EIGENANALYSIS FOR CAVITY PERTURBATIONS**

Hui H. Gan\*<sup>1</sup>, Qi I. Dai<sup>1</sup>, Tian Xia<sup>1</sup>, Qin S. Liu<sup>2</sup>, Weng C. Chew<sup>3</sup>

<sup>1</sup>*ECE, University of Illinois at Urbana-Champaign, Urbana, IL*

<sup>2</sup>*EEE, The University of Hong Kong, Pokfulam, Hong Kong, CHINA*

<sup>3</sup>*ECE, Purdue University, West Lafayette, IN*

**10:00 C01-3 TRANSIENT ANTENNA PATTERNS BASED ON THE ANTENNA EQUATION**

Everett G. Farr\*

*Farr Fields, LC, Albuquerque*

**10:20 C01-4 HIGH ORDER DGTD SOLVERS FOR NANOSCALE LIGHT-MATTER INTERACTIONS**

Stephane Lanteri\*, Alexis Gobé, Jonathan Viquerat, Nikolaï Schmitt, Claire Scheid

*Côte d'Azur University, Inria, CNRS, LJAD., Sophia Antipolis, FRANCE*

**Session D01: Multi-band and wideband antennas and antenna measurements**

Tuesday, May 28 09:20-10:40, Room D

Session Chairs: Satish Sharma, *San Diego State University*; Kristopher Buchanan, *SSC Pacific*

**09:20 D01-1 DESIGN OF HYBRID WIRELESS POWER TRANSFER AND DUAL ULTRAHIGH-FREQUENCY ANTENNA SYSTEM**

Mohammad Haerinia\*, Sima Noghianian

*University of North Dakota, Grand Forks*

**09:40 D01-2 HEXAGONAL ORIGAMI DUAL FREQUENCY ANTENNA**

David Rohde<sup>1</sup>, Sima Noghianian\*<sup>1</sup>, Yi-hsiang Chang<sup>2</sup>, Satish Sharma<sup>3</sup>

<sup>1</sup>*Schools of Electrical Engineering and Computer Science, University of North Dakota, Grand Forks, ND*

<sup>2</sup>*Department of Technology, Illinois State University, Normal, IL*

<sup>3</sup>*Department of Electrical and Computer Engineering, San Diego State University, San Diego, CA*

**10:00 D01-3 MODELLING AND SIMULATION OF ONBOARD WIRE ANTENNAS FOR A 3U CUBESAT USING COMPUTATIONAL ELECTROMAGNETICS (CEM) SOFTWARE**

Umang Garg\*, Rutwik N. Jain

*Electronics and Instrumentation, Birla Institute of Technology and Science, Pilani, Pilani, Rajasthan, INDIA*

**10:20 D01-4 PACIFIC OCEAN HF NOISE DISTRIBUTIONS OFF SOUTHERN CALIFORNIA**

Kristopher R. Buchanan\*, Lu Xu, Chris Dilay, David Hilton

*Electromagnetics Technology Branch, SSC Pacific, San Diego CA*

**Session E01: Memorial Session for Prof. Dennis P. Nyquist-I**

Tuesday, May 28 09:20-10:40, Room E

Session Conveners: George Hanson, *University of Wisconsin Milwaukee*; Michael Havrilla, *Air Force Institute of Technology*

Session Chairs: Michael Havrilla, *Air Force Institute of Technology*; George Hanson, *University of Wisconsin Milwaukee*

**09:20 E01-1 (Invited) CHARACTERIZATION OF CONDUCTOR-BACKED ABSORBING MATERIALS USING A BOTTOM-FILLED RECTANGULAR WAVEGUIDE**

Edward J. Rothwell\*, Saranraj Karuppuswami

*Electrical and Computer Engineering, Michigan State University, East Lansing, MI*

**09:40 E01-2 (Invited) SCALAR POTENTIAL DEPOLARIZING DYAD ARTIFACT IN BI-ISOTROPIC MEDIA**

Michael J. Havrilla\*

*Air Force Institute of Technology, Wright-Patterson AFB, Ohio*

**10:00 E01-3 (Invited) THE ROLE OF THE STEEPEST-DESCENT PATH IN ELECTROMAGNETICS**

David R. Jackson\*<sup>1</sup>, Francisco Mesa<sup>2</sup>

<sup>1</sup>*ECE, University of Houston, Houston, TX*

<sup>2</sup>*Applied Physics I, University of Seville, Seville, SPAIN*

**10:20 E01-4 (Invited) ELECTROQUASISTATIC AND MAGNETOQUASISTATIC EQUATIONS AND FIELDS**

Arthur D. Yaghjian\*

*Electromagnetics Research Consultant, Concord, MA*

**Session B02: Novel mathematical methods in electromagnetics - I**

Tuesday, May 28 13:00-15:20, Room B

Session Conveners: Kazuya Kobayashi, *Chuo University*; Yury Shestopalov, *Faculty of Engineering and Sustainable Development, University of Gävle*

Session Chairs: Kazuya Kobayashi, *Chuo University*; Yury Shestopalov, *Faculty of Engineering and Sustainable Development, University of Gävle*

**13:00 B02-1 (Invited) A NOVEL MODIFIED SILICON MICROMACHINING PROCESS WITH NEAR-ZERO DIELECTRIC LOSS FOR HIGH-EFFICIENCY ANTENNA DESIGN UP TO TERAHERTZ BAND**

Yue Li\*, Peiqin Liu, Zhijun Zhang

*Tsinghua University, Beijing, CHINA*

**13:20 B02-2 (Invited) DESIGN OF 3D PLANAR CAUSTIC BEAMS IN THE FREQUENCY AND THE TIME DOMAINS**

Timor Melamed\*

*Ben-Gurion University, Beer Sheva, ISRAEL*

**13:40 B02-3 (Invited) DIFFUSION OF LIGHT IN BOUNDED RANDOM MEDIA**

Valentin Freilikher\*<sup>1</sup>, Yuri Bliokh<sup>1</sup>, Chushun Tian<sup>2</sup>

<sup>1</sup>*Department of Physics, Bar Ilan University, Israel, Ramat Gan, ISRAEL*

<sup>2</sup>*Department of Physics, Technion-Israel Institute of Technology, Israel, Haifa, ISRAEL*

**14:00 B02-4 (Invited) ELECTROMAGNETIC SCATTERING BY THREE STAGGERED AND UNEVENLY SPACED TRUNCATED HALF-PLANES**

Piergiorgio L. E. Uslenghi<sup>1</sup>, Marco D. Poort\*<sup>1</sup>, Vito G. Daniele<sup>2</sup>

<sup>1</sup>*University of Illinois at Chicago, Chicago, Illinois*

<sup>2</sup>*Politecnico di Torino, Torino, ITALY*

**14:20 B02-5 (Invited) DESIGN AND OPTIMIZATION OF ULTRA-COMPACT SUBSTRATE INTEGRATED WAVEGUIDE FILTERS**

Guga Burduli\*<sup>1</sup>, Arkadi Akopian<sup>1</sup>, Vakhtang Jandieri<sup>2</sup>, Daniel Erni<sup>2</sup>

<sup>1</sup>*School of Mathematics and Computer Sciences, Free University of Tbilisi, Tbilisi, GEORGIA*

<sup>2</sup>*General and Theoretical Electrical Engineering (ATE), Faculty of Engineering, Duisburg-Essen University, Duisburg, GERMANY*

**14:40 B02-6 (Invited) APPLICATION OF THE METHOD OF FRACTIONAL DERIVATIVES TO THE SOLUTION OF THE PROBLEM OF PLANE WAVE DIFFRACTION BY TWO AXISYMMETRIC STRIPS OF DIFFERENT SIZES**

Kamil Karacuha\*<sup>1</sup>, Eldar Veliyev<sup>1,2</sup>, Vasil Tabatadze<sup>1,3,4</sup>, Ertugrul Karacuha<sup>1</sup>

<sup>1</sup>*Informatics Institute, Istanbul technical university, Istanbul, TURKEY*

<sup>2</sup>*National University of 'Kharkiv Polytechnic Institute', Kharkiv, UKRAINE*

<sup>3</sup>*Physics Department, Tbilisi State University, Tbilisi, GEORGIA*

<sup>4</sup>*Informatics Department, Samtskhe-Javakheti State University, Akhaltsikhe, GEORGIA*

**15:00 B02-7 (Invited) PLANE WAVE DIFFRACTION BY A TRUNCATED ELLIPTIC CYLINDER WITH A STRONGLY ELONGATED CROSS-SECTION : UNIFORMITY OF THE ASYMPTOTIC FORMULAS FOR THE INDUCED CURRENT WITH RESPECT TO THE ELONGATION PARAMETER**

Frederic A. Molinet\*

*MOTHESSIM, L'HAY LES ROSES, FRANCE*

**Session B03: High-frequency wave propagation in highly disturbed ionosphere**

Tuesday, May 28 15:40-17:40, Room B

Session Conveners: Vadim Gherm, *St. Petersburg State University*; Nikolay Zernov, *St. Petersburg State University*

Session Chairs: Nikolay Zernov, *St. Petersburg State University*; Vadim Gherm, *St. Petersburg State University*

**15:40 B03-1 (Invited) DIFFRACTALS AND PROPAGATION IN EXTENDED POWER-LAW MEDIA**

Charles L. Rino\*

*Smead Aerospace Engineering Sciences DepartmentA, University of Colorado, Menlo Park, California*

**16:00 B03-2 (Invited) A COMPARATIVE ANALYSIS OF HIGH FREQUENCY FIELDS ON TRANSIONOSPHERIC PATHS ALONG STRONGLY ANISOTROPIC RANDOM INHOMOGENEITIES OF ELECTRON DENSITY**

Vadim Gherm\*<sup>1</sup>, Nikolay Zernov<sup>1</sup>, Charles Rino<sup>2</sup>

<sup>1</sup>*St. Petersburg State University, St. Petersburg, RUSSIAN FEDERATION*

<sup>2</sup>*The University of Colorado, Boulder, CO*

**16:20 B03-3 MODELING INTERMITTENCY OF SCINTILLATING TRANSIONOSPHERIC SIGNALS**

Vadim Gherm, Ekaterina Makarenkova\*

*St. Petersburg State University, St. Petersburg, RUSSIAN FEDERATION*

**16:40 B03-4 (Invited) ANALYTIC DESCRIPTION OF THE COHERENCE PROPERTIES OF HIGH FREQUENCY FIELD IN THE INHOMOGENEOUS STOCHASTIC TRANSIONOSPHERIC CHANNEL WITH ANISOTROPIC RANDOM IRREGULARITIES**

Nikolay Zernov\*, Andrei Driuk

*Department of Radio Physics, St. Petersburg State University, Sant Petersburg, RUSSIAN FEDERATION*

**17:00 B03-5 ASPECTS OF IONOSPHERIC SCINTILLATION DURATION UNDER LOW LATITUDES**

Bruno J. Affonso\*<sup>1</sup>, Caio C. Marques<sup>1</sup>, André L. A. Silva<sup>2</sup>, Jonas Sousasantos<sup>2</sup>, André R. F. Martinon<sup>3</sup>,

Eurico R. de Paula<sup>3</sup>, Bruno C. Vani<sup>4</sup>, Alison Moraes<sup>5</sup>

<sup>1</sup>*Embraer, Sao Jose dos Campos, SP, BRAZIL*

<sup>2</sup>*Instituto Tecnológico de Aeronáutica, Sao Jose dos Campos, SP, BRAZIL*

<sup>3</sup>*Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, SP, BRAZIL*

<sup>4</sup>*Instituto Federal de Educação, Ciência e Tecnologia de São Paulo, Presidente Epitáfio, SP, BRAZIL*

<sup>5</sup>*Instituto de Aeronáutica e Espaço, Sao Jose dos Campos, SP, BRAZIL*

**17:20 B03-6 SAR IMAGES SIMULATION OF VEGETATED AREAS INVOLVING HYDROCARBONS PRESENCE**

Pierre Borderies\*<sup>1</sup>, Jean-pascal Monvoisin<sup>1</sup>, Dominique Dubucq<sup>2</sup>, Cedric Taillandier<sup>2</sup>

<sup>1</sup>*DEM, Université Fédérale de Toulouse, Toulouse, FRANCE*

<sup>2</sup>*TOTAL, Pau, FRANCE*

**Session C02: Advanced algorithms in computational electromagnetics - I**

Tuesday, May 28 13:00-15:20, Room C

Session Conveners: Shinichiro Ohnuki, *Nihon University*; Vladimir Okhmatovski, *University of Manitoba*

Session Chairs: Shinichiro Ohnuki, *Nihon University*; Vladimir Okhmatovski, *University of Manitoba*

**13:00 C02-1 (Invited) A HYBRID FAST MULTIPOLE ALGORITHM FOR BROADBAND ELECTROMAGNETIC SIMULATIONS**

Tian Xia, Lingling Meng, Weng C. Chew\*

*Electrical and Computer Engineering, University of Illinois, Urbana-Champaign, Champaign*

**13:20 C02-2 (Invited) THE GALERKIN DISCRETISATION FOR THE EFIE WITH THE CALDERON PRECONDITIONING USING THE INTEGRATION BY PARTS**

Kazuki Niino\*, Naoshi Nishimura

*Kyoto University, Kyoto, JAPAN*

**13:40 C02-3 (Invited) FAST DIRECT AND ITERATIVE SOLUTIONS OF SCATTERING PROBLEMS WITH TENSOR TRAIN DECOMPOSITION**

Vladimir Okhmatovski\*, Zhuotong Chen, Shucheng Zheng

*Electrical and Computer Engineering, University of Manitoba, Winnipeg, CANADA*

**14:00 C02-4 (Invited) EIGENMODE ANALYSIS OF COMPOSITE RIGHT/LEFT-HANDED COAXIAL CHOKE STRUCTURE FOR COAXIALLY FED ANTENNA**

Naobumi Michishita\*<sup>1</sup>, Takatsugu Fukushima<sup>1</sup>, Hisashi Morishita<sup>1</sup>, Naoya Fujimoto<sup>2</sup>

<sup>1</sup>*National Defense Academy, Yokosuka, Kanagawa, JAPAN*

<sup>2</sup>*Hitachi Kokusai Electric Inc., Kodaira, Tokyo, JAPAN*

**14:20 C02-5 (Invited) EFFICIENT INVERSE SOURCES SOLUTIONS ABOVE LOSSY DIELECTRIC HALFSPACE**

Thomas Eibert\*

*TUM HFT, Munich, GERMANY*

**14:40 C02-6 (Invited) COMPLEX-FREQUENCY-DOMAIN ANALYSIS OF ELECTROMAGNETIC WAVES**

Di Wu, Yuki Ando, Soichiro Masuda, Shohei Nishino, Ryohei Ohnishi, Takumi Yasuda, Shinichiro Ohnuki\*

*Nihon University, Tokyo, JAPAN*

**15:00 C02-7 (Invited) A 2D/Q-2D SUBDOMAIN FINITE ELEMENT METHOD FOR IRREGULAR POWER/GROUND PLATE-PAIR ANALYSIS WITH WAVEPORT EXCITATION**

Ping Li\*<sup>1</sup>, Lijun Jiang<sup>2</sup>, Yaojiang Zhang<sup>3</sup>, Shuai Xu<sup>3</sup>, Hakan Bageci<sup>1</sup>

<sup>1</sup>*Electronic Engineering, King Abdullah University of Science and Technology, Thuwal, SAUDI ARABIA*

<sup>2</sup>*Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, CHINA*

<sup>3</sup>*EMC Lab, Huawei Technologies, Shenzhen, CHINA*

**Session C03: Advanced algorithms in computational electromagnetics - II**

Tuesday, May 28 15:40-17:40, Room C

Session Conveners: Shinichiro Ohnuki, *Nihon University*; Vladimir Okhmatovski, *University of Manitoba*

Session Chairs: Shinichiro Ohnuki, *Nihon University*; Vladimir Okhmatovski, *University of Manitoba*

**15:40 C03-1 (Invited) HIGH ORDER SCALABLE HYBRIDIZED DISCONTINUOUS GALERKIN METHOD FOR FREQUENCY-DOMAIN ELECTROMAGNETICS**

Stephane Lanteri\*<sup>1</sup>, Ludovic Moya<sup>1</sup>, Emmanuel Agullo<sup>2</sup>, Luc Giraud<sup>2</sup>, Matthieu Kuhn<sup>2</sup>

<sup>1</sup>*Inria, Sophia Antipolis, FRANCE*

<sup>2</sup>*Inria, Bordeaux, FRANCE*

**16:00 C03-2 (Invited) DESIGN OF OPTICAL WAVEGUIDE DEVICES USING FUNCTION-EXPANSION-BASED TOPOLOGY OPTIMIZATION**

Yasuhide Tsuji\*

*Information and Electronic Engineering, Muroran Institute of Technology, Muroran, JAPAN*

**16:20 C03-3 (Invited) SCATTERING OF ELECTROMAGNETIC WAVE BY A RECTANGULAR CYLINDER WITH CONDUCTING STRIPS**

Tsuneki Yamasaki\*

*Electrical Engineering, College of Science & Technology, Nihon University, Tokyo, JAPAN*

**16:40 C03-4 (Invited) NEW PROPAGATION REGIMES OF TM WAVES IN A WAVEGUIDE FILLED WITH A NONLINEAR DIELECTRIC METAMATERIAL**

Eugene Smolkin<sup>1</sup>, Maxim Snegur<sup>1</sup>, Yury Shestopalov\*<sup>2</sup>

<sup>1</sup>*Penza State University, Penza, Penza region, RUSSIAN FEDERATION*

<sup>2</sup>*University of Gavle, Gavle, Sweden, SWEDEN*

**17:00 C03-5 (Invited) INVESTIGATION ON THE ACCELERATION OF THE 3D IMPEDANCE METHOD FOR DOSIMETRIES UNDER THE QUASI-STATIC MAGNETIC FIELD EXPOSURE**

Yukihisa Suzuki\*, Masao Taki

*Department of Electrical Engineering and Computer Science, Tokyo Metropolitan University, Tokyo, JAPAN*

**17:20 C03-6 (Invited) NOVEL PARALLEL FINITE-DIFFERENCE METHOD FOR DESIGNING PLASMONIC DEVICES**

Shinichiro Ohnuki\*<sup>1</sup>, Ryohei Ohnishi<sup>1</sup>, Di Wu<sup>1</sup>, Takashi Yamaguchi<sup>2</sup>

<sup>1</sup>*Nihon University, Tokyo, JAPAN*

<sup>2</sup>*Tokyo Metropolitan Industrial Technology Research Institute, Tokyo, JAPAN*

**Session D02: Analytical and canonical solutions for metamaterials and metasurfaces**

Tuesday, May 28 13:00-15:20, Room D

Session Conveners: Viktor Asadchy, *Aalto University*; Ana Diaz-Rubio, *Aalto University*; Sergei Tretyakov, *Aalto University*

Session Chairs: Viktor Asadchy, *Aalto University*; Ana Diaz-Rubio, *Aalto University*; Sergei Tretyakov, *Aalto University*

**13:00 D02-1 (Invited) SUBWAVELENGTH ROBUST WAVEGUIDING WITH CHIRAL METAMATERIAL WAVEGUIDES**

Bakhtiyar Orzabayev\*, Nadège Kaina, Romain Fleury

*École polytechnique fédérale de Lausanne, Lausanne, SWITZERLAND*

**13:20 D02-2 (Invited) NON-LOCAL POWER WAVE TRANSFORMATIONS USING OMEGA BIANISOTROPIC HUYGENS' METASURFACE PAIRS**

Ayman H. Dorrah\*, Gleb Egorov, George V. Eleftheriades

*The Edward S. Rogers Sr. Department of Electrical & Computer Engineering, University of Toronto, Toronto, CANADA*

**13:40 D02-3 (Invited) FLOQUET-BLOCH ANALYSIS OF A PRACTICAL FABRY-PEROT HUYGENS' METASURFACE**

Sherman W. Marcus\*, Ariel Epstein

*Faculty of Electrical Engineering, Technion - Israel Institute of Technology, Haifa, ISRAEL*



**14:00 D02-4 (Invited) Perfect Anomalous Reflection and Refraction Accompanied by an Ideal Polarization**

**Conversion: Potential of a Chiral Metasurface**

Hamidreza Kazemi\*, Mohammad Albooyeh, Filippo Capolino

*University of California Irvine, Irvine, CA*

**14:20 D02-5 (Invited) APPLICATIONS AND POTENTIALS OF RECIPROCAL BIANISOTROPIC METASURFACES**

Mohammad Albooyeh\*<sup>1</sup>, Viktor Asadchy<sup>2</sup>, Jinwei Zeng<sup>1</sup>, Hamidreza Kazemi<sup>1</sup>, Filippo Capolino<sup>1</sup>

<sup>1</sup>*University of California, Irvine, IRVINE*

<sup>2</sup>*Aalto University, Espoo, FINLAND*

**14:40 D02-6 (Invited) EPSILON-NEAR-ZERO PROPERTIES OF PERIODIC MULTILAYERS OPERATING IN PHOTONIC CRYSTAL REGIME**

Vladislav Popov\*<sup>1</sup>, Sergei Tretyakov<sup>2</sup>, Andrey Novitsky<sup>3</sup>

<sup>1</sup>*SONDRA, CentraleSupélec, Université Paris-Saclay, F-91190, Gif-sur-Yvette, FRANCE*

<sup>2</sup>*Aalto University, FI-00076, Aalto, FINLAND*

<sup>3</sup>*Department of Theoretical Physics and Astrophysics, Belarusian State University, 220030, Minsk, BELARUS*

**15:00 D02-7 (Invited) NONRECIPROCAL WAVEFRONT MANIPULATION IN MOVING METAGRATINGS**

Younes Radi\*, Andrea Alu

*Advanced Science Research Center, New York, NY*

**Session D03: Theory and applications of characteristic modes**

Tuesday, May 28 15:40-17:20, Room D

Session Conveners: Deb Chatterjee, *University of Missouri at Kansas City (UMKC)*; Ahmed Hassan, *University of Missouri-Kansas City*

Session Chairs: Deb Chatterjee, *University of Missouri at Kansas City (UMKC)*; Ahmed Hassan, *University of Missouri-Kansas City*

**15:40 D03-1 THE SHAPE OPTIMIZATION OF DIELECTRIC RESONATOR ANTENNAS**

Hamad Alroughani\*<sup>1</sup>, Derek A. McNamara<sup>2</sup>

<sup>1</sup>*Electrical Engineering, Kuwait University, Kuwait, KUWAIT*

<sup>2</sup>*Electrical Engineering & Computer Science, University of Ottawa, Ottawa, Ontario, CANADA*

**16:00 D03-2 CHARACTERISTIC MODES OF LOSSY OBJECTS**

Henrik Wallén\*, Pasi Ylä-Oijala

*Department of Electronics and Nanoengineering, Aalto University, Espoo, FINLAND*

**16:20 D03-3 SCALABLE CHARACTERISTIC MODE ANALYSIS USING BIG DATA TECHNIQUES**

Khulud Alsultan\*<sup>1</sup>, Praveen Rao<sup>1</sup>, Anthony N. Caruso<sup>2</sup>, Ahmed M. Hassan<sup>1</sup>

<sup>1</sup>*Computer Science Electrical Engineering, University of Missouri-Kansas City, Kansas City, MO*

<sup>2</sup>*Department of Physics and Astronomy, University of Missouri-Kansas City, Kansas City, MO*

**16:40 D03-4 Characteristic Mode Analysis of Electromagnetic Coupling to Wires with Realistic Shapes**

Mohamed Z. M. Hamdalla\*<sup>1</sup>, Waleed Al-Shaikhli<sup>1</sup>, John Lancaster<sup>1</sup>, James D. Hunter<sup>2</sup>, Liu Yuanzhuo<sup>2</sup>,

Victor Khilkevich<sup>2</sup>, Daryl G. Beetner<sup>2</sup>, Anthony N. Caruso<sup>1</sup>, Ahmed M. Hassan<sup>1</sup>

<sup>1</sup>*University of Missouri-Kansas City, Kansas City, MO 64110*

<sup>2</sup>*Missouri University of Science and Technology, Rolla, MO 65409*

**17:00 D03-5 A MULTILAYERED GREEN'S FUNCTION MODEL FOR THE CHARACTERISTIC MODE ANALYSIS OF CARBON NANOTUBE COMPOSITES**

Sumitra Dey\*<sup>1</sup>, Ahmed M. Hassan<sup>1</sup>, Deb Chatterjee<sup>1</sup>, Edward J. Garboczi<sup>2</sup>

<sup>1</sup>*Computer Science and Electrical Engineering Department, University of Missouri - Kansas City, Kansas City, MO*

<sup>2</sup>*Applied Chemicals and Materials Division, National Institute of Standards and Technology, Boulder, CO*

**Session E02: International Union of Radio Science: 100 years of history and achievements of Commission B-I**

Tuesday, May 28 13:00-15:20, Room E

Session Conveners: Yahya Rahmat-Samii, *University of California, Los Angeles*; Ari Sihvola, *Aalto University*; Ross Stone, *Stoneware*

Session Chairs: Yahya Rahmat-Samii, *University of California, Los Angeles*; Ross Stone, *Stoneware*; Ari Sihvola, *Aalto University*

**13:00 E02-1 (Invited) THE HISTORY OF URSI**

Ross Stone\*

*Stoneware, San Diego, CA*

**13:20 E02-2 (Invited) THE HISTORY OF URSI COMMISSION B AND ITS SYMPOSIUM ON ELECTROMAGNETIC THEORY**

Ross Stone\*

*Stoneware, San Diego, CA*

**13:40 E02-3 (Invited) 50 YEARS OF FDTD SIMULATIONS AND COUNTING: PERSPECTIVES FROM BOOMERS, GEN X, GEN Y, AND GEN Z**

Susan C. Hagness\*

*Department of Electrical and Computer Engineering, University of Wisconsin - Madison, Madison, WI*

**14:00 E02-4 (Invited) Why Are We Still Fascinated With Reflector Antennas? The Last 100 Years of Reflectors and URSI Commission B Influences**

Yahya Rahmat-Samii\*

*Department of Electrical and Computer Engineering, University of California, Los Angeles, Los Angeles*

**14:20 E02-5 (Invited) A HISTORY OF LEAKY WAVES AND LEAKY-WAVE ANTENNAS**

David R. Jackson\*<sup>1</sup>, Paolo Baccarelli<sup>2</sup>, Paolo Burghignoli<sup>2</sup>, Walter Fuscaldo<sup>2</sup>, Alessandro Galli<sup>2</sup>, Giampiero Lovat<sup>3</sup>

<sup>1</sup>*ECE, University of Houston, Houston, TX*

<sup>2</sup>*Information Engineering, Sapienza University of Rome, Rome, ITALY*

<sup>3</sup>*Astronautics, Electrical, and Energy, Sapienza University of Rome, Rome, ITALY*

**14:40 E02-6 (Invited) MICROSTRIP PATCH ANTENNAS, OVERCOMING DEFICIENCIES AND REALIZING UNEXPECTED PERFORMANCES**

Lotfollah Shafai\*, Navid Rezaadeh

*Electrical and Computer Engineering, University of Manitoba, Winnipeg, CANADA*

**15:00 E02-7 (Invited) 100 YEARS OF ELECTROMAGNETIC WAVES IN RANDOM MEDIA**

Akira Ishimaru\*

*University of Washington, Seattle, Washington*

**Session E03: Memorial Session for Prof. Dennis P. Nyquist-II**

Tuesday, May 28 15:40-17:20, Room E

Session Conveners: George Hanson, *University of Wisconsin Milwaukee*; Michael Havrilla, *Air Force Institute of Technology*

Session Chairs: Michael Havrilla, *Air Force Institute of Technology*; George Hanson, *University of Wisconsin Milwaukee*

**15:40 E03-1 (Invited) COMPLEX PLANE ANALYSIS OF HYPERBOLIC TWO-DIMENSIONAL MATERIALS**

George Hanson\*<sup>1</sup>, Seyyed Ali Hassani Gangaraj<sup>2</sup>

<sup>1</sup>*University of Wisconsin Milwaukee, Milwaukee, WI*

<sup>2</sup>*Cornell University, Ithaca, NY*

**16:00 E03-2 (Invited) LOCAL EFFECTIVE PERMITTIVITY OF SPATIALLY-DISPERSIVE BOUNDED WIRE-MEDIUM STRUCTURES WITH ARBITRARY TERMINATIONS**

Alexander B. Yakovlev\*<sup>1</sup>, Mário G. Silveirinha<sup>2</sup>, George W. Hanson<sup>3</sup>

<sup>1</sup>*Department of Electrical Engineering, University of Mississippi, University, Mississippi*

<sup>2</sup>*Instituto Superior Técnico, University of Lisbon and Instituto de Telecomunicações, Lisbon, PORTUGAL*

<sup>3</sup>*Department of Electrical Engineering and Computer Science, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin*

**16:20 E03-3 (Invited) ANOTHER LOOK AT FINITE ELEMENT PARTICLE IN CELL METHOD**

Zane Crawford, Scott O'Connor, John Luginsland, Balasubramaniam Shanker\*

*Electrical and Computer Engineering, Michigan State University, East Lansing, MI*

**16:40 E03-4 (Invited) THEORETICAL LIMITS ON THE ACCURACY OF RADAR MEASUREMENTS OF RANGE, RADIAL VELOCITY, ANGLE, AND ANGULAR VELOCITY, AND IMPLICATIONS FOR RADAR SYSTEM DESIGN**

Jeffrey Nanzer\*

*Michigan State University, East Lansing MI*

**17:00 E03-5 (Invited) NUMERICAL GREEN'S FUNCTION WITH DISCRETE EXTERIOR CALCULUS**

Shu Chen<sup>1</sup>, Weng C. Chew\*<sup>2</sup>

<sup>1</sup>*Physics, University of Illinois at Urbana-Champaign, Urbana, IL*

<sup>2</sup>*Electrical and Computer Engineering, Purdue University, West Lafayette, IN*

**Session F02: Materials in electromagnetics**

Tuesday, May 28 13:00-15:20, Room F

Session Conveners: Andrey Osipov, *German Aerospace Center (DLR)*; Paul Smith, *Macquarie University*

Session Chairs: Andrey Osipov, *German Aerospace Center (DLR)*; Paul Smith, *Macquarie University*

**13:00 F02-1 ON THE DEVELOPMENT OF A BIO-BASED DIELECTRIC MATERIAL**

Sima Noghianian\*<sup>1</sup>, Ali Alshami<sup>2</sup>, Ala Alemaryeen<sup>1</sup>, Austin Tesser<sup>2</sup>, Jeremy Lewis<sup>2</sup>, Maysam Haghshenas<sup>3</sup>

<sup>1</sup>*Schools of Electrical Engineering and Computer Science, University of North Dakota, Grand Forks, ND*

<sup>2</sup>*Department of Chemical Engineering, University of North Dakota, Grand Forks, ND*

<sup>3</sup>*Department of Mechanical Engineering, University of North Dakota, Grand Forks, ND*

**13:20 F02-2 EXTENSION OF SNOEK'S LAW TO HIGHER RF FREQUENCIES BY CONTROLLING NANOMAGNETIC PARTICLE PARAMETERS**

Quang M. Nguyen\*, Shi Liu, Amir I. Zaghoul

*US Army Research Laboratory, Adelphi, MD*

**13:40 F02-3 ANALYTICAL VERIFICATION OF EFFECTIVE CONSTITUTIVE PARAMETER  
INCREASING USING METAMATERIAL INSERTS**

Quang Nguyen\*, Amir Zaghoul

*US Army Research Laboratory, Adelphi, MD*

**14:00 F02-4 (Invited) FROM TRANSFORMATION OPTICS TO TOPOLOGY: LOCAL AND GLOBAL  
METHODS FOR MATERIAL DESIGN**

Simon A. Horsley\*

*University of Exeter, Exeter, UNITED KINGDOM*

**14:20 F02-5 (Invited) ON THE ACCURACY OF THE HOMOGENIZED EQUIVALENT IMPEDANCE  
MODEL FOR MODULATED METASURFACE DESCRIPTION**

Enrica Martini\*<sup>1</sup>, Francesco Caminita<sup>1</sup>, David Gonzalez<sup>2</sup>, Gabriele Minatti<sup>1</sup>, Stefano Maci<sup>3</sup>

<sup>1</sup>*Wave Up Srl, SIENA, ITALY*

<sup>2</sup>*Institut d'Électronique et de Télécommunications de Rennes, Rennes, ITALY*

<sup>3</sup>*University of Siena, SIENA, ITALY*

**14:40 F02-6 (Invited) ABOUT FIELD EXPRESSIONS FOR THE DIFFRACTION BY AN ANISOTROPIC  
IMPEDANCE WEDGE AT SKEW INCIDENCE AND RELATIONS WITH GAMMA FUNCTION**

Jml Bernard\*

*CEA-DIF / CMLA-ENS Cachan, Arpajon, FRANCE*

**15:00 F02-7 TOWARDS A RIGOROUS ELECTROMAGNETIC THEORY OF THE SOLAR GLORY**

Andrey Osipov\*

*German Aerospace Center (DLR), Wessling, GERMANY*

**Session F03: Education in electromagnetics**

Tuesday, May 28 15:40-17:40, Room F

Session Conveners: Ari Sihvola, *Aalto University*; Henrik Wallen, *Aalto University*

Session Chairs: Henrik Wallen, *Aalto University*; Ari Sihvola, *Aalto University*

**15:40 F03-1 (Invited) IMPLEMENTATION OF A COURSE ON RADAR AND REMOTE SENSING AT  
LUND UNIVERSITY**

Daniel Sjöberg\*

*Electrical and Information Technology, Lund University, Lund, SWEDEN*

**16:00 F03-2 (Invited) ONLINE EXPERIENCES FOR ELECTRICAL ENGINEERING EDUCATION**

Timothy D. Drysdale\*

*The University of Edinburgh, Edinburgh, UNITED KINGDOM*

**16:20 F03-3 (Invited) TEACHING ELECTROMAGNETICS AND ANTENNAS USING FREE SOFTWARE AND ONLINE CALCULATORS**

Reyhan Baktur\*

*Electrical and Computer Engineering, Utah State University, Logan*

**16:40 F03-4 SEEING IS BELIEVING: THE WAY WE TEACH POLARIZATION OF EM WAVES IN NTU**

Shih-Yuan Chen\*

*Department of Electrical Engineering, National Taiwan University, Taipei, TAIWAN*

**17:00 F03-5 ELECTROMAGNETIC FIELDS AT AALTO UNIVERSITY**

Mohammad S. Mirmoosa, Masoud S. M. Mollaei, Grigori A. Ptitsyn\*, Ari Sihvola, Constantin R. Simovski,

Sergei A. Tretyakov

*Electrical Engineering, Aalto University, Espoo, FINLAND*

**17:20 F03-6 MINKOWSKI SPACE-TIME DIAGRAM UTILIZATION IN ELECTROMAGNETIC SCATTERING PROCESSES**

Mohamed A. Salem\*

*Engineering Science, Sonoma State University, Rohnert Park, CA*

**Session B04: Novel mathematical methods in electromagnetics - II**

Wednesday, May 29 08:20-10:40, Room B

Session Conveners: Kazuya Kobayashi, *Chuo University*; Yury Shestopalov, *Faculty of Engineering and Sustainable Development, University of Gävle*

Session Chairs: Ramakrishna Janaswamy, *University of Massachusetts*; Tsuneki Yamasaki, *College of Science & Technology, Nihon University*

**08:20 B04-1 (Invited) A REVIEW OF SOME METHODS FOR CALCULATING STORED EM ENERGY**

Ramakrishna Janaswamy\*

*University of Massachusetts, Amherst, MA*

**08:40 B04-2 (Invited) LOCALIZED WAVES AND THE PHYSICS AND ENGINEERING OF TIME DOMAIN ANTENNAS**

Richard W. Ziolkowski\*

*University of Technology Sydney, Ultimo, AUSTRALIA*

**09:00 B04-3 (Invited) MODE CONVERSION AND SCATTERING ANALYSIS OF OPTICAL AND ELECTROMAGNETIC GUIDED WAVES IN TILTED AND CURVED WAVEGUIDES BY CONFORMAL MAPPING METHOD**

Yasumitsu Miyazaki\*

*Aichi Mathematical Technology Laboratory, Nagoya, Aichi, JAPAN*

**09:20 B04-4 (Invited) RECENT ADVANCES IN THEORY AND APPLICATIONS OF THE SURFACE-VOLUME-SURFACE ELECTRIC FIELD INTEGRAL EQUATION**

Vladimir Okhmatovski\*, Reza Gholami, Shucheng Zheng, Zhuotong Chen

*Electrical and Computer Engineering, University of Manitoba, Winnipeg, CANADA*

**09:40 B04-5 (Invited) ON THE AVAILABILITY OF PROCESSES FOR CREATION A THING SPACE FROM A NULL SPACE**

Taner Sengor\*

*Dept. of Electronics and Communication Engineering, Yildiz Technical University (emeritus), Istanbul, TR, TURKEY*

**10:00 B04-6 INFLECTIVE SPACES: CONTRIBUTION INTO THE PHYSICAL TRUTH**

Taner Sengor\*

*Dept. of Electronics and Communication Engineering, Yildiz Technical University (emeritus), Istanbul, TR, TURKEY*

**10:20 B04-7 LOCATION OF SURFACE WAVE POLES IN SOMMERFELD TYPE INTEGRALS: A MITTAG-LEFFLER EXPANSION APPROACH**

Kalyan C. Durbhakula\*, Deb Chatterjee, Ahmed M. Hassan

*Computer Science and Electrical Engineering, University of Missouri - Kansas City, Kansas City, Missouri*

**Session C04: Near-field coupling in wireless applications: when wireless devices are closer than you can imagine**

Wednesday, May 29 08:20-10:40, Room C

Session Conveners: Andrea Michel, *University of Pisa*; Paolo Nepa, *University of Pisa*

Session Chairs: Andrea Michel, *University of Pisa*; Giuliano Manara, *University of Pisa*

**08:20 C04-1 (Invited) AGAIN ON SPATIAL FOCUSING AND SHAPING OF THE ELECTROMAGNETIC FIELD IN THE ANTENNA RADIATIVE NEAR-FIELD REGION**

Paolo Nepa<sup>1</sup>, Giuliano Manara\*<sup>1</sup>, Marcos R. Pino<sup>2</sup>, Rafael G. Ayestarán<sup>2</sup>

<sup>1</sup>*Dept. of Information Engineering, University of Pisa, Pisa, ITALY*

<sup>2</sup>*Dept. of Electrical Engineering, University of Oviedo, Oviedo, SPAIN*

**08:40 C04-2 (Invited) A UNIVERSAL METHOD FOR FIELD CONTROLS**

Geyi Wen\*

*Nanjing University of Information Science and Technology, Nanjing, Jiangsu, CHINA*

**09:00 C04-3 (Invited) WIRELESS IMPLANTABLE PRESSURE SENSORS IN BIOMEDICINE: IN VIVO RELIABILITY TESTING OF NEAR FIELD COUPLING AND POWER TRANSFER**

Leena Ukkonen<sup>\*1</sup>, Lauri Sydänheimo<sup>1</sup>, Waqas Khan<sup>1</sup>, Shubin Ma<sup>1</sup>, Toni Björninen<sup>1</sup>, Shuvo Roy<sup>2</sup>, Yahya Rahmat-Samii<sup>3</sup>, Jan Rabaey<sup>4</sup>

<sup>1</sup>*Faculty of Medicine and Health Technology, Tampere University, Tampere, FINLAND*

<sup>2</sup>*Dept. of Bioengineering and Therapeutic Sciences, University of California San Francisco, San Francisco*

<sup>3</sup>*Electrical and Computing Engineering, University of California Los Angeles, Los Angeles*

<sup>4</sup>*Electrical Engineering and Computer Sciences, University of California at Berkeley, Berkeley*

**09:20 C04-4 (Invited) NEAR-FIELD MIMO COMMUNICATION LINKS IN A REVERBERATING ENVIRONMENT**

Sendy Phang<sup>\*1</sup>, Mohd Hafiz Baharuddin<sup>2</sup>, Michel T. Ivrlac<sup>3</sup>, Stephen C. Creagh<sup>1</sup>, Gabriele Gradoni<sup>1,2</sup>, David W. P. Thomas<sup>2</sup>, Josef A. Nosseck<sup>3,4</sup>, Gregor Tanner<sup>1</sup>

<sup>1</sup>*School of Mathematical Sciences, University of Nottingham, Nottingham, UNITED KINGDOM*

<sup>2</sup>*The George Green Institute for Electromagnetics Research, University of Nottingham, Nottingham, UNITED KINGDOM*

<sup>3</sup>*Institute for Circuit Theory and Signal Processing, Technische Universität München, München, GERMANY*

<sup>4</sup>*Department of Teleinformatic Engineering, Federal University of Ceara, Fortaleza, BRAZIL*

**09:40 C04-5 (Invited) NEAR FIELD UHF RFID READER ANTENNA BASED ON COMPOSITE RIGHT/LEFT HANDED STRUCTURE COMPATIBLE WITH CONFIGURABLE READING**

Romain Siragusa<sup>\*1</sup>, Etienne Perret<sup>1,2</sup>

<sup>1</sup>*Univ. Grenoble Alpes, Grenoble INP, LCIS, Valence, FRANCE*

<sup>2</sup>*Institut Universitaire de France, Paris, FRANCE*

**10:00 C04-6 (Invited) USING THE POWER TRANSFER EFFICIENCY FOR RFID DETECTION IN UNUSUAL SCENARIOS**

Andrea Michel<sup>\*1</sup>, Marcos Rodriguez Pino<sup>2</sup>, Guillermo Alvarez Narciani<sup>2</sup>, Manuel Arrebola<sup>2</sup>, Paolo Nepa<sup>1</sup>

<sup>1</sup>*Department of Information Engineering, University of Pisa, Pisa, ITALY*

<sup>2</sup>*Universidad de Oviedo, Oviedo, SPAIN*

**10:20 C04-7 RF CANCELLATION OF COUPLED TRANSMIT SIGNAL AND NOISE IN STAR ACROSS 1 GHZ BANDWIDTH**

Satheesh Bojja Venkatakrisnan\*, Alexander Hovsepian, Elias Alwan, John Volakis

*Dept of Electrical and Computer Engg, Florida International University, Miami*

**Session D04: Inverse scattering and imaging**



Wednesday, May 29 08:20-10:40, Room D

Session Conveners: Lianlin Li, *Peking University*; Matteo Pastorino, *University of Genoa*

Session Chairs: Lianlin Li, *Peking University*; Matteo Pastorino, *University of Genoa*

**08:20 D04-1 PHASELESS COMPUTATIONAL GHOST IMAGING USING DYNAMIC METASURFACE ANTENNAS**

Aaron V. Diebold, Mohammadreza F. Imani\*, Timothy Slesman, David R. Smith

*Department of Electrical and Computer Engineering, Duke university, Durham, NC*

**08:40 D04-2 (Invited) INITIAL EXPERIMENTAL VALIDATION OF A NOVEL PROTOTYPE FOR MICROWAVE TOMOGRAPHIC IMAGING**

Alessandro Fedeli<sup>1</sup>, Manuela Maffongelli<sup>2</sup>, Ricardo Monleone<sup>2</sup>, Claudio Pagnamenta<sup>2</sup>, Matteo Pastorino\*<sup>1</sup>,

Samuel Poretti<sup>2</sup>, Andrea Randazzo<sup>1</sup>, Andrea Salvadè<sup>2</sup>

<sup>1</sup>*Department of Electrical, Electronic, Telecommunications Engineering, and Naval Architecture, University of Genoa, Genoa, ITALY*

<sup>2</sup>*Department of Technology and Innovation, University of Applied Sciences of Southern Switzerland, Manno, SWITZERLAND*

**09:00 D04-3 (Invited) SENSE PEOPLE WITH WI-FI SIGNALS**

Lianlin Li\*, Ya Shuang

*School of EECS, Peking University, Beijing, CHINA*

**09:20 D04-4 SAR DESPECKLING USING NOISE-DEPENDENT DEEP NEURAL NETWORK**

Lianlin Li\*, Longgang Wang

*School of EECS, Peking University, Beijing, CHINA*

**09:40 D04-5 PHASELESS MICROWAVE IMAGING BY MEANS OF A LEBESGUE-SPACE INVERSION SCHEME**

Claudio Estatico<sup>1</sup>, Alessandro Fedeli<sup>2</sup>, Matteo Pastorino\*<sup>2</sup>, Andrea Randazzo<sup>2</sup>, Emanuele Tavanti<sup>2</sup>

<sup>1</sup>*Department of Mathematics, University of Genoa, Genoa, ITALY*

<sup>2</sup>*Department of Electrical, Electronic, Telecommunications Engineering, and Naval Architecture, University of Genoa, Genoa, ITALY*

**10:00 D04-6 (Invited) HALF-ORDER THREE DIMENSIONAL CURL OPERATOR**

Raphael Kastner\*

*Tel Aviv University, Tel Aviv, Isrel, ISRAEL*

**10:20 D04-7 RADAR CROSS SECTION ANALYSIS OF SMALL GROUP TARGET**

Hroshi Suenobu\*, Tai Tanaka, Michio Takikawa, Naofumi Yoneda

*Mitsubishi Electric Corporation, Kamakura, Kanagawa, JAPAN*

**Session E04a: History of Electromagnetics**

Wednesday, May 29 08:20-09:20, Room E

Session Conveners: Ari Sihvola, *Aalto University*; Henrik Wallen, *Aalto University*

Session Chairs: Ari Sihvola, *Aalto University*; Henrik Wallen, *Aalto University*

**08:20 E04a-1 THE DISCOVERY OF ELECTROMAGNETISM BY HANS CHRISTIAN ØRSTED 199 YEARS AGO**

Olav Breinbjerg\*

*Technical University of Denmark, Kgs. Lyngby, DENMARK*

**08:40 E04a-2 (Invited) MAXWELL'S VIEW OF ELECTRIC POLARIZATION AS DISPLACEMENT**

Arthur D. Yaghjian\*

*Electromagnetics Research Consultant, Concord, MA*

**09:00 E04a-3 (Invited) FROM THE UNIVERSITY OF ALBERTA TO THE BEGINNINGS OF EMTS: CONTRIBUTIONS OF GEORGE SINCLAIR AND EDWARD JORDAN TO ANTENNA EDUCATION**

Ashwin K. Iyer\*

*Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Alberta, CANADA*

**Session E04b: International Union of Radio Science: 100 years of history and achievements of Commission B-II**

Wednesday, May 29 09:20-10:40, Room E: Topaz

Session Conveners: Yahya Rahmat-Samii, *University of California, Los Angeles*; Ari Sihvola, *Aalto University*; Ross Stone, *Stoneware*

Session Chairs: Yahya Rahmat-Samii, *University of California, Los Angeles*; Ross Stone, *Stoneware*; Ari Sihvola, *Aalto University*

**09:20 E04b-1 (Invited) HISTORY OF COMPLEX MEDIA IN ELECTROMAGNETICS**

Ari Sihvola\*

*Department of Electronics and Nanoengineering, Aalto University, Espoo, FINLAND*

**09:40 E04b-2 (Invited) HISTORY OF METAMATERIALS AND METASURFACES**

Daniel Sievenpiper\*

ECE, UCSD, La Jolla, CA

**10:00 E04b-3 (Invited) SURFACE ELECTROMAGNETICS: HISTORIC DEVELOPMENT AND ANTENNA APPLICATIONS**

Fan Yang\*<sup>1</sup>, Shenheng Xu<sup>1</sup>, Yahya Rahmat-Samii<sup>2</sup>

<sup>1</sup>*Tsinghua University, Haidian District, Beijing, China, CHINA*

<sup>2</sup>*University of California, Los Angeles, USA*

**10:20 E04b-4 (Invited) FULL USE OF KELLER'S GTD COEFFICIENTS IN METHOD OF EQUIVALENT EDGE CURRENTS FOR CORNER-, SLOPE- AND GRAZING INCIDENCE- DIFFRACTION**

Makoto Ando\*<sup>1</sup>, Maifuz Ali<sup>2</sup>

<sup>1</sup>*National Institute of Technology, Hachioji, JAPAN*

<sup>2</sup>*ECE, International Institute of Informational Technology, Naya Raipur, INDIA*

**Session F04: Electromagnetics at the nanoscale and quantum effects -I**

Wednesday, May 29 08:20-10:40, Room F

Session Conveners: Amir Boag, *Tel Aviv University*; Amir Natan, *Tel-Aviv University*

Session Chairs: Amir Boag, *Tel Aviv University*; Amir Natan, *Tel-Aviv University*

**08:20 F04-1 (Invited) WEISSKOPF–WIGNER THEORY OF VACUUM FLUCTUATION ENTANGLEMENT IN ATOMIC DECAY – THE INFLUENCE OF COMPLEX, NONRECIPROCAL ENVIRONMENTS**

George Hanson\*, Alexander Holmes

*University of Wisconsin Milwaukee, Milwaukee, WI*

**08:40 F04-2 (Invited) COLLECTIVE EMISSION OF QUANTUM ANTENNAS FOR SUPER-RESOLUTION: USING TEMPORAL CORRELATIONS**

Dmitri Mogilevtsev\*<sup>1</sup>, Ilya Peshko<sup>1,2</sup>, Gregory Y. Slepyan<sup>3</sup>, Amir Boag<sup>3</sup>

<sup>1</sup>*Center for Quantum Optics and Information, Institute of Physics, National Academy of Sciences of Belarus, Minsk, BELARUS*

<sup>2</sup>*Physics Faculty, Belarus State University, Minsk, BELARUS*

<sup>3</sup>*School of Electrical Engineering, Tel Aviv University, Tel Aviv, ISRAEL*

**09:00 F04-3 (Invited) THEORY OF QUANTUM ANTENNAS IN THE STRONG COUPLING REGIME: MASTER EQUATIONS APPROACH**

Gregory Slepyan\*, Alex Komarov

*Tel Aviv University, Tel Aviv, Israel, ISRAEL*

**09:20 F04-4 (Invited) GREEN FUNCTION METHODS FOR OPTOELECTRONICS**

Michael Galperin\*

*Chemistry and Biochemistry, University of California, San Diego, La Jolla, CA*

**09:40 F04-5 (Invited) REAL-SPACE DENSITY FUNCTIONAL THEORY CALCULATIONS OF NANO-SCALE STRUCTURES**

Amir Natan\*

*Physical Electronics, Tel-Aviv University, Tel-Aviv, ISRAEL*

**10:00 F04-6 (Invited) COMPUTATIONAL TECHNIQUES FOR SEMICLASSICAL MAXWELL-BLOCH SYSTEMS**

Connor Glosser, Carlo Piermarocci, Balasubramaniam Shanker\*

*Electrical and Computer Engineering, Michigan State University, East Lansing, MI*

**10:20 F04-7 (Invited) CALCULATIONS OF CASIMIR FORCE WITH FAST ALGORITHMS**

Tian Xia, Weng C. Chew\*

*Electrical and Computer Engineering, University of Illinois, Urbana-Champaign, Champaign*

**Session B05: Novel mathematical methods in electromagnetics - III**

Wednesday, May 29 15:40-17:40, Room B

Session Conveners: Kazuya Kobayashi, *Chuo University*; Yury Shestopalov, *Faculty of Engineering and Sustainable Development, University of Gävle*

Session Chairs: Yasumitsu Miyazaki, *Aichi Mathematical Technology Laboratory*; Aihua Wood, *Air Force Institute of Technology*

**15:40 B05-1 FDTD ANALYSIS OF TRANSIENT RADIATING AND REFLECTING ELECTROMAGNETIC FIELDS OF FINITE LENGTH MICROSTRIP LINES WITH TERMINAL CROSS-SECTIONS**

Rakkappan Balasubramanian<sup>1</sup>, Yasumitsu Miyazaki\*<sup>2</sup>

<sup>1</sup>*Synclayer, Inc, Kani, Gifu, JAPAN*

<sup>2</sup>*Aichi Mathematical Technology Laboratory, Nagoya, Aichi, JAPAN*

**16:00 B05-2 (Invited) REVIEW OF RECENT RESEARCH OF ELECTROMAGNETICS OF COMPLEX ENVIRONMENTS**

Akira Ishimaru\*

*University of Washington, seattle, washington*

**16:20 B05-3 (Invited) TRANSIENT ANALYSIS OF PULSE RESPONSES FROM PERIODICALLY ARRAYED DISPERSION MEDIA WITH AIR REGION**

Ryosuke Ozaki, Tsuneki Yamasaki\*

*Electrical Engineering, College of Science and Technology, Nihon University, Tokyo, JAPAN*

**16:40 B05-4 (Invited) RADAR DETECTION ANALYSIS THROUGH WALLS**

Matthew Charnley<sup>1</sup>, Aihua Wood\*<sup>2</sup>

<sup>1</sup>*Rutgers University, New Brunswick, NJ*

<sup>2</sup>*Air Force Institute of Technology, Wright-Patterson AFB, OH*

**17:00 B05-5 (Invited) OPTIMIZATION OF BEAM-STEERING METASURFACES USING MODIFIED CROSS-ENTROPY ALGORITHM**

Khushboo Singh, Muhammad U. Afzal, David Bulger, Maria Kovaleva, Karu P. Esselle\*

*School of Engineering, Macquarie University, SYDNEY, AUSTRALIA*

**17:20 B05-6 MODELLING OF THE TRANSMISSION LINES EXCITED BY THE NONUNIFORM ELECTROMAGNETIC FIELD USING THE ELECTRIC FIELD REPRESENTATION METHODS**

Jun Guo\*, Yan-zhao Xie

*Xi'an Jiaotong University, Xi'an 710049, CHINA*

**Session C05: Analytical methods in antennas, scattering and wave propagation**

Wednesday, May 29 15:40-17:00, Room C

Session Conveners: Ramakrishna Janaswamy, *University of Massachusetts*; Satish Sharma, *San Diego State University*

Session Chairs: Ramakrishna Janaswamy, *University of Massachusetts*; Satish Sharma, *San Diego State University*

**15:40 C05-1 PROPERTIES OF MODAL QUALITY FACTORS OF ANTENNAS**

Geyi Wen\*

*Nanjing University of Information Science and Technology, Nanjing, Jiangsu, CHINA*

**16:00 C05-2 A COLLECTIVE UTD RAY ANALYSIS OF THE NEAR AND FAR FIELDS OF AXIAL AND CIRCUMFERENTIAL PHASED ARRAY OF SOURCES WITH NON UNIFORM AMPLITUDE DISTRIBUTION WHEN PLACED ON CONVEX PEC CYLINDERS**

Panuwat H. Janpugdee<sup>1</sup>, Prabhakar H. Pathak\*<sup>2</sup>

<sup>1</sup>*EE, Chulalongkorn University, Bangkok, THAILAND*

<sup>2</sup>*ECE, The Ohio State University, Columbus, OH*

**16:20 C05-3 SPLIT-STEP WAVELET PROPAGATION MODELLING USING LOCAL OPERATORS**

Thomas Bonnafont\*, Rémi Douvenot, Alexandre Chabory  
*SINA/TELECOM/EMA, ENAC, Toulouse, FRANCE*

**16:40 C05-4 ACCOMMODATING PLANE WAVE REFLECTIONS IN THE KDB SYSTEM**

Michael J. Havrilla\*  
*Air Force Institute of Technology, Wright-Patterson AFB, Ohio*

**Session D05: EBGs and other periodic structures**

Wednesday, May 29 15:40-16:40, Room D

Session Chairs: Te-Kao Wu, *FSS and Antenna Consulting*; George Hanson, *University of Wisconsin Milwaukee*

**15:40 D05-1 BISTABLE CHARACTERISTICS OF A PEC BAR GRATING WITH A NONLINEAR DEFECT**

Liudmyla A. Kochetova\*<sup>1</sup>, Sergiy L. Prosvirnin<sup>2,3</sup>  
<sup>1</sup>*Department of Quasi-optics, O. Ya. Usikov Institute for Radiophysics and Electronics of National Academy of Sciences of Ukraine, Kharkiv, UKRAINE*  
<sup>2</sup>*Department of Theoretical Radiophysics, Institute of Radio Astronomy of NASU, Kharkiv, UKRAINE*  
<sup>3</sup>*School of Radio Physics, V. N. Karazin Kharkiv National University, Kharkiv, UKRAINE*

**16:00 D05-2 ANGLE OF INCIDENCE-STABLE FSS WITH DOUBLE SQUARE RING SLOT ELEMENTS**

Te-Kao Wu\*  
*FSS and Antenna Consulting, RPV, CA*

**16:20 D05-3 GYROTROPIC GRAPHENE MODEL, SUBSTRATE EFFECTS, AND FARADAY ROTATION WITH NONRECIPROCAL QUASI-TWO-DIMENSIONAL STRUCTURES**

George Hanson\*<sup>1</sup>, Mohsen Sabbaghi<sup>1</sup>, Mike Weinert<sup>1</sup>, Lian Li<sup>2</sup>, Cheng Cen<sup>2</sup>  
<sup>1</sup>*University of Wisconsin Milwaukee, Milwaukee, WI*  
<sup>2</sup>*West Virginia University, Morgantown, WV*

**Session E05: Advanced metamaterial concepts for electromagnetics - I**

Wednesday, May 29 15:40-17:40, Room E: Topaz

Session Conveners: Andrea Alu, *Advanced Science Research Center*; Dimitrios Sounas, *Wayne State University*

Session Chairs: Andrea Alu, *Advanced Science Research Center*; Dimitrios Sounas, *Wayne State University*

**15:40 E05-1 THEORETICAL ANALYSIS OF NONLOCAL METASURFACES FOR ANALOG SIGNAL PROCESSING**

Dimitrios Sounas\*<sup>1</sup>, Hoyceong Kwon<sup>2</sup>, Andrea Alu<sup>3</sup>

<sup>1</sup>*Electrical and Computer Engineering, Wayne State University, Detroit, MI 48202*

<sup>2</sup>*Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX 78712*

<sup>3</sup>*Advanced Science Research Center, City University of New York, New York, NY 10031*

**16:00 E05-2 SCATTERING, EXTINCTION, AND ALBEDO OF IMPEDANCE-BOUNDARY SPHERES**

Ari Sihvola\*, Dimitrios C. Tzarouchis, Pasi Ylä-Oijala, Henrik Wallén, Beibei Kong

*Department of Electronics and Nanoengineering, Aalto University, Espoo, FINLAND*

**16:20 E05-3 ASYMMETRIC SURFACE WAVE GUIDING BY HELICAL IMPEDANCE TUBES**

Yarden Mazor\*<sup>1</sup>, Andrea Alu<sup>2,3</sup>

<sup>1</sup>*University of Texas at Austin, Austin*

<sup>2</sup>*City University of New York, New York*

<sup>3</sup>*City College of New York, New York*

**16:40 E05-4 (Invited) ENHANCING SUBWAVELENGTH IMAGE RECOGNITION WITH RESONANT METAMATERIAL LENSES**

Bakhtiyar Orzabayev\*, Romain Fleury

*École polytechnique fédérale de Lausanne, Lausanne, SWITZERLAND*

**17:00 E05-5 DESIGNING METAGRATINGS VIA LOCAL PERIODIC APPROXIMATION**

Vladislav Popov\*<sup>1</sup>, Fabrice Boust<sup>1,2</sup>, Shah Nawaz Burokur<sup>3</sup>

<sup>1</sup>*SONDRA, CentraleSupélec, Université Paris-Saclay, F-91190, Gif-sur-Yvette, FRANCE*

<sup>2</sup>*DEM, ONERA, Université Paris-Saclay, F-91123, Palaiseau, FRANCE*

<sup>3</sup>*LEME, UPL, Univ Paris Nanterre, F-92410, Ville d'Avray, FRANCE*

**17:20 E05-6 BREACH OF SYMMETRIES IN ROTATING ARRAYS AND METAMATERIALS OBSERVED IN THEIR REST FRAME**

Ben Z. Steinberg\*, Ido Kuzma

*School of EE, Tel-Aviv University, Tel-Aviv, ISRAEL*

**Session F05: Electromagnetics at the nanoscale and quantum effects - II**

Wednesday, May 29 15:40-17:20, Room F

Session Conveners: Amir Boag, *Tel Aviv University*; Amir Natan, *Tel-Aviv University*

Session Chairs: Amir Boag, *Tel Aviv University*; Amir Natan, *Tel-Aviv University*

**15:40 F05-1 (Invited) SPIN DIFFUSION FORMULATIONS IN MICROMAGNETIC MODELING**

Xueyang Wang, Shihao Zhuang, Iana Volvach, Vitaliy Lomakin\*

*University of California, San Diego, La Jolla, CA 92093*

**16:00 F05-2 TIME-DOMAIN INTEGRAL EQUATION ANALYSIS OF THE NONLINEAR ELECTROMAGNETIC RESPONSE OF CARBON NANOTUBES**

Md Khadimul Islam\*<sup>1</sup>, Edward J. Garboczi<sup>2</sup>, Ahmed M. Hassan<sup>1</sup>

<sup>1</sup>*Computer Science & Electrical Engineering Department, University of Missouri-Kansas City, Kansas City, Missouri*

<sup>2</sup>*Applied Chemicals and Materials Division, National Institute of Standards and Technology, Boulder, Colorado*

**16:20 F05-3 (Invited) QUANTUM MAXWELL'S EQUATIONS FROM THE FIELD MATTER HAMILTONIAN**

Aiyin Y. Liu<sup>1</sup>, Weng C. Chew\*<sup>2</sup>

<sup>1</sup>*Electrical and Computer Engineering, University of Illinois at Urbana Champaign, Urbana, IL*

<sup>2</sup>*Electrical and Computer Engineering, Purdue University, West Lafayette, IN*

**16:40 F05-4 (Invited) CARBON-NANOTUBE-ELECTROLYTE INTERFACE: QUANTUM AND ELECTRIC DOUBLE LAYER CAPACITANCE**

Jinfeng Li\*<sup>1</sup>, Phi H. Q. Pham<sup>2</sup>, Weiwei Zhou<sup>3</sup>, Ted D. Pham<sup>4</sup>, Peter J. Burke<sup>5</sup>

<sup>1</sup>*Department of Physics and Astronomy, University of California, Irvine, Irvine, CA*

<sup>2</sup>*Department of Chemical Engineering and Materials Science, University of California, Irvine, Irvine, CA*

<sup>3</sup>*Integrated Nanosystems Research Facility, University of California, Irvine, Irvine, CA*

<sup>4</sup>*Department of Biomedical Engineering, University of California, Irvine, Irvine, CA*

<sup>5</sup>*Department of Electrical Engineering and Computer Science, University of California, Irvine, Irvine, CA*

**17:00 F05-5 (Invited) SCANNING MICROWAVE MICROSCOPY OF VITAL MITOCHONDRIA IN RESPIRATION BUFFER**

Jinfeng Li<sup>1</sup>, Zahra Nemati<sup>2</sup>, Peter Burke\*<sup>3</sup>

<sup>1</sup>*Physics and Astronomy, University of California, Irvine, Irvine*

<sup>2</sup>*Materials Science and Engineering, University of California, Irvine, Irvine*

<sup>3</sup>*Electrical Engineering and Computer Science, University of California, Irvine, Irvine*

**Session B06: Electromagnetic Theory - I**

Thursday, May 30 08:20-10:40, Room B

Session Conveners: Daniel Sjoberg, *Lund University*; Ben Steinberg, *Tel-Aviv University*

Session Chairs: Daniel Sjoberg, *Lund University*; Ben Steinberg, *Tel-Aviv University*



**08:20 B06-1 (Invited) WELL-POSEDNESS OF SCATTERING PROBLEMS AT LUMINAL SPACE-TIME INTERFACES**

Zoe-Lise Deck-Leger\*, Nima Chamanara, Christophe Caloz

*Polytechnique Montreal, Montreal, CANADA*

**08:40 B06-2 (Invited) COHERENT VIRTUAL ABSORPTION FOR ENERGY TRANSFER, STORAGE AND RELEASE**

Andrea Alu\*, Alex Krasnok, Michele Cotrufo, Younes Radi

*Advanced Science Research Center, New York*

**09:00 B06-3 FORWARD AND INVERSE HOMOGENIZATION OF THE ELECTROMAGNETIC PROPERTIES OF A QUASIPERIODIC COMPOSITE**

Elena Cherkhev<sup>1</sup>, Sébastien Guenneau<sup>2</sup>, Niklas Wellander\*<sup>3</sup>

<sup>1</sup>*Department of Mathematics, University of Utah, Salt Lake City, Utah*

<sup>2</sup>*Institut Fresnel, Aix-Marseille Université, CNRS, Centrale Marseille, Marseille, FRANCE*

<sup>3</sup>*Radar Systems, FOI, Swedish Defence Research Agency, Linköping, SWEDEN*

**09:20 B06-4 BOUNDARY VALUE PROBLEMS FOR THE BI-ANISOTROPIC MAXWELL SYSTEM IN LIPSCHITZ DOMAINS**

Eric Stachura\*

*Mathematics, Kennesaw State University, Marietta, GA*

**09:40 B06-5 MODELING OF OPTICAL DIFFRACTION RADIATION OF A MODULATED ELECTRON BEAM FLOWING NEAR TO METAL PLASMONIC NANOWIRES**

Dariia O. Yevtushenko\*<sup>1,2</sup>, Sergii V. Dukhopelnykov<sup>1</sup>

<sup>1</sup>*Micro and Nano Optics, Institute of Radio-Physics and Electronics NASU, Kharkiv, UKRAINE*

<sup>2</sup>*Department of Photonics and Laser Eng, Kharkiv National University of Radio Electronics, Kharkiv, UKRAINE*

**10:00 B06-6 PHASE SYNCHRONIZATION OF COHERENTLY COUPLED ELECTROMAGNETIC OSCILLATORS**

Jiajie Ding<sup>1,2</sup>, Mohammad Ali Miri\*<sup>1,2</sup>

<sup>1</sup>*Department of Physics, Queens College of CUNY, Queens, New York*

<sup>2</sup>*Physics Program, The Graduate Center of CUNY, New York, New York*

**10:20 B06-7 (Invited) QUASI-TOPOLOGICAL SURFACE PLASMON POLARITONS ON GYROTROPIC INTERFACES**

George Hanson\*<sup>1</sup>, Samaneh Pakniyat<sup>1</sup>, Alexander Holmes<sup>1</sup>, Shahrokh Jam<sup>2</sup>

<sup>1</sup>*University of Wisconsin Milwaukee, Milwaukee, WI*

<sup>2</sup>*Shiraz University of Technology, Shiraz, IRAN*

**Session C06: Chaos and complexity in electromagnetism**

Thursday, May 30 08:20-10:40, Room C

Session Conveners: Gabriele Gradoni, *University of Nottingham*; Ari Sihvola, *Aalto University*; Joe Wiart, *LTCI Telecom ParisTech Université Paris Saclay*

Session Chairs: Gabriele Gradoni, *University of Nottingham*; Ari Sihvola, *Aalto University*; Joe Wiart, *LTCI Telecom ParisTech Université Paris Saclay*

**08:20 C06-1 (Invited) NONLINEAR WAVE CHAOS IN SUPERCONDUCTING BILLIARDS**

Min Zhou\*<sup>1,2</sup>, Edward Ott<sup>1,3</sup>, Thomas M. Antonsen<sup>1,3</sup>, Steven M. Anlage<sup>1,2,3</sup>

<sup>1</sup>*Electrical and Computer Engineering, university of maryland, college park*

<sup>2</sup>*Center for Nanophysics and Advanced Materials, university of maryland, college park*

<sup>3</sup>*Physics, university of maryland, college park*

**08:40 C06-2 (Invited) WAVE CHAOTIC PROPERTIES OF CASCADED COMPLEX ENCLOSURES**

Shukai Ma\*<sup>1</sup>, Bo Xiao<sup>2</sup>, Thomas M. Antonsen<sup>1,2</sup>, Edward Ott<sup>1,2</sup>, Steven M. Anlage<sup>1,2</sup>

<sup>1</sup>*Department of Physics, University of Maryland, College Park, MD*

<sup>2</sup>*Department of Electrical and Computer Engineering, University of Maryland, College Park, MD*

**09:00 C06-3 Design of Chaotic Reverberation Chambers**

Luca Bastianelli\*<sup>1</sup>, Franco Moglie<sup>1</sup>, Valter Mariani Primiani<sup>1</sup>, Gabriele Gradoni<sup>2,3</sup>

<sup>1</sup>*Dipartimento di Ingegneria dell'Informazione, Università Politecnica delle Marche, Ancona, Italy, ITALY*

<sup>2</sup>*School of Mathematical Sciences, University of Nottingham, Nottingham, UK, UNITED KINGDOM*

<sup>3</sup>*George Green Institute for Electromagnetics Research, University of Nottingham, Nottingham, UK, UNITED KINGDOM*

**09:20 C06-4 (Invited) WAVE-BASED ANALOG COMPUTATION IN RECONFIGURABLE WAVE-CHAOTIC SYSTEMS**

Philipp del Hougne\*<sup>1,2,3</sup>

<sup>1</sup>*Université Côte d'Azur, Nice, FRANCE*

<sup>2</sup>*Institut Langevin, Paris, FRANCE*

<sup>3</sup>*dH Laboratories, Alzenau, GERMANY*

**09:40 C06-5 (Invited) CHAOTIC WAVEFORMS WITH ENHANCED TARGETING CAPABILITIES**

Tsampikos Kottos\*

*Physics, Wesleyan University, Middletown, CT*

**10:00 C06-6 ORBITAL ANGULAR MOMENTUM OF RANDOM ELECTROMAGNETIC FIELDS NEAR BOUNDARIES**

Gabriele Gradoni\*<sup>1</sup>, Thomas Payne<sup>2</sup>, Luk R. Arnaut<sup>3</sup>

<sup>1</sup>*School of Mathematical Sciences, University of Nottingham, Nottingham, UNITED KINGDOM*

<sup>2</sup>*Department of Electrical and Electronic Engineering, University of Nottingham, Nottingham, UNITED KINGDOM*

<sup>3</sup>*School of Electronic Engineering and Computer Science, Queen Mary University of London, London, UNITED KINGDOM*

**10:20 C06-7 (Invited) NUMBER OF INDEPENDENT CONFIGURATIONS AND FIELD UNIFORMITY CRITERION IN CHAOTIC RECONFIGURABLE REVERBERATION CHAMBERS WITH TUNABLE METASURFACES**

Jean-Baptiste Gros\*<sup>1</sup>, Philipp del Hougne<sup>2</sup>, Ulrich Kuhl<sup>2</sup>, Olivier Legrand<sup>2</sup>, Fabrice Mortessagne<sup>2</sup>, Geoffroy Lerosey<sup>3</sup>

<sup>1</sup>*Institut Langevin, CNRS UMR 7587, Paris, FRANCE*

<sup>2</sup>*Universite' Co^te d'Azur, CNRS, INPHYNI, UMR 7010, Nice, FRANCE*

<sup>3</sup>*Greenerwave, Paris, FRANCE*

**Session D06: Mathematical modelling of EM problems - I**

Thursday, May 30 08:20-10:40, Room D

Session Conveners: Paul Smith, *Macquarie University*; Piergiorgio Uslenghi, *University of Illinois at Chicago*

Session Chairs: Karu Esselle, *Macquarie University, Sydney*; Matteo Pastorino, *University of Genoa*

**08:20 D06-1 (Invited) NON-MARKOVIAN EARLY- AND LATE-TIME DYNAMICS OF THE POPULATION AND FORCE ON EXCITED- AND GROUND-STATE ATOMS IN NONRECIPROCAL ENVIRONMENTS**

George Hanson\*<sup>1</sup>, S.A. Hassani Gangaraj<sup>2</sup>, Mario Silveirinha<sup>3</sup>, Mauro Antezza<sup>4</sup>, Francisco Monticone<sup>2</sup>

<sup>1</sup>*University of Wisconsin Milwaukee, Milwaukee, WI*

<sup>2</sup>*Cornell University, Ithaca, NY*

<sup>3</sup>*University of Lisbon and Instituto de Telecomunicações, Lisbon, PORTUGAL*

<sup>4</sup>*Université de Montpellier, Montpellier, FRANCE*

**08:40 D06-2 (Invited) NON-RECIPROCAL HYPERBOLIC PROPAGATION OVER MOVING METASURFACES**

Yarden Mazor\*<sup>1</sup>, Andrea Alu<sup>2,3</sup>

<sup>1</sup>*University of Texas at Austin, Austin*

<sup>2</sup>*City University of New York, New York*

<sup>3</sup>*City College of New York, New York*

**09:00 D06-3 (Invited) TRANSIENT MOLECULAR SIMULATION OF THE ELECTRIC FIELDS FROM MICROTUBULES**

Kyle A. Thackston\*, Daniel F. Sievenpiper

*ECE, UCSD, San Diego*

**09:20 D06-4 (Invited) OPTIMIZING AMPLITUDE DISTRIBUTION IN A FEED ARRAY TO CONTROL SIDE-LOBE LEVELS OF A BEAM-STEERING METASURFACE**

Khushboo Singh, Muhammad U. Afzal, David Bulger, Maria Kovaleva, Karu P. Esselle\*

*School of Engineering, Macquarie University, SYDNEY, AUSTRALIA*

**09:40 D06-5 (Invited) EXCEPTIONAL POINTS OF DEGENERACY DIRECTLY INDUCED BY SPACE-TIME PERIODIC VARIATION**

Hamidreza Kazemi\*, Mohamad Y. Nada, Ahmed F. Abdelshafy, Tarek Maely, Filippo Capolino

*EECS, University of California Irvine, Irvine, CA*

**10:00 D06-6 (Invited) BEAM-FRAME FORMULATION FOR TIME-DEPENDENT TOMOGRAPHIC INVERSE SCATTERING IN A NOISY BACKGROUND**

Ram Tuvi\*<sup>1</sup>, Ehud Heyman<sup>1</sup>, Timor Melamed<sup>2</sup>

<sup>1</sup>*School of Electrical Engineering, Tel Aviv University, Tel Aviv, ISRAEL*

<sup>2</sup>*Department of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva, ISRAEL*

**10:20 D06-7 (Invited) VARIABLE-EXPONENT LEBESGUE-SPACE INVERSION FOR SUBSURFACE IMAGING**

Claudio Estatico<sup>1</sup>, Alessandro Fedeli<sup>2</sup>, Matteo Pastorino\*<sup>2</sup>, Andrea Randazzo<sup>2</sup>

<sup>1</sup>*Department of Mathematics, University of Genoa, Genoa, ITALY*

<sup>2</sup>*Department of Electrical, Electronic, Telecommunications Engineering, and Naval Architecture, University of Genoa, Genoa, ITALY*

**Session E06: Millimeter-Wave Antennas and 5G Communications**

Thursday, May 30 08:20-10:40, Room E

Session Conveners: Jiro Hirokawa, *Tokyo Institute of Technology*; John Volakis, *Florida International Univ*

Session Chairs: John Volakis, *Florida International Univ*; Jiro Hirokawa, *Tokyo Institute of Technology*

**08:20 E06-1 BEAM-STEERABLE ARRAY FED BY TRAVELING-WAVE MICROSTRIP LINE FOR 5G MILLIMETER-WAVE MOBILE TERMINAL APPLICATIONS**

Changjiang Deng\*<sup>1</sup>, Kamal Sarabandi<sup>2</sup>

<sup>1</sup>*Beijing Institute of Technology, Beijing, CHINA*

<sup>2</sup>*University of Michigan, Ann Arbor, MI*

**08:40 E06-2 A LOW COST MILLIMETER-WAVE PHASED ARRAY**

Alexander D. Johnson\*, Elias A. Alwan, John L. Volakis

*Electrical and Computer Engineering, Florida International University, Miami, Florida*

**09:00 E06-3 DESIGN OF H-PLANE SIDELobe SUPPRESSION USING A SLIT LAYER IN A CORPORATE-FEED WAVEGUIDE SLOT ARRAY ANTENNA OF 2×2-ELEMENT RADIATING UNITS**

Jiro Hirokawa\*, Haruka Arakawa, Takashi Tomura

*Tokyo Institute of Technology, Tokyo, JAPAN*

**09:20 E06-4 W-BAND DUAL-LARGE-REFLECTARRAY ANTENNA WITH LOW SENSITIVITY AND BROAD BANDWIDTH CHARACTERISTIC**

Euncheol Choi\*, Sangwook Nam

*INMC, Dept. of Electrical and Computer Engineering, seoul national university, Seoul Special City, SOUTH KOREA*

**09:40 E06-5 Broadbeam and Low Cross-Pol Antenna for Millimeter-Wave Cell Exposure Testing**

Jae-Young Chung\*, Philip A. Dzagbletey

*SeoulTech, Seoul, SOUTH KOREA*

**10:00 E06-6 ANALYSIS AND DESIGN OF AXIAL CORRUGATED KA-BAND FEED HORN**

Ila Agnihotri\*, Satish K. Sharma

*Electrical and Computer Engineering, San Diego State University, San Diego, CA*

**10:20 E06-7 ANALYSIS AND DESIGN OF A W-BAND CIRCULAR POLARIZED FEED HORN WITH INBUILT POLARIZER FOR LOW F/D OFFSET REFLECTOR ANTENNA**

Ghanshyam Mishra\*<sup>1</sup>, Satish Kumar Sharma<sup>1</sup>, Jia-Chi Chieh<sup>2</sup>

<sup>1</sup>*Electrical and Computer Engineering, San diego state university, San Diego, California*

<sup>2</sup>*Advanced Integrated Circuits and Sensors Division, SPAWAR Systems Center Pacific, San Diego, California*

**Session F06: Scattering and diffraction**

Thursday, May 30 08:20-10:40, Room F

Session Conveners: Ludger Klinkenbusch, *University of Kiel*; Giuliano Manara, *University of Pisa*

Session Chairs: Ludger Klinkenbusch, *University of Kiel*; Giuliano Manara, *University of Pisa*

**08:20 F06-1 (Invited) SCATTERING BY TWO PARALLEL THIN WIRES INSIDE A DIHEDRAL CORNER REFLECTOR**

Piergiorgio L. E. Uslenghi\*

*University of Illinois at Chicago, Chicago, Illinois*

**08:40 F06-2 (Invited) INVESTIGATING MULTIPLE DIFFRACTIONS NEAR OPTICAL BOUNDARIES WITH BIDIRECTIONAL RAY-TRACING AND ANTENNA RECIPROCITY**

Mehmet Taygur, Thomas Eibert\*

*TUM HFT, Munich, GERMANY*

**09:00 F06-3 (Invited) SURFACE-PLASMON AND LEAKY-WAVE PROPAGATION IN LINEAR ARRAY OF CIRCULAR SCATTERERS**

Vakhtang Jandieri<sup>1</sup>, Paolo Baccarelli<sup>2</sup>, Giuseppe Schettini\*<sup>2</sup>

<sup>1</sup>*General and Theoretical Electrical Engineering (ATE), Faculty of Engineering, Duisburg-Essen University, Duisburg, GERMANY*

<sup>2</sup>*Department of Engineering, Roma Tre University, Rome, ITALY*

**09:20 F06-4 (Invited) PERFORMANCE TRADEOFFS REVEALED BY MULTI-OBJECTIVE OPTIMIZATION OF MULTI-LAYERED CORE-SHELL NANOPARTICLES**

Sawyer D. Campbell\*, Douglas H. Werner

*Department of Electrical Engineering, The Pennsylvania State University, University Park, PA*

**09:40 F06-5 (Invited) MAXIMUM GAIN, EFFECTIVE AREA, AND SCATTERING**

Mats Gustafsson\*<sup>1</sup>, Miloslav Capek<sup>2</sup>

<sup>1</sup>*Lund University, Lund, SWEDEN*

<sup>2</sup>*Czech Technical University in Prague, Prague, CZECH REPUBLIC*

**10:00 F06-6 (Invited) WIENER-HOPF ANALYSIS OF THE DIFFRACTION BY A HALF-PLANE DIPOLE ARRAY**

Miguel Camacho\*<sup>1</sup>, Filippo Capolino<sup>2</sup>, Matteo Albani<sup>3</sup>

<sup>1</sup>*Department of Physics and Astronomy, University of Exeter, Exeter, UNITED KINGDOM*

<sup>2</sup>*Department of Electrical Engineering and Computer Science, University of California, Irvine, Irvine, California*

<sup>3</sup>*Department of Information Engineering and Mathematics, University of Siena, Siena, ITALY*

**10:20 F06-7 (Invited) DIFFRACTION COEFFICIENT FOR WIDE-ANGLE CONES**

Michael Katsav, Ehud Heyman\*

*School of Electrical Engineering, Tel Aviv University, Tel Aviv, ISRAEL*

**Session B07: Electromagnetic theory - II**

Thursday, May 30 13:00-15:20, Room B

Session Conveners: Daniel Sjoberg, *Lund University*; Ben Steinberg, *Tel-Aviv University*

Session Chairs: Daniel Sjoberg, *Lund University*; Ben Steinberg, *Tel-Aviv University*

**13:00 B07-1 (Invited) DYNAMICS OF SHORT-PULSE SIGNALS IN SOFTLY-SWITCHED TIME-VARYING TRANSMISSION LINES**

Amir Shlivinski\*<sup>1</sup>, Yakir Hadad<sup>2</sup>

<sup>1</sup>*Ben Gurion University of the Negev, Beer Sheva, ISRAEL*

<sup>2</sup>*Tel-Aviv University, Tel Aviv, ISRAEL*

**13:20 B07-2 (Invited) A GENERALIZED MODE-MATCHING METHOD FOR GLIDE-SYMMETRIC STRUCTURES**

Guido Valerio<sup>1</sup>, Fatemeh Ghasemifard<sup>2</sup>, Martin Norgren\*<sup>2</sup>, Oscar Quevedo-Teruel<sup>2</sup>

<sup>1</sup>*Laboratoire d'Electronique et Electromagnetisme, Sorbonne Université, Paris, FRANCE*

<sup>2</sup>*Department of Electromagnetic Engineering, School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, SWEDEN*

**13:40 B07-3 (Invited) ON THE OPTIMAL PLASMONIC RESONANCES IN GOLD NANOSPHERES EMBEDDED IN DISPERSIVE MEDIA**

Sven Nordebo\*<sup>1</sup>, Yevhen Ivanenko<sup>1</sup>, Richard Bayford<sup>2</sup>

<sup>1</sup>*Physics and Electrical Engineering, Linnaeus University, Växjö, SWEDEN*

<sup>2</sup>*Department of Natural Sciences, Middlesex University, London, UNITED KINGDOM*

**14:00 B07-4 (Invited) FUNDAMENTAL PROPERTIES OF MIE RESONANCES IN WATER SPHERES**

Rasmus E. Jacobsen\*<sup>1</sup>, Samel Arslanagic<sup>2</sup>, Andrei V. Lavrinenko<sup>1</sup>

<sup>1</sup>*Department of Photonics Engineering, Technical University of Denmark, Kongens Lyngby, DENMARK*

<sup>2</sup>*Department of Electrical Engineering, Technical University of Denmark, Kongens Lyngby, DENMARK*

**14:20 B07-5 NON-PASSIVE APPROXIMATION AS A TOOL TO STUDY THE REALIZABILITY OF AMPLIFYING MEDIA**

Yevhen Ivanenko\*, Sven Nordebo

*Department of Physics and Electrical Engineering, Linnaeus University, Växjö, SWEDEN*

**14:40 B07-6 (Invited) GENERAL THEORY OF EXCEPTIONAL POINTS OF DEGENERACY IN EM SYSTEMS**

Mohamed Y. Nada\*<sup>1</sup>, Ahmed Abdelshafy<sup>1</sup>, Tarek Mealy<sup>1</sup>, Hamidreza Kazemi<sup>1</sup>, Alexander Figotin<sup>2</sup>,

Filippo Capolino<sup>1</sup>

<sup>1</sup>*Department of Electrical Engineering and Computer Science, University of California, Irvine (UCI), Irvine*

<sup>2</sup>*Department of Mathematics, University of California, Irvine (UCI), Irvine*

**15:00 B07-7 (Invited) DESCRIBING THE PERFORMANCE OF NONLINEAR AND TIME-VARYING ANTENNAS**

Kurt R. Schab\*<sup>1</sup>, K.c. Kerby-Patel<sup>2</sup>, Nicole L. Bohannon<sup>3</sup>, Jessica E. Ruyle<sup>4</sup>

<sup>1</sup>*Santa Clara University, Santa Clara, CA*

<sup>2</sup>*University of Massachusetts, Boston, MA*

<sup>3</sup>*Laboratory for Physical Sciences, College Park, MD*

<sup>4</sup>*University of Oklahoma, Norman, OK*

### **Session B08: Electromagnetic Theory - III**

Thursday, May 30 15:40-17:40, Room B

Session Conveners: Daniel Sjoberg, *Lund University*; Ben Steinberg, *Tel-Aviv University*

Session Chairs: Daniel Sjoberg, *Lund University*; Ben Steinberg, *Tel-Aviv University*

#### **15:40 B08-1 RF EFFECTS OF UMBRELLA REFLECTOR ANTENNA TOPOLOGY FOR CUBESATS: OPTIMAL FEED POINT, BORESIGHT GAIN LOSS AND GRATING LOBES**

Vignesh Manohar\*, Yahya Rahmat-Samii

*Electrical and Computer Engineering, University of California, Los Angeles, Los Angeles*

#### **16:00 B08-2 (Invited) ANALYTICAL FORMULATION FOR LOOP ANTENNAS VALID FROM THE RF TO OPTICAL REGIME: A REVIEW**

Ryan J. Chaky\*<sup>1</sup>, Jogender Nagar<sup>1</sup>, Arnold F. McKinley<sup>2</sup>, Mario F. Pantoja<sup>3</sup>, Douglas H. Werner<sup>1</sup>

<sup>1</sup>*Dept. of Electrical Engineering, The Pennsylvania State University, University Park, PA*

<sup>2</sup>*Dept. of Electronic and Electrical Engineering, University College London, London, UNITED KINGDOM*

<sup>3</sup>*Dept. of Electromagnetics, University of Granada, Granada, SPAIN*

#### **16:20 B08-3 (Invited) STORED ENERGIES AND CURRENT OPTIMIZATION WITH CONSTRAINTS**

Lars Jonsson\*

*EECS, KTH Royal Institute of Technology, Stockholm, SWEDEN*

#### **16:40 B08-4 (Invited) CAUSALITY AND CONVEXITY: POWER-BANDWIDTH LIMITS TO OPTICAL RESPONSE**

Owen D. Miller\*<sup>1,2</sup>, Hyungki Shim<sup>2,3</sup>

<sup>1</sup>*Applied Physics, Yale University, New Haven, CT*

<sup>2</sup>*Energy Sciences Institute, Yale University, New Haven, CT*

<sup>3</sup>*Physics, Yale University, New Haven, CT*

#### **17:00 B08-5 (Invited) GENERALIZED MODE EXPANSIONS FOR ANTENNA ANALYSIS**

Mats Gustafsson\*<sup>1</sup>, Miloslav Capek<sup>2</sup>, Kurt Schab<sup>3</sup>



<sup>1</sup>Lund University, Lund, SWEDEN

<sup>2</sup>Czech Technical University in Prague, Prague, CZECH REPUBLIC

<sup>3</sup>Santa Clara University, Santa Clara

**17:20 B08-6 (Invited) A RIGOROUS THEORY OF BACKSCATTERING FROM AN ELECTRICALLY LARGE DIELECTRIC SPHERE**

Andrey Osipov\*

German Aerospace Center (DLR), Wessling, GERMANY

**Session C07: Recent advances in optimization techniques in electromagnetics**

Thursday, May 30 13:00-15:20, Room C

Session Conveners: Ahmad Hoorfar, *Villanova University*; Sembiam Rengarajan, *California State University*

Session Chairs: Sembiam Rengarajan, *California State University*; Ahmad Hoorfar, *Villanova University*

**13:00 C07-1 (Invited) RECENT CONTRIBUTIONS TO MULTIOBJECTIVE EVOLUTIONARY OPTIMIZATION IN ELECTROMAGNETICS**

Ronald P. Jenkins\*, Douglas H. Werner

*The Pennsylvania State University, University Park*

**13:20 C07-2 (Invited) GA, PSO AND BSO AS EVOLUTIONARY OPTIMIZATION METHODS: RELYING ON SURVIVABILITY, COOPERATION AND WISDOM OF SPECIES**

Yahya Rahmat-Samii\*

*Department of Electrical and Computer Engineering, University of California, Los Angeles, Los Angeles*

**13:40 C07-3 (Invited) JOINT DIRECTION-OF-ARRIVAL AND MUTUAL COUPLING ESTIMATION OF SPARSE ARRAYS USING FIREWORKS ALGORITHM**

Ahmad Hoorfar\*<sup>1</sup>, Elie BouDaher<sup>2</sup>

<sup>1</sup>*Villanova University, Villanova, PA*

<sup>2</sup>*Bose Corporation, Framingham, MA*

**14:00 C07-4 (Invited) ANTENNA ARRAY OUTPUT POWER MINIMIZATION USING PARTICLE SWARM OPTIMIZATION**

Nghia Tran\*<sup>1</sup>, Farshid Tamjid<sup>2</sup>, Farhan Quaiyum<sup>2</sup>, Robab Kazemi<sup>3</sup>, Aly Fathy<sup>2</sup>, Ozlem Kilic<sup>1</sup>

<sup>1</sup>*EECS, The Catholic University of America, Washington DC*

<sup>2</sup>*EECS, University of Tennessee at Knoxville, Knoxville TN*

<sup>3</sup>*EECS, University of Tabriz, Iran, IRAN*

**14:20 C07-5 (Invited) A STUDY OF SEVERAL NATURE-INSPIRED OPTIMIZATION TECHNIQUES**

Sembiam R. Rengarajan\*, Samuel Gaxiola, Utsav Poudel, Edwin Rebollo

*Electrical and Computer Engineering, California State University, Northridge, CA*

**14:40 C07-6 (Invited) SNO-BASED DESIGN OF MULTI-BEAM REFLECTARRAYS**

Michele Beccaria<sup>1</sup>, Andrea Massaccesi<sup>1</sup>, Alessandro Niccolai<sup>2</sup>, Paola Pirinoli\*<sup>1</sup>, Riccardo E. Zich<sup>2</sup>

<sup>1</sup>*Electronics and Telecommunications, Politecnico di Torino, Torino, ITALY*

<sup>2</sup>*Energy, Politecnico di Milano, Milano, ITALY*

**15:00 C07-7 (Invited) DIRECT FULL-WAVE FEM OPTIMIZATION FOR COMPUTER AIDED DESIGN OF COMPLEX MICROWAVE DEVICES AND ANTENNAS**

Martyna Mul<sup>1</sup>, Grzegorz Fotyga<sup>1</sup>, Adam Lamecki<sup>2</sup>, Lukasz Balewski<sup>2</sup>, Michal Mrozowski\*<sup>1</sup>

<sup>1</sup>*Gdansk University of Technology, Gdansk, POLAND*

<sup>2</sup>*EM Invent Ltd., Gdansk, POLAND*

**Session C08: Bioelectromagnetics**

Thursday, May 30 15:40-17:20, Room C

Session Chairs: Gianluca Lazzi, *University of Utah*; Dragan Poljak, *University of Split*

**15:40 C08-1 ANALYSIS OF MISALIGNMENT EFFECTS ON LINK BUDGET OF AN IMPLANTABLE ANTENNA**

Mohammad Haerinia\*, Sima Noghianian

*University of North Dakota, Grand Forks*

**16:00 C08-2 PLANAR ARRAY OF NON-RESONATING CONCENTRIC COILS FOR HIGH-FLEXIBILITY WIRELESS POWER TRANSFER APPLICATIONS**

Danilo Brizi<sup>1</sup>, John Stang\*<sup>2</sup>, Agostino Monorchio<sup>1</sup>, Gianluca Lazzi<sup>2</sup>

<sup>1</sup>*University of Pisa, Pisa, ITALY*

<sup>2</sup>*University of Southern California, Los Angeles*

**16:20 C08-3 A NOTE ON MEASURES OF HUMAN EXPOSURE TO SIGNALS WITH CONTINUOUS SPECTRA**

Dragan Poljak\*<sup>1</sup>, Lara Payewski<sup>2</sup>

<sup>1</sup>*Electronics and Computing, University of Split, Split, CROATIA*

<sup>2</sup>*Sapienza University, Rome, ITALY*

**16:40 C08-4 BIOMEDICAL ANTENNA CHARACTERIZATION IN-FRONT OF HOMOGENEOUS AND FREQUENCY DEPENDENT INHOMOGENEOUS HUMAN HEAD**

Md Rokunuzzaman Robel\*, Asif Ahmed, Thomas Baum, Wayne S. T. Rowe

*School of Engineering, RMIT University, Melbourne, Victoria, AUSTRALIA*

**17:00 C08-5 STOCHASTIC SENSITIVITY ANALYSIS OF BIOHEAT TRANSFER EQUATION**

Anna Susnjara\*, Dragan Poljak, Frano Rezo, Josip Matkovic

*Department of electronics and computer science, Faculty of electrical engineering, mechanical engineering and naval architecture, Split, CROATIA*

**Session D07: Mathematical modelling of EM problems - II**

Thursday, May 30 13:00-15:20, Room D

Session Conveners: Paul Smith, *Macquarie University*; Piergiorgio Uslenghi, *University of Illinois at Chicago*

Session Chairs: Ludger Klinkenbusch, *University of Kiel*; Guido Lombardi, *Politecnico di TOirno-ISMB*

**13:00 D07-1 (Invited) DIFFRACTION OF A UNIFORM COMPLEX-SOURCE BEAM BY A SLIT**

Ludger Klinkenbusch\*

*Electrical Engineering and Information Technology, Kiel University, Kiel, GERMANY*

**13:20 D07-2 (Invited) EXACT GEOMETRICAL OPTICS SCATTERING BY A 45-DEGREE METAL WEDGE ILLUMINATED BY MULTIPLE PLANE WAVES**

Piergiorgio L. E. Uslenghi\*

*University of Illinois at Chicago, Chicago, Illinois*

**13:40 D07-3 (Invited) SOLUTIONS OF SCATTERING PROBLEMS INVOLVING THE MODIFIED WIENER-HOPF GEOMETRIES**

Takashi Nagasaka, Kazuya Kobayashi\*

*Department of Electrical, Electronic, and Communication Engineering, Chuo University, Tokyo, JAPAN*

**14:00 D07-4 (Invited) WIENER-HOPF FORMULATION OF THE SCATTERING BY A PEC WEDGE OVER AN HALF DIELECTRIC GROUNDED SLAB**

Vito Daniele, Guido Lombardi\*, Rodolfo S. Zich

*Politecnico di Toirno-ISMB, Torino, ITALY*

**14:20 D07-5 (Invited) ADDITIVE SINGULAR BASIS FUNCTIONS FOR THE MOM SOLUTION OF PLATE STRUCTURES WITH CORNERS**

Roberto D. Graglia\*<sup>1</sup>, Andrew F. Peterson<sup>2</sup>, Paolo Petrini<sup>1</sup>

<sup>1</sup>*DET, Politecnico di Torino, Torino, ITALY*

<sup>2</sup>*Georgia Institute of Technology, Atlanta, GA*

**14:40 D07-6 (Invited) ANALYSIS OF THE IMPACT ON FIELDS AND CURRENTS WHEN CORNERS OF A SCATTERER ARE ROUNDED**

Paul D. Smith\*, Audrey J. Markowskei

*Department of Mathematics and Statistics, Macquarie University, Sydney, NSW, AUSTRALIA*

**15:00 D07-7 (Invited) ELECTROMAGNETIC COUPLING OF TWO SLOTTED ARBITRARILY PROFILED CYLINDRICAL CAVITY RESONATORS**

Elena D. Vinogradova\*, Paul D. Smith

*Department of Mathematics and Statistics, Macquarie University, Sydney, NSW, AUSTRALIA*

**Session D08: Exotic EM wave-matter interaction phenomena empowered by complex material platforms**

Thursday, May 30 15:40-17:40, Room D

Session Conveners: Samel Arslanagic, *Technical University of Denmark*; Richard Ziolkowski, *University of Arizona, Tucson*

Session Chairs: Samel Arslanagic, *DTU*; Richard Ziolkowski, *University of Technology Sydney*

**15:40 D08-1 ACTIVE NANO PARTICLES FOR ENHANCED AND DIRECTIVE RADIATION AND SCATTERING PHENOMENA**

Samel Arslanagic\*

*Department of Electrical Engineering, Technical University of Denmark, Kgs. Lyngby, DENMARK*

**16:00 D08-2 CAN A DIELECTRIC SPHERE EMULATE THE BEHAVIOR OF A SURFACE IMPEDANCE SPHERE?**

Dimitrios C. Tzarouchis\*, Henrik Wallén, Pasi Ylä-Oijala, Ari Sihvola

*Aalto University, Espoo, FINLAND*

**16:20 D08-3 OPTICAL METASURFACES BASED ON SPHEROIDAL NANOPARTICLES: THEORY AND APPLICATIONS**

Alessio Monti\*<sup>1</sup>, Andrea Alù<sup>2</sup>, Alessandro Toscano<sup>3</sup>, Filiberto Bilotti<sup>3</sup>

<sup>1</sup>*Engineering, Niccolò Cusano University, Rome, ITALY*

<sup>2</sup>*CUNY Advanced Science Research Center, New York*

<sup>3</sup>*Engineering, Roma Tre University, Rome, ITALY*

**16:40 D08-4 MULTI-OBJECTIVE OPTIMIZATION OF NANOANTENNAS FOR PHASE-GRADIENT METASURFACE APPLICATIONS**

Sawyer D. Campbell\*, Eric B. Whiting, Douglas H. Werner

*The Pennsylvania State University, University Park, PA*

**17:00 D08-5 CONTROLLING CIRCULAR POLARIZATION: SELECTIVITY AND CAUSALITY**

Daniel Sjöberg\*

*Lund University, Lund, SWEDEN*

**17:20 D08-6 THE PHYSICS AND ENGINEERING OF METAMATERIAL-INSPIRED NEAR-FIELD  
RESONANT PARASITIC (NFRP) HUYGENS RADIATING AND SCATTERING PLATFORMS**

Richard W. Ziolkowski\*

*University of Technology Sydney, Ultimo, AUSTRALIA*

**Session E07: Advanced metamaterial concepts for electromagnetics - II**

Thursday, May 30 13:00-15:20, Room E: Topaz

Session Conveners: Andrea Alu, *Advanced Science Research Center*; Dimitrios Sounas, *Wayne State University*

Session Chairs: Andrea Alu, *Advanced Science Research Center*; Dimitrios Sounas, *Wayne State University*

**13:00 E07-1 DUAL-FOCAL METALENSSES BASED ON COMPLETE DECOUPLING OF AMPLITUDE,  
PHASE AND POLARIZATION**

He-Xiu Xu\*, Cheng-Wei Qiu\*

*National University of Singapore, Singapore, SINGAPORE*

**13:20 E07-2 (Invited) TOPOLOGICAL AND NONRECIPROCAL GUIDING AND LASING IN  
PHOTONIC METAMATERIALS WITH TIME-MODULATED GAIN AND LOSS**

Alexander Khanikaev\*<sup>1</sup>, Mengyao Li<sup>1</sup>, Xiang Ni<sup>1</sup>, Matthew Weiner<sup>1</sup>, Andrea Alu<sup>2</sup>

<sup>1</sup>*Electrical Engineering, City College of New York, New York, NY*

<sup>2</sup>*Photonics Initiative, Advanced Science Research Center, New York, NY*

**13:40 E07-3 (Invited) MANIPULATING SURFACE WAVES AND NANOSCALE FORCES/TORQUES  
WITH NONRECIPROCAL PLATFORMS**

S. Ali Hassani Gangaraj<sup>1</sup>, George W. Hanson<sup>2</sup>, Mario G. Silveirinha<sup>3</sup>, Mauro Antezza<sup>4,5</sup>, Francesco Monticone\*<sup>1</sup>

<sup>1</sup>*School of Electrical and Computer Engineering, Cornell University, Ithaca, NY*

<sup>2</sup>*Department of Electrical Engineering, University of Wisconsin-Milwaukee, Milwaukee, WI*

<sup>3</sup>*Instituto Superior Tecnico, University of Lisbon and Instituto de Telecomunicacoes, Lisbon, PORTUGAL*

<sup>4</sup>*Laboratoire Charles Coulomb (L2C), CNRS-Universite de Montpellier, Montpellier, FRANCE*

<sup>5</sup>*Institut Universitaire de France, Paris, FRANCE*

**14:00 E07-4 (Invited) NONRECIPROCAL COLLIMATED SURFACE PLASMONS IN DRIFT-BIASED  
GRAPHENE SHEETS**

Diego Correas Serrano, J. Sebastian Gomez Diaz\*

*Electrical and Computer Engineering Department, UC Davis, Davis, California*

**14:20 E07-5 EFFICIENT HOT-ELECTRON TRANSFER IN METAL-INSULATOR-SEMICONDUCTOR  
HYPERBOLIC METAMATERIALS**

Pai-Yen Chen\*

*Department of Electrical and Computer Engineering, University of Illinois at Chicago, Chicago*

**14:40 E07-6 PARITY-TIME SYMMETRY AND EXCEPTIONAL POINTS IN METAMATERIALS**

Andrea Alu\*<sup>1</sup>, Zhicheng Xiao<sup>2</sup>, Dimitrios Sounas<sup>3</sup>, Younes Radi<sup>1</sup>

<sup>1</sup>*Advanced Science Research Center, New York*

<sup>2</sup>*The University of Texas at Austin, Austin, TX*

<sup>3</sup>*Wayne State University, Detroit, MI*

**15:00 E07-7 (Invited) USING TEMPORAL SWITCHING FOR IMPEDANCE MATCHING BEYOND THE  
BODE-FANO BOUND**

Yakir Hadad\*<sup>1</sup>, Amir Shlivinski<sup>2</sup>

<sup>1</sup>*School of Electrical Engineering, Tel-Aviv University, Tel-Aviv, ISRAEL*

<sup>2</sup>*Department of Electrical and Computer engineering, Ben-Gurion University, Beer-Sheva, ISRAEL*

**Session E08: Advanced metamaterial concepts for electromagnetics - III**

Thursday, May 30 15:40-17:00, Room E

Session Conveners: Andrea Alu, *Advanced Science Research Center*; Dimitrios Sounas, *Wayne State University*

Session Chairs: Andrea Alu, *Advanced Science Research Center*; Dimitrios Sounas, *Wayne State University*

**15:40 E08-1 (Invited) TIME-MODULATED REACTIVE ELEMENTS FOR CONTROL OF  
ELECTROMAGNETIC ENERGY**

Grigori A. Ptitsyn\*, Mohammad S. Mirmoosa, Viktor S. Asadchy, Sergei A. Tretyakov

*Electrical Engineering, Aalto University, Espoo, FINLAND*

**16:00 E08-2 EQUIVALENCE-PRINCIPLE-BASED ACTIVE METASURFACES**

Paris Ang\*<sup>1</sup>, Alex M. H. Wong<sup>2</sup>, George V. Eleftheriades<sup>1</sup>

<sup>1</sup>*Electrical and Computer Engineering, University of Toronto, Toronto, Ontario, CANADA*

<sup>2</sup>*City University of Hong Kong, Kowloon Tong, Hong Kong, CHINA*

**16:20 E08-3 (Invited) ANALYSIS AND DESIGN OF TIME-VARYING METAMATERIALS AND  
METASURFACES**

Anthony Grbic\*, Cody Scarborough, Zhanni Wu

*University of Michigan, Ann Arbor*

**16:40 E08-4 (Invited) SIMPLE AND INSIGHTFUL COMPUTATION OF SPACE-TIME CRYSTAL DISPERSION DIAGRAMS**

Zoe-Lise Deck-Leger\*, Nima Chamanara, Christophe Caloz

*Electrical Engineering, Polytechnique Montreal, Montreal, CANADA*

**Session F07: Antenna theory**

Thursday, May 30 13:00-15:20, Room F

Session Chairs: Satish Sharma, *San Diego State University*; Everett Farr, *Farr Fields, LC*

**13:00 F07-1 QUASI-STATIC DESIGN OF SMALL ULTRA-WIDEBAND ANTENNAS**

Thomas O. Jones\*

*Electromagnetics and Advanced Technology Division, SPAWAR Systems Center Pacific, San Diego CA*

**13:20 F07-2 A FREQUENCY-TUNABLE, OMNI-DIRECTIONAL, CIRCULARLY POLARIZED, ELECTRICALLY SMALL ANTENNA**

Dylan B. Rice, Sungkyun Lim\*

*Department of Electrical and Computer Engineering, Georgia Southern University, Statesboro, GA*

**13:40 F07-3 L-BAND WIDE-ANGLE CIRCULAR POLARIZED SEQUENTIAL ROTATED ANTENNA FOR GPS APPLICATIONS**

Ghanshyam Mishra\*, Satish K. Sharma

*Electrical and Computer Engineering, San Diego State University, San Diego, CA*

**14:00 F07-4 A COMPACT IMPLANTABLE MONOPOLE BASED ON NULLIFIER**

G. Lasri, T. Paley, B. Milgrom, Motti Haridim\*

*Holon Institute of Technology, Holon, ISRAEL*

**14:20 F07-5 THE ANTENNA EQUATION: A DESCRIPTION OF ANTENNAS INSPIRED BY SCATTERING PARAMETERS**

Everett G. Farr\*

*Farr Fields, LC, Albuquerque*

**14:40 F07-6 3D PRINTING-BASED LIQUID METAL PATCH ANTENNAS WITH WIDE-BAND FREQUENCY AND MULTI-POLARIZATION RECONFIGURATIONS**

Lingnan Song\*, Wurao Gao, Yahya Rahmat-Samii

*Electrical and Computer Engineering, University of California, Los Angeles, Los Angeles, CA*

**15:00 F07-7 USING THE ANTENNA EQUATION TO DESCRIBE COUPLING INTO AND LEAKAGE FROM IMPERFECTLY SHIELDED ENCLOSURES**

Everett G. Farr\*

*Farr Fields, LC, Albuquerque*

**Session F08: Forward scattering and propagation**

Thursday, May 30 15:40-17:40, Room F

Session Conveners: Cristina Ponti, *"Roma Tre" University - Department of Engineering*; Andrea Randazzo, *DITEN - University of Genoa*

Session Chairs: Cristina Ponti, *"Roma Tre" University - Department of Engineering*; Andrea Randazzo, *DITEN - University of Genoa*

**15:40 F08-1 (Invited) NEAR-FIELD SCATTERING BY CYLINDERS LOCATED ON BOTH SIDES OF A HALF-SPACE INTERFACE**

Siu-Chun Lee\*

*Applied Sciences Lab, Inc., Baldwin Park, CA*

**16:00 F08-2 (Invited) POLARIMETRIC PATH LOSS MODELS FOR INDOOR SCENARIOS WITH DIFFUSE COMPONENTS**

Davy P. Gaillot<sup>1</sup>, Pierre Laly<sup>1</sup>, Shiqi Cheng<sup>1</sup>, Emmeric Tanghe<sup>2</sup>, Martine Liénard<sup>1</sup>, Luc Martens<sup>2</sup>, Wout Joseph<sup>2</sup>

<sup>1</sup>*IEMN, University of Lille, Villeneuve d'Ascq, FRANCE*

<sup>2</sup>*IMEC, Ghent University, Ghent, BELGIUM*

**16:20 F08-3 A SEMI-ANALYTICAL PROCEDURE FOR THE COMPUTATION OF THE TWO-DIMENSIONAL GREEN'S FUNCTION FOR ELLIPTICALLY-LAYERED MEDIA**

Alessandro Fedeli, Matteo Pastorino, Andrea Randazzo\*

*Department of Electrical, Electronic, Telecommunications Engineering, and Naval Architecture, University of Genoa, Genoa, ITALY*

**16:40 F08-4 (Invited) IMAGING OF SUBWAVELENGTH FEATURES IN THE FAR-FIELD USING RESONANT METASURFACES: DESIGN FROM MICROWAVE TO INFRARED FREQUENCIES**

Elham Baladi, Mitchell Semple, Ashwin K. Iyer\*

*Electrical and Computer Engineering, University of Alberta, EDMONTON, CANADA*

**17:00 F08-5 ADVANCES IN CWA AND APPLICATION TO RADAR AND TOMOGRAPHIC CASES**

Cristina Ponti\*, Massimo Santarsiero, Giuseppe Schettini

*"Roma Tre" University, Rome, ITALY*

**17:20 F08-6 (Invited) TWO-DIMENSIONAL INVERSE SCATTERING USING A BAYESIAN APPROACH**

Yangqing Liu, Danilo Erricolo\*



*Department of Electrical and Computer Engineering (MC 154), University of Illinois at Chicago, Chicago, IL*

**Session B09: Novel mathematical methods in electromagnetics - IV**

Friday, May 31 08:20-10:40, Room B

Session Conveners: Kazuya Kobayashi, *Chuo University*; Yury Shestopalov, *Faculty of Engineering and Sustainable Development, University of Gävle*

Session Chairs: Guido Lombardi, *Politecnico di TOirno-ISMB*; Elena Vinogradova, *Macquarie University*

**08:20 B09-1 (Invited) TIME-BANDWIDTH LIMIT AND RECIPROCITY IN OPTICAL NANOSTRUCTURES**

Andrea Alu\*<sup>1</sup>, Sander Mann<sup>1</sup>, Dimitrios Sounas<sup>2</sup>, Mykhailo Tymchenko<sup>3</sup>

<sup>1</sup>*Advanced Science Research Center, New York, NY*

<sup>2</sup>*Wayne State University, Detroit, MI*

<sup>3</sup>*The University of Texas at Austin, Austin, TX*

**08:40 B09-2 (Invited) THE FREDHOLM FACTORIZATION IN PRESENCE OF PENETRABLE RECTANGULAR RODS**

Vito Daniele, Guido Lombardi\*, Rodolfo S. Zich

*Politecnico di Toirno-ISMB, Torino, ITALY*

**09:00 B09-3 (Invited) CAUSAL DYNAMIC CONSTITUTIVE RELATIONS FOR LOSSY DISPERSIVE DIELECTRICS**

Fatih Erden\*<sup>1</sup>, Oleg A. Tretyakov<sup>2</sup>

<sup>1</sup>*Electronics Engineering Department, National Defense University, Turkish Naval Academy, Istanbul, TURKEY*

<sup>2</sup>*Electronics Engineering Department, Gebze Technical University, Kocaeli, TURKEY*

**09:20 B09-4 (Invited) MATHEMATICAL FORMULATION OF PHASE RETRIEVAL FOR PHASELESS SPHERICAL NEAR-FIELD ANTENNA MEASUREMENTS WITH PROBE CORRECTION**

Olav Breinbjerg\*, Javier F. Álvarez

*Department of Electrical Engineering, Technical University of Denmark, Kgs. Lyngby, DENMARK*

**09:40 B09-5 (Invited) Linear Algebra Perspective of Exceptional Points of Degeneracy of Guided Modes**

Tarek Mealy\*, Ahmed A. Abdelshafy, Mohamed Y. Nada, Hamidreza Kazemi, Filippo Capolino

*Electrical Engineering, University of California, Irvine, Irvine*

**10:00 B09-6 (Invited) PLANE WAVE DIFFRACTION BY ARBITRARILY LOCATED FINITE SINUSOIDAL GRATINGS**

Elena D. Vinogradova\*<sup>1</sup>, Kazuya Kobayashi<sup>2</sup>

<sup>1</sup>*Department of Mathematics and Statistics, Macquarie University, Sydney, NSW, AUSTRALIA*

<sup>2</sup>*Department of Electrical, Electronic, and Communication Engineering, Chuo University, Tokyo, JAPAN*

**10:20 B09-7 (Invited) ANALYSIS OF POWER ABSORPTION ON A METASURFACE STRUCTURE**

Satoshi Yagitani\*, Mitsunori Ozaki, Tomohiko Imachi

*Kanazawa University, Kanazawa, JAPAN*

**Session C09: Integral equation, hybrid, and fast Methods-I**

Friday, May 31 08:20-10:40, Room C

Session Conveners: Francesco Andriulli, *Politecnico di Torino*; Thomas Eibert, *TUM HFT*

Session Chairs: Thomas Eibert, *TUM HFT*; Francesco Andriulli, *Politecnico di Torino*

**08:20 C09-1 (Invited) OVERVIEW OF ADVANCES IN SEVERAL MAJOR COMPONENTS OF METHOD OF MOMENTS SURFACE INTEGRAL EQUATION MODELING AND ANALYSIS IN COMPUTATIONAL ELECTROMAGNETICS**

Branislav M. Notaros\*, Sanja B. Manic, Cam Key, Jake Harmon, Donald Estep

*Colorado State University, Fort Collins, CO*

**08:40 C09-2 (Invited) COUPLING FINITE ELEMENTS AND AUXILIARY SOURCES: REALISTIC SIMULATIONS OF MAXWELL'S EQUATIONS**

Daniele Casati\*<sup>1</sup>, Ralf Hiptmair<sup>1</sup>, Jasmin Smajic<sup>2</sup>

<sup>1</sup>*Seminar for Applied Mathematics, ETH Zurich, Zurich, SWITZERLAND*

<sup>2</sup>*Institute for Energy Technology, Hochschule für Technik Rapperswil, Rapperswil, SWITZERLAND*

**09:00 C09-3 ASYMPTOTIC APPROXIMATIONS FOR TRANSMISSION BOUNDARY-VALUE PROBLEMS IN PLASMONIC STRUCTURES**

Camille Carvalho\*, Shilpa Khatri, Arnold D. Kim

*University of California, Merced, Merced CA*

**09:20 C09-4 (Invited) SOLUTION OF LARGE SCALE SCATTERING PROBLEMS ON 3D COMPOSITE OBJECTS WITH SURFACE-VOLUME-SURFACE EFIE ACCELERATED WITH H-MATRICES**

Vladimir Okhmatovski\*, Reza Gholami

*Electrical and Computer Engineering, University of Manitoba, Winnipeg, CANADA*

**09:40 C09-5 (Invited) AN OPERATOR PRECONDITIONER FOR THE ELECTRIC FIELD INTEGRAL EQUATION ON OPEN SURFACES**

Carolina A. Urzua-Torres\*<sup>1</sup>, Ralf Hiptmair<sup>2</sup>

<sup>1</sup>*Institut für Angewandte Mathematik, TU Graz, Graz, AUSTRIA*

<sup>2</sup>*Seminar for Applied Mathematics, ETH Zurich, Zurich, SWITZERLAND*

**10:00 C09-6 (Invited) ISOGEOMETRIC DISCRETIZATIONS OF THE ELECTRIC FIELD INTEGRAL EQUATION**

Felix Wolf\*<sup>1</sup>, Jürgen Dölz<sup>2</sup>, Sebastian Schöps<sup>1</sup>, Stefan Kurz<sup>1</sup>

<sup>1</sup>*Centre of Computational Engineering, Technische Universität Darmstadt, Darmstadt, Hessen, GERMANY*

<sup>2</sup>*Department of Mathematics, Technische Universität Darmstadt, Darmstadt, Hessen, GERMANY*

**10:20 C09-7 (Invited) ANALYSIS OF CONFORMAL ANTENNAS WITH QUASI-CYLINDRICAL ANISOTROPIC SUBSTRATES USING DISCRETE MODE MATCHING METHOD**

Veenu Kamra\*, Achim Dreher

*Institute of Communications and Navigation, German Aerospace Center, Oberpfaffenhofen, Wessling, Bavaria, GERMANY*

**Session D09: Mathematical modelling of EM problems - III**

Friday, May 31 08:20-10:40, Room D

Session Conveners: Paul Smith, *Macquarie University*; Piergiorgio Uslenghi, *University of Illinois at Chicago*

Session Chairs: JML Bernard, *CEA-DIF / CMLA-ENS Cachan*; Yury Shestopalov,

**08:20 D09-1 (Invited) ANALOGY BETWEEN ELASTODYNAMIC DISPLACEMENT AND ELECTROMAGNETIC VECTOR POTENTIALS**

John W. Neese\*<sup>1</sup>, David R. Jackson<sup>2</sup>, Leon A. Thomsen<sup>1</sup>

<sup>1</sup>*Dept. of Earth and Atmospheric Sciences, University of Houston, Houston, TX*

<sup>2</sup>*Dept. of Electrical and Computer Engineering, University of Houston, Houston, TX*

**08:40 D09-2 (Invited) MODERN APPLICATIONS OF THE BATEMAN-WHITTAKER THEORY**

Ioannis M. Besieris\*<sup>1</sup>, Amr M. Shaarawi<sup>2</sup>

<sup>1</sup>*ECE, Virginia Tech, Blacksburg*

<sup>2</sup>*Physics, American University in Cairo, New Cairo, EGYPT*

**09:00 D09-3 (Invited) COMPARISON BETWEEN TWO UNIFORM ASYMPTOTIC EVALUATIONS OF A TYPICAL DIFFRACTION INTEGRAL**

Giuliano Manara\*<sup>1</sup>, Sergio Terranova<sup>1</sup>, Ludger Klinkenbusch<sup>2</sup>

<sup>1</sup>*Department of Information Engineering, University of Pisa, Pisa, ITALY*

<sup>2</sup>*Institute of Electrical and Information Engineering, Kiel University, Kiel, GERMANY*

**09:20 D09-4 (Invited) PROPAGATION OVER AN ARBITRARY CONSTANT IMPEDANCE PLANE FOR ARBITRARY PRIMARY SOURCES, EXACT SERIES AND COMPLETE ASYMPTOTICS WITH ERROR FUNCTIONS**

Jml Bernard\*

*CEA-DIF / CMLA-ENS Cachan, Arpajon, FRANCE*

**09:40 D09-5 (Invited) A GENERAL APPROACH TO THE ANALYSIS OF COMPLEX WAVES**

Yury Shestopalov\*

*Mathematics, Faculty of Engineering and Sustainable Development, University of Gävle, Gävle, SWEDEN*

**10:00 D09-6 (Invited) OBLIQUE PLANE-WAVE TRANSMISSION THROUGH AN INHOMOGENEOUSLY LOADED SLOT ARRAY**

Abdulaziz H. Haddab\*, Edward F. Kuester

*University of Colorado Boulder, Boulder, Colorado*

**10:20 D09-7 TM-WAVE PROPAGATION IN A GRADED WAVEGUIDE STRUCTURE**

Mariana Dalarsson\*, Sven Nordebo

*Linnaeus University, Department of Physics and Electrical Engineering, Växjö, SWEDEN*

**Session E09: Metamaterials and metasurfaces I**

Friday, May 31 08:20-10:40, Room E

Session Chairs: Viktor Asadchy, *Aalto University*; Anitha Vaddinuri, *Sree Vidyanikethan Engineering College*

**08:20 E09-1 MODELING METAMATERIAL ELEMENT IN DIELECTRIC-FILLED WAVEGUIDE-FED METASURFACE ANTENNAS**

Insang Yoo\*, David R. Smith

*Electrical and Computer Engineering, Duke university, Durham*

**08:40 E09-2 A CASE STUDY IN SMART MOTION DETECTION USING DYNAMIC METASURFACE APERTURES**

Oren S. Mizrahi\*, Mohammadreza F. Imani, Kenneth P. Trofatter, Jonah N. Gollub, David R. Smith

*Department of Electrical & Computer Engineering, Duke University, Durham, NC*

**09:00 E09-3 EMBEDDING PARABOLIC REFLECTOR ON HOLOGRAM FOR REDIRECTING SURFACE LEAKY WAVES INTO FORWARD ONES**

Mohammad Moein Moeini\*, Homayoon Oraizi, Amrollah Amini

*Department of Electrical Engineering, Iran University of Science and Technology, Tehran, Tehran, IRAN*

**09:20 E09-4 PLANAR BROADBAND HUYGENS' METASURFACES**

Viktar S. Asadchy\*<sup>1</sup>, Francisco S. Cuesta<sup>1</sup>, Ihar A. Faniayeu<sup>2</sup>, Sergei A. Tretyakov<sup>1</sup>

<sup>1</sup>*Department of Electronics and Nanoengineering, Aalto University, Espoo, Uusimaa, FINLAND*

<sup>2</sup>*Department of Physics, University of Gothenburg, Gothenburg, SWEDEN*

**09:40 E09-5 DESIGNING META-MIRROR FOR FREQUENCY SELECTIVE DIFFUSIVE AND SPECULAR REFLECTIONS**

Boyu Sima, Ke Chen, Junming Zhao, Yijun Feng\*

*School of Electronic Science & Engineering, Nanjing university, Nanjing, CHINA*

**10:00 E09-6 REALIZATION OF A COMPLEMENTARY SPLIT-RING RESONATOR (SRR) BASED METAMATERIAL ANTENNA**

Anitha R. Vaddinuri\*

*Electronics and Communication Engineering, Sree Vidyanikethan Engineering College, Tirupathi, INDIA*

**10:20 E09-7 POWER-DEPENDENT INVISIBILITY DEVICES FOR ANTENNA ARRAYS**

Alessio Monti\*<sup>1</sup>, Mirko Barbuto<sup>1</sup>, Alessandro Toscano<sup>2</sup>, Filiberto Bilotti<sup>2</sup>

<sup>1</sup>*Engineering, Niccolò Cusano University, Rome, ITALY*

<sup>2</sup>*Engineering, Roma Tre University, Rome, ITALY*

**Session F09: Antenna Arrays and MIMOs - I**

Friday, May 31 08:20-10:40, Room F

Session Chairs: John Volakis, *Florida International Univ*; Koichi Ogawa, *Toyama University*

**08:20 F09-1 OPTICALLY RECONFIGURABLE AND CONFORMAL X-BAND ANTENNA ARRAY BASED ON A TUNABLE TRANSMISSION SURFACE**

Marco D. Poort\*, Piergiorgio L. Uslenghi

*Electrical and Computer Engineering, University of Illinois at Chicago, Chicago, IL*

**08:40 F09-2 TEXTILE-BASED ULTRA-WIDEBAND TIGHTLY COUPLED DIPOLE ARRAY**

Matthew W. Nichols\*, Alexander D. Johnson, Elias A. Alwan, John L. Volakis

*Florida International University, Miami, Florida*

**09:00 F09-3 SEMI-ACTIVE MULTIPLE BEAM ARRAYS**

Antoine G. Roederer\*, Alexander G. Yarovoy

*Delft University of Technology, Delft, NETHERLANDS*

**09:20 F09-4 SIMPLIFYING AND GENERALIZING ANTENNA ARRAY EXPRESSIONS WITH THE ANTENNA EQUATION**

Everett Farr\*

*Farr Fields, LC, Albuquerque*

**09:40 F09-5 DAISY CHAIN MIMO ANTENNA FOR WHOLE AZIMUTH TENS-OF-GIGABIT  
CONNECTED CARS**

Nana Narukawa\*, Taiki Fukushima, Kazuhiro Honda, Koichi Ogawa  
*Graduate School of Engineering, Toyama University, Toyama, JAPAN*

**10:00 F09-6 MIMO CHANNELS WITH MINIMAL CROSS TALK IN RECONFIGURABLE WAVE-  
CHAOTIC SYSTEMS**

Philipp del Hougne\*<sup>1,2</sup>, Mathias Fink<sup>2</sup>, Geoffroy Lerosey<sup>3</sup>  
<sup>1</sup>*Université Côte d'Azur, Nice, FRANCE*  
<sup>2</sup>*Institut Langevin, Paris, FRANCE*  
<sup>3</sup>*Greenerwave, Paris, FRANCE*

**10:20 F09-7 OTA EXPERIMENTS ON THE ANGULAR ACCURACY OF A PHASE MONOPULSE AOA  
ANTENNA USING THE MEAN IQ-VALUE METHOD IN A Rician FADING CHANNEL**

Kazuhiro Honda\*, Nana Narukawa, Koichi Ogawa  
*Graduate School of Engineering, Toyama University, Toyama, JAPAN*

**Session B10: Novel mathematical methods in electromagnetics - V**

Friday, May 31 13:00-15:20, Room B

Session Conveners: Kazuya Kobayashi, *Chuo University*; Yury Shestopalov, *Faculty of Engineering and Sustainable Development, University of Gävle*

Session Chairs: Mariana Georgieva, *Consulting and Researcher in Physics and Computer Sciences*; Gabriele Gradoni, *University of Nottingham*

**13:00 B10-1 (Invited) AN ACCURATE TOOL FOR THE CALCULATION OF PROPAGATION MODES  
IN A WAVEGUIDE PERTURBED BY AXIALLY ALIGNED PEC INSERTIONS**

Paul D. Smith\*<sup>1</sup>, Elena D. Vinogradova<sup>1</sup>, Yury V. Shestopalov<sup>2</sup>  
<sup>1</sup>*Department of Mathematics and Statistics, Macquarie University, Sydney, NSW, AUSTRALIA*  
<sup>2</sup>*Department of Electronics, Mathematics and Natural Sciences, University of Gävle, Gävle, SWEDEN*

**13:20 B10-2 (Invited) QUANTUM GRAPH MODEL FOR INFORMATION TRANSFER THROUGH  
NETWORKS OF CABLES**

Gabriele Gradoni\*<sup>1</sup>, Mubarak Ahmed<sup>1</sup>, Stephen C. Creagh<sup>1</sup>, Steve Greedy<sup>2</sup>, Chris Smartt<sup>2</sup>, Gregor Tanner<sup>1</sup>  
<sup>1</sup>*School of Mathematical Sciences, University of Nottingham, Nottingham, UNITED KINGDOM*  
<sup>2</sup>*George Green Institute for Electromagnetics Research, University of Nottingham, Nottingham, UNITED KINGDOM*

**13:40 B10-3 (Invited) ON A NEW IMPEDANCE BOUNDARY CONDITION FOR THE LOW-FREQUENCY AND DENSE MESH STABLE SOLUTION OF THE ELECTRIC FIELD INTEGRAL EQUATION**

Alexandre Dely\*<sup>1</sup>, Francesco P. Andriulli<sup>2</sup>, Kristof Cools<sup>3</sup>

<sup>1</sup>*IMT Atlantique, Brest, FRANCE*

<sup>2</sup>*Politecnico di Torino, Turin, ITALY*

<sup>3</sup>*Delft University of Technology, Delft, NETHERLANDS*

**14:00 B10-4 A NOVEL SEMI-ANALYTICAL MODE-MATCHING TECHNIQUE FOR MODELING REALISTIC ELECTROMAGNETIC WELL-LOGGING SENSORS IMMERSSED IN DISSIPATIVE INHOMOGENEOUS MEDIA**

Lisseth Saavedra Patiño\*, Guilherme S. Rosa, Jose R. Bergmann

*Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, BRAZIL*

**14:20 B10-5 (Invited) THEOREM FOR THE RELATION BETWEEN THE  $L_1(C,N)$  AND  $T_1(L,N)$  NUMBERS**

Georgi N. Georgiev<sup>1</sup>, Mariana N. Georgieva-Grosse\*<sup>2</sup>

<sup>1</sup>*Faculty of Mathematics and Informatics, Faculty of University of Veliko Tirnovo "St. St. Cyril and Methodius", Veliko Tirnovo, BULGARIA*

<sup>2</sup>*Consulting and Researcher in Physics and Computer Sciences, Polikraishte, BULGARIA*

**14:40 B10-6 (Invited) EXCITATION OF EIGENMODE CURRENT FOR MULTIPLE RESONANCE ANTENNA**

Keisuke Fujita\*

*National Institute of Technology, Yuge College, Ehime, JAPAN*

**15:00 B10-7 DIFFRACTION BY A SLIT IN A MATERIAL SCREEN**

Takashi Nagasaka\*, Kazuya Kobayashi

*Department of Electrical, Electronic, and Communication Engineering, Chuo University, Tokyo, JAPAN*

**Session C10: Integral equation, hybrid, and fast methods-II**

Friday, May 31 13:00-13:40, Room C

Session Conveners: Francesco Andriulli, *Politecnico di Torino*; Thomas Eibert, *TUM HFT*

Session Chairs: Thomas Eibert, *TUM HFT*; Francesco Andriulli, *Politecnico di Torino*

**13:00 C10-1 (Invited) ACCELERATION OF STABLE HIGHER ORDER TIME DOMAIN INTEGRAL EQUATIONS**

Connor Glosser, Balasubramaniam Shanker\*

*Michigan State University, East Lansing, MI*

**13:20 C10-2 (Invited) A LARGE TIME STEP STABLE SPACE-TIME GALERKIN MFIE**

Kristof Cools\*<sup>1</sup>, Francesco P. Andriulli<sup>2</sup>

<sup>1</sup>*TU Delft, Delft, NL, NETHERLANDS*

<sup>2</sup>*Politecnico di Torino, Turin, IT, ITALY*

**Session D10: Antennas and microwave devices inspired by electromagnetic band gap-I**

Friday, May 31 13:00-15:20, Room D

Session Conveners: Karu Esselle, *Macquarie University, Sydney*; Ladislau Matekovits, *Politecnico di Torino*

Session Chairs: Karu Esselle, *Macquarie University, Sydney*; Ladislau Matekovits, *Politecnico di Torino*

**13:00 D10-1 THE MTM-EBG: A FULLY UNIPLANAR, PRINTABLE, AND EMBEDDED SOLUTION FOR MULTI-BAND FUNCTIONALITY IN MICROSTRIP DEVICES AND ANTENNAS**

Braden P. Smyth, Stuart Barth, Jacob A. Brown, Ashwin K. Iyer\*

*Electrical and Computer Engineering, University of Alberta, Edmonton, AB, CANADA*

**13:20 D10-2 ENGINEERING TOPOLOGICAL STATES OF INTERACTING PHOTONS WITH LC CIRCUITS**

Nikita A. Olekhno<sup>1</sup>, Egor I. Kretov<sup>1</sup>, Dmitry S. Filonov<sup>1,2</sup>, Andrey A. Stepanenko<sup>1</sup>, Barbara Cappello<sup>3</sup>,

Ladislau Matekovits<sup>3</sup>, Maxim A. Gorlach\*<sup>1</sup>

<sup>1</sup>*ITMO University, Saint Petersburg, RUSSIAN FEDERATION*

<sup>2</sup>*Tel Aviv University, Tel Aviv, ISRAEL*

<sup>3</sup>*Politecnico di Torino, Turin, ITALY*

**13:40 D10-3 METASURFACE CLOAKS FOR DECOUPLING CLOSELY SPACED PHASED ANTENNA ARRAYS**

Hossein M. Bernety<sup>1</sup>, Alexander B. Yakovlev\*<sup>2</sup>, Harry G. Skinner<sup>3</sup>, Seong-Youp Suh<sup>3</sup>

<sup>1</sup>*Department of Electrical and Computer Engineering, University of Utah, Salt Lake City, Utah*

<sup>2</sup>*Department of Electrical Engineering, University of Mississippi, University, MS*

<sup>3</sup>*Intel Corporation, Hillsboro, OR*

**14:00 D10-4 3-D PRINTED CIRCULARLY-POLARIZED LENS ANTENNA OPERATING AT TERAHERTZ FREQUENCIES**

Geng-Bo Wu<sup>1,2</sup>, Yuan-Song Zeng<sup>1,3</sup>, Ka F. Chan<sup>1</sup>, Shi-Wei Qu<sup>3</sup>, Chi H. Chan\*<sup>1,2</sup>



<sup>1</sup>State Key Laboratory of Terahertz and Millimeter Waves, City University of Hong Kong, Kowloon, Hong Kong, CHINA

<sup>2</sup>Department of Electronic Engineering, City University of Hong Kong, Kowloon, Hong Kong, CHINA

<sup>3</sup>School of Electronic Science and Engineering, University of Electronic Science and Technology of China, Chengdu, CHINA

**14:20 D10-5 2-D EBG WAVEGUIDES: AN ANALYSIS IN TERMS OF LEAKY WAVES**

Paolo Baccarelli<sup>1</sup>, Vakhtang Jandieri<sup>2</sup>, Silvio Ceccuzzi<sup>3</sup>, Cristina Ponti<sup>1</sup>, Giuseppe Schettini\*<sup>1</sup>

<sup>1</sup>Department of Engineering, Roma Tre University, Roma, ITALY

<sup>2</sup>General and Theoretical Electrical Engineering (ATE), University of Duisburg-Essen, Duisburg, GERMANY

<sup>3</sup>Fusion and Nuclear Safety Department, ENEA, Frascati, ITALY

**14:40 D10-6 All-Dielectric Compact Superstrates for High-Gain Resonant-Cavity Antennas: Designs & Measurements**

Affan A. Baba\*<sup>1</sup>, Raheel M. Hashmi<sup>1</sup>, Karu P. Esselle<sup>1</sup>, Ladislau Matekovits<sup>2</sup>

<sup>1</sup>School of Engineering, Macquarie University, SYDNEY, AUSTRALIA

<sup>2</sup>Electronics and Telecommunication, Politecnico di Torino, Turin, ITALY

**15:00 D10-7 TOPOLOGICAL METAMATERIALS BASED ON MAGNET-FREE NON-RECIPROCAL UNIT CELLS**

Andrea Alu\*<sup>1</sup>, Mykhailo Tymchenko<sup>2</sup>

<sup>1</sup>Photonics Initiative, Advanced Science Research Center, New York, NY

<sup>2</sup>Dept. Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX

**Session D11: Antennas and microwave devices inspired by electromagnetic band gap-II**

Friday, May 31 15:40-16:20, Room D

Session Conveners: Karu Esselle, Macquarie University, Sydney; Ladislau Matekovits, Politecnico di Torino

Session Chairs: Karu Esselle, Macquarie University, Sydney; Ladislau Matekovits, Politecnico di Torino

**15:40 D11-1 Antenna Array Oscillators Based on Exceptional Point of Degeneracy with Balanced Gain and Loss**

Ahmed F. Abdelshafy\*, Tarek Mealy, Mohamed Y. Nada, Hamidreza Kazemi, Filippo Capolino

University of California Irvine, Irvine, CA

**16:00 D11-2 PHASE METHOD: A MORE PRECISE BEAM STEERING MODEL FOR PHASE-DELAY METASURFACE BASED RISLEY ANTENNA**

Junbo Wang\*, Yahya Rahmat-Samii

*Electrical and Computer Engineering, University of California, Los Angeles, Los Angeles, CA*

**Session E10: High-frequency and hybrid methods**

Friday, May 31 13:00-15:20, Room E

Session Conveners: Giuliano Manara, *University of Pisa*; Prabhakar Pathak, *The Ohio State University*

Session Chairs: Prabhakar Pathak, *The Ohio State University*; Giuliano Manara, *University of Pisa*

**13:00 E10-1 (Invited) A COLLECTIVE UTD RAY ANALYSIS OF THE RADIATION BY AXIAL, CIRCUMFERENTIAL AND SKEWED CONFORMAL PHASED ARRAY OF SOURCES PLACED ON A SMOOTH CONVEX PEC CYLINDER**

Prabhakar H. Pathak\*<sup>1</sup>, Panuwat Janpugdee<sup>2</sup>

<sup>1</sup>*ECE, The Ohio State University, Columbus, OH*

<sup>2</sup>*EE, Chulalongkorn University, Bangkok, THAILAND*

**13:20 E10-2 (Invited) A QUICK REVIEW OF THE PARABOLIC EQUATION METHOD FOR PROPAGATION AND RCS PREDICTION**

Ramakrishna Janaswamy\*

*University of Massachusetts, Amherst, MA*

**13:40 E10-3 (Invited) ITERATIVE PHYSICAL OPTICS ALGORITHMS FOR IMPENETRABLE AND PENETRABLE SCATTERERS**

Semion Duberstein, Igor Gershenzon, Amir Boag\*

*School of Electrical Engineering, Tel Aviv University, Tel Aviv, ISRAEL*

**14:00 E10-4 (Invited) UTD DIFFRACTION COEFFICIENT FOR METASURFACE EDGE DIFFRACTION**

Miguel Camacho\*<sup>1</sup>, Filippo Capolino<sup>2</sup>, Matteo Albani<sup>3</sup>

<sup>1</sup>*Department of Physics and Astronomy, University of Exeter, Exeter, UNITED KINGDOM*

<sup>2</sup>*Department of Electrical Engineering and Computer Science, University of California, Irvine, Irvine, California*

<sup>3</sup>*Department of Information Engineering and Mathematics, University of Siena, Siena, ITALY*

**14:20 E10-5 (Invited) SOLVING MULTI-BOUNCE EM SCATTERING AND PROPAGATION PROBLEMS WITHOUT RAY TRACING USING THE ITERATIVE PHYSICAL OPTICS FRAMEWORK**

Robert J. Burkholder\*

*The Ohio State University, Columbus, OH*

**14:40 E10-6 HIGH-FREQUENCY ELECTROMAGNETIC PROPAGATOR AND COUPLING MODEL BY THE DYNAMICAL ENERGY ANALYSIS BY DISCRETE FLOW METHOD**

Sendy Phang\*<sup>1</sup>, Timo Hartmann<sup>1</sup>, Shukai Ma<sup>2</sup>, Stephen C. Creagh<sup>1</sup>, Gabriele Gradoni<sup>1,3</sup>, Stephen Anlage<sup>2</sup>,  
David W. P. Thomas<sup>3</sup>, Thomas Antonsen<sup>2</sup>, Gregor Tanner<sup>1</sup>

<sup>1</sup>*School of Mathematical Sciences, University of Nottingham, Nottingham, UNITED KINGDOM*

<sup>2</sup>*Department of Physics, University of Maryland, Maryland*

<sup>3</sup>*The George Green Institute for Electromagnetics Research, University of Nottingham, Nottingham, UNITED KINGDOM*

**15:00 E10-7 A HIGH-FREQUENCY UNIFORM ASYMPTOTIC SOLUTION FOR ELECTROMAGNETIC FIELD SCATTERING BY A 3D WEDGE INCLUDING GRAZING INCIDENCE SCENARIOS**

Guilherme S. Rosa\*, Flavio J. V. Hasselmann

*Center for Telecommunications Studies, Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, RJ, BRAZIL*

**Session E11: Metamaterials and Metasurfaces II**

Friday, May 31 15:40-17:40, Room E

Session Chairs: Go Itami, *Nippon Telegraph and Telephone Corporation*; Ariel Epstein, *Technion - Israel Institute of Technology*

**15:40 E11-1 TOWARD THE DESIGN OF COAX-FED PLANAR METASURFACE ANTENNAS USING OPTIMIZATION**

Insang Yoo\*<sup>1</sup>, Mohammadreza F. Imani<sup>1</sup>, Laura Pulido-Mancera<sup>2</sup>, Timothy Slesman<sup>3</sup>, David R. Smith<sup>1</sup>

<sup>1</sup>*Electrical and Computer Engineering, Duke university, Durham, NC*

<sup>2</sup>*Pivotal Commware, Kirkland, WA*

<sup>3</sup>*Applied Physics Laboratory, Johns Hopkins University, Baltimore, MD*

**16:00 E11-2 DIRECTION-OF-ARRIVAL ESTIMATION FROM SCATTERING PATTERNS IN A SUBWAVELENGTH PERIODIC STRUCTURE OF A CONDUCTIVE SCATTERER**

Go Itami\*<sup>1</sup>, Tatsuya Iizuka<sup>1</sup>, Yohei Toriumi<sup>1</sup>, Jun Kato<sup>1</sup>, Osamu Sakai<sup>2</sup>

<sup>1</sup>*Network Technology Laboratories, Nippon Telegraph and Telephone Corporation, Tokyo, JAPAN*

<sup>2</sup>*The University of Shiga Prefecture, Department of Electronic Systems Engineering, Shiga, JAPAN*

**16:20 E11-3 SEAMLESS WAVEGUIDE BENDS WITH IN-LINE METASURFACES**

Liran Biniashvili, Ariel Epstein\*

*Faculty of Electrical Engineering, Technion - Israel Institute of Technology, Haifa, ISRAEL*

**16:40 E11-4 MINIATURIZED VIRTUAL ARRAY DUAL BAND LOOP QUASI – YAGI ANTENNA DESIGN FOR 5G APPLICATION**

Feza T. Celik\*<sup>1</sup>, Kamil Karacuha<sup>2</sup>

<sup>1</sup>electrical and electronics engineering, middle east technical university, Ankara, TURKEY

<sup>2</sup>informatics institute, istanbul technical university, Istanbul, TURKEY

**17:00 E11-5 DESIGN OF METAMATERIAL BASED ANTENNA FOR SMART GRID APPLICATIONS**

Sujatha S. Machineni\*<sup>1</sup>, Anitha R. Vaddinuri<sup>2</sup>

<sup>1</sup>Electrical and Electronics Engineering, Sree Vidyanikethan Engineering College, Tirupati, INDIA

<sup>2</sup>Electronics and Communication Engineering, Sree Vidyanikethan Engineering College, Tirupati, INDIA

**17:20 E11-6 LITERATURE REVIEW ON RADAR ABSORBERS USING METAMATERIALS**

Mohamed Edries\*<sup>1</sup>, Mohamed El-morsy<sup>1</sup>, Hesham Mohamed<sup>2</sup>, Sherif Hekal<sup>3</sup>, Hala Mansour<sup>3</sup>

<sup>1</sup>Dept. of Electronics and Communication, Higher Institute of Engineering El Shorouk City, Cairo, EGYPT

<sup>2</sup>Dept. of Electronics and Communication, Electronics Research institute, Cairo, EGYPT

<sup>3</sup>Dept. of Electronics and Communication, Banha University, Cairo, EGYPT

**Session F10: Antenna arrays and MIMOs - II**

Friday, May 31 13:00-15:20, Room F

Session Chairs: Tatha Babu, Sree Vidyanikethan Engineering College; Koichi Ogawa, Toyama University

**13:00 F10-1 RANGE-DOPPLER AND RADAR CROSS SECTION ROUTINES OF A CIRCULARLY DISTRIBUTED ARRAY**

Kristopher R. Buchanan\*, Sara Wheeland, Drew Overturf

Electromagnetics Technology Branch, SSC Pacific, San Diego CA

**13:20 F10-2 COMPUTATIONALLY EXPEDITIOUS STRATEGY FOR THE SYNTHESIS OF MASSIVE THINNED CIRCULAR ANTENNA ARRAYS**

Ashwin Padmanabhan\*<sup>1</sup>, V S Gangwar<sup>1</sup>, Juhi K. Modi<sup>2</sup>

<sup>1</sup>LRDE, Bengaluru, KARNATAKA, INDIA

<sup>2</sup>Department of Electronics Engineering, IIT (ISM), Dhanbad, Jharkand, INDIA

**13:40 F10-3 ROTATING CIRCULAR ANTENNA ARRAY DESIGN FOR MICROWAVE SYNTHETIC APERTURE RADIOMETER**

Cheng Zhang\*, Hao Liu, Ji Wu

National Space Science Center, Chinese Academy of Sciences, Beijing, CHINA

**14:00 F10-4 A COMPACT 2 X 2 MIMO ANTENNA WITH POLARIZATION DIVERSITY FOR X-BAND APPLICATIONS**

Tatha Babu\*

Electronics and Communication Engineering, Sree Vidyanikethan Engineering College, Tirupathi, INDIA

**14:20 F10-5 64 × 64 MIMO ANTENNA ARRANGED IN A DAISY CHAIN ARRAY STRUCTURE AT 50 GBPS CAPACITY**

Nana Narukawa\*, Taiki Fukushima, Kazuhiro Honda, Koichi Ogawa

*Graduate School of Engineering, Toyama University, Toyama, JAPAN*

**14:40 F10-6 A GROUP-SPARSE COMPRESSED SENSING APPROACH FOR THINNING MULTI-CARRIER FREQUENCY DIVERSE ARRAYS**

Said E. El-Khamy<sup>1</sup>, Noha O. Korany<sup>1</sup>, Magdy A. Abdelhay<sup>\*2</sup>

<sup>1</sup>*Department of Electrical Engineering, Alexandria University, Alexandria, EGYPT*

<sup>2</sup>*Department of Communications Engineering, Alexandria Institute of Engineering and Technology, Alexandria, EGYPT*

**15:00 F10-7 ANALYSIS AND MODELING OF 28 GHZ COUPLED-LINE-BASED QUADRATURE COUPLER AND POWER DIVIDERS/COMBINERS FOR 5G COMMUNICATIONS**

Yo-Sheng Lin\*, Kai-Siang Lan, Yen-Chi Chen

*Electrical Engineering, National Chi Nan University, PULLI, TAIWAN*