AES 2018 in Marseille - France

The 6th Advanced Electromagnetics Symposium

Program

June 24 – July 1, 2018
Round-trip Marseille Cruise

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AES 2018 in Marseille - France

The 6th Advanced Electromagnetics Symposium

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Edited by

Said Zouhdi | Paris-Sud University, France

CONTENTS

ABOUT AES

The Advanced Electromagnetics Symposium (AES) serves as an international multidisciplinary forum for deliberations on recent advances and developments in the entire broad field of electromagnetics, Antennas and Propagation. Included in this wide-ranging subject, pertinent to both researchers and industry professionals, are all aspects of electromagnetics, and all frequency ranges from static to optics. Of special interest are :

- Electromagnetic Theory
- Antennas
- Propagation theory, modelling and simulation
- Microwave and Millimeter Circuits and Systems
- Scattering, diffraction and RCS
- Electromagnetic Compatibility
- Computational Electromagnetics
- Optimization Techniques
- Coupled Field Problems
- Optics and Photonics
- Remote Sensing, Inverse Problems, Imaging Radar
- Electromagnetic and photonic Materials
- Bioeffects of EM fields, Biological Media, Medical electromagnetics
- Techniques and tools for RF material characterisation
- EMI/EMC/PIM chambers, instrumentation and measurements
- Educational Electromagnetics

Additionally, through its unique from-Conference-to-Journal-Publication concept, AES offers a rare opportunity for authors to submit papers to Advanced Electromagnetic (AEM) journal and then be considered for journal publication.

Following a now well-established tradition AES takes place in unique locations around the world.

Year	Organizers	Venue
2017	Junsuk Rho, Said Zouhdi	Incheon, Korea
2016	Enrique Márquez Segura, Eva Rajo-Iglesias, Said Zouhdi	Torremolinos (Malaga), Spain
2014	Lingling Sun, Ke Wu, Said Zouhdi	Hangzhou, China
2013	Hamid M. K. Al-Naimiy, Said Zouhdi	Sharjah-Dubai, United Arab Emirates
2012	Xavier Begaud, Said Zouhdi	Paris, France

AES 2017 ORGANIZATION

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Paris–Sud University, France

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AES 2018 VENUE

AES 2018 will be held aboard the dream-class cruise ship Costa Diadema as a round-trip Marseille cruise from 24 June to 1st July 2018.

GETTING TO THE CRUISE PORT/TERMINAL

The departure port is located :

Porte 4, Port de Marseille, Chemin du Littoral
13015 Marseille
France

Get driving directions and arrange for transfers from your airport or hotel ahead of time. If you are flying in, don't forget to claim your luggage at the airline's baggage claim area.

From ”Marseille Provence” Airport

Marseille Provence Airport is located around 27 km / 17 ml (1/2 hour drive distance) northwest of the cruise port and 9 km (5,6 ml) from the city centre.

- ☐ **By Taxi**
  The easiest way to reach the cruise port is to take a taxi straight from the airport, the price is around €50.

- ☐ **By Bus and Taxi**
  Shuttle bus lines run every 20 min from the airport to the St Charles train station daily (between 5 am - 11 pm). Drive distance is approx 30 min. A taxi from from the train station to the cruise ship terminals costs about €20. Occasionally, the port also provides a free shuttle bus line to the city.

Travelling by Car

To reach terminal car parking, take exit 5 off the A55 if you are heading for the cruise terminal area at Porte 4 (Gate 4). You should find a large cruise passengers' car-park, or parking croisieristes, at the end of the Mole Leon Gourret near the Marseille-Provence Cruise Terminal. Be advised that the charges for this car-park are fairly steep.

CRUISE ITINERARY

7 Days Mediterranean-West

Costa Diadema is setting sail on Sunday, 24 June 2018, for 7 nights departing from Marseille and visiting Palma de Mallorca ; Cagliari ; Civitavecchia ; Savona ; Marseille.

Embarkation Time

Embarkation time is when you should arrive at the cruise terminal. In Marseille we will procced with the conference registration before embarking (from **12 :00** to **15 :30**). This will give you enough time to complete your check-in at the cruise terminal before boarding.

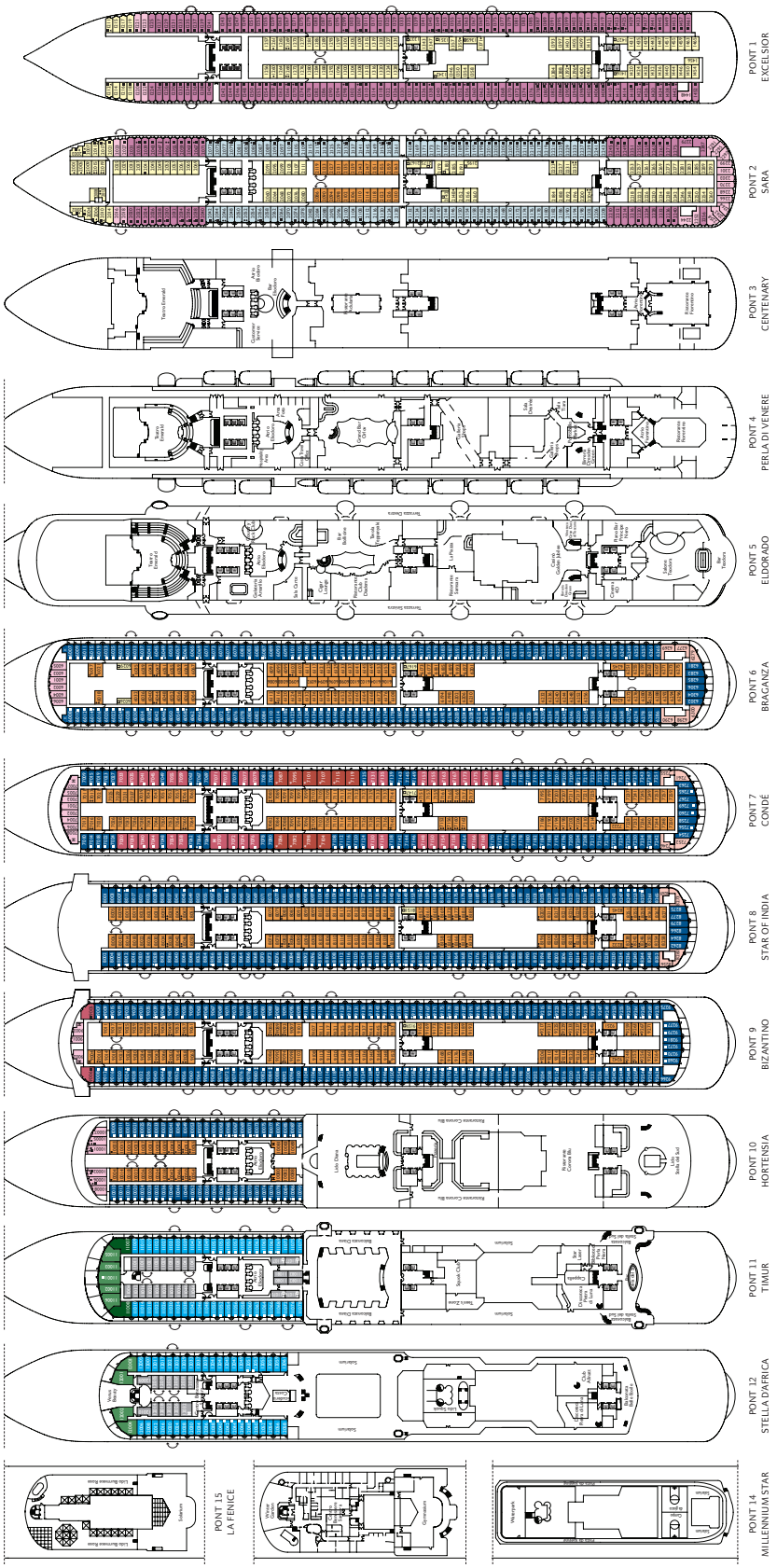
In the other stopover ports (Barcelona, Palma de Mallorca, Cagliari, Civitavecchia and Savona) we highly encourage you to board no later than one hour prior to the departure time (gates close 30mn before depar-

ture).

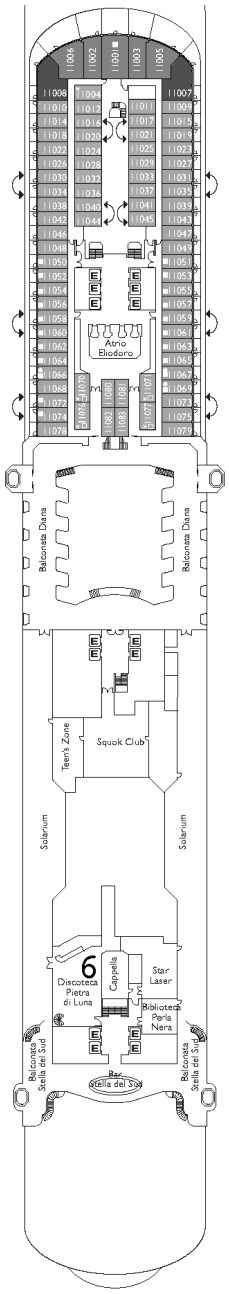
Ports of Call

Day	Port	Arrival	Departure
1	Marseille	-	17:00
2	Barcelona	9:00	19:00
3	Palma de Mallorca	9:00	-
4	Palma de Mallorca	-	1:00
5	Cagliari, Sardinia	8:00	17:00
6	Civitavecchia	8:00	19:00
7	Savona, Italy	7:00	17:00
8	Marseille	8:00	-

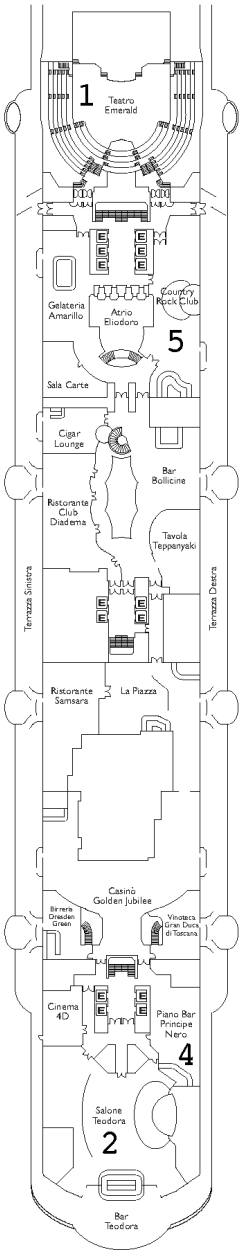
COSTA DIADEMA DECK PLANS



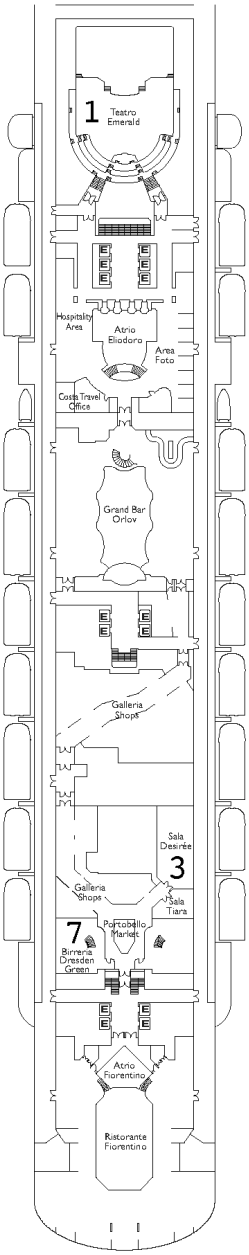
FLOOR PLANS



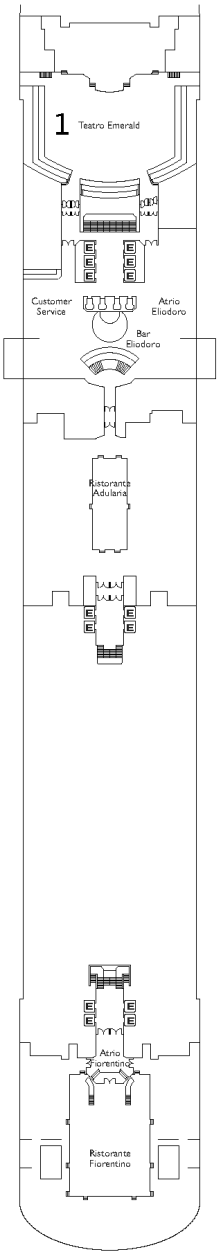
PONT 11
TIMUR



PONT 5
ELDORADO



PONT 4
PERLA DI VENERE



PONT 3
CENTENARY

1 : Teatro Emerald
2 : Salone Teodora
3 : Sala Desirée
4 : Piano Bar Principe Nero
5 : Country Rock Club
6 : Discoteca Pietra di Luna
7 : Birreria Dresden Green

GUIDELINES FOR PRESENTERS

ORAL PRESENTATIONS

Each session room is equipped with a stationary computer connected to a LCD projector. Presenters must load their presentation files in advance onto the session computer. Technician personnel will be available to assist you.

Scheduled time slots for oral presentations are 15 mn for regular, 20 mn for invited presentations, 30 mn for keynote talks and 35 mn for plenary talks, including questions and discussions. Presenters are required to report to their session room and to their session Chair at least 15 minutes prior to the start of their session.

The session chair must be present in the session room at least 15 minutes before the start of the session and must strictly observe the starting time and time limit of each paper.

POSTER PRESENTATIONS

Presenters are requested to stand by their posters during their session. One poster board, A0 size (118.9 x 84.1 cm), in portrait orientation, will be available for each poster (there are no specific templates for posters). Pins or thumbtacks are provided to mount your posters on the board. All presenters are required to mount their papers 30mn before the session and remove them at the end of their sessions. Posters must prepared using the standard AES poster template (available on the symposium website).

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Sunday 24th June, 2018

Registration

Embarkation Counter

12:00 - 15:30

Opening Address

Teatro Emerald

18:15 - 18:45

Monday 25th June, 2018

10:00 - 12:05 — Birreria Dresden Green

Session 1A1

Waves in heterogeneous and nonlinear media: direct and inverse problems, recent advances, and applications

Organized by: Yury Shestopalov

Chaired by: Yury Shestopalov

10:00 : Invited talk
Iteration Methods for 3D Electromagnetic Scattering Problems
Alexander Samokhin[1], **Anna Samokhina**[2], **Yury Shestopalov**[3]
[1] *Moscow Technological University (Russia),* [2] *Russian Academy of Sciences (Russia),* [3] *University of Gavle (Sweden)*

We consider iteration methods which can be used for numerical solution of volume singular integral equations (VSIEs) describing many classes of 3D electromagnetic scattering problems.

10:20 : Invited talk
Optimization Approach in Axisymmetric Problems of Manipulating DC Currents
Gennady Valentinovich Alekseev, Dmitry Tereshko
Russian Academy of Sciences (Russia)

Inverse problems associated with designing axisymmetric material shells for DC currents manipulating are studied. Applying the optimization method these inverse problems are reduced to corresponding control problems. A numerical algorithm based on the particle swarm optimization is proposed and the results of numerical experiments are discussed.

10:40 : Invited talk
Problems of Electromagnetic Scattering on 3D Dielectric and Perfectly Conducting Structures
Alexander Samokhin[1], **Anna Samokhina**[2], **Yury Shestopalov**[3]
[1] *Moscow Technological University (Russia),* [2] *Russian Academy of Sciences (Russia),* [3] *University of Gavle (Sweden)*

By using integral equations, we consider the problems of electromagnetic scattering on 3D inhomogeneous dielectric objects in presence of perfectly conducting surfaces. We also present method for the numerical solution of these problems.

11:00 : Invited talk
Waves in Metal-Dielectric Waveguides filled with Nonlinear Inhomogeneous Media
Yuri Shestopalov[1], **Eugene Smolkin**[2], **Maxim Snegur**[1]
[1] *University of Gavle (Sweden),* [2] *Penza State University (Russia)*

The propagation of monochromatic electromagnetic waves in a cylindrical waveguide filled with nonlinear inhomogeneous media is considered. The physical problem is reduced to solving a transmission eigenvalue problem for a system of ordinary differential equations. Spectral parameters of the problem are propagation constants of the waveguide. For the numerical solution, a method is proposed based on solving an auxiliary Cauchy problem (a version of the shooting method). As a result of comprehensive numerical modeling, new propagation regimes are discovered.

11:20 : Resonant States and Unique Permittivity Reconstruction of Layered Dielectrics
Yury Shestopalov
University of Gavle (Sweden)

Proceeding from the discovery of complex singularities of the scattering matrix of a multi-layered parallel-

plane dielectric inclusion in a waveguide of rectangular cross section, a method is proposed for justifying unique reconstruction of the layer permittivities. The technique is extended to the analysis of more complicated dielectric inclusions placed in waveguides of arbitrary cross section.

11:35 : Synthesis of Anisotropic Impedance Metasurface as Substrate of Cylindrical Phased Antenna Array on the Given Polarization of Radiation Field

Andrey Semenikhin, Diana Semenikhina, Yuru Yukhanov, Artem Chernokolpakov
Southern Federal University (Russia)

Inverse problem for homogeneous anisotropic cylindrical impedance metasurface (MS) as substrate of conformal cylindrical antenna array is formulated and solved. Cylindrical phased antenna array model made of ribbons of exiting longitudinal electric and magnetic currents. On MS, input anisotropic thin-layered covering is placed. The impedance tensor of MS is found, which ensures a given polarization of the radiation field of the antenna array.

11:50 : Synthesis of an anisotropic impedance plane for the incidence of two orthogonally polarized waves

Yury Yukhanov, Tatyana Privalova, Egor Privalov
Southern Federal University (Russia)

The problem of synthesis of an inhomogeneous anisotropic impedance plane, on which two uniform plane waves of orthogonal polarizations fall from different directions, is solved. The synthesized plane reflects these waves in a given direction with the required transformation of the plane of polarization. The reflection coefficients are obtained. The limitations on the class of scattering diagrams implemented using a dense array of orthogonal reactance strips are formulated. Numerical results are presented.

Lunch

12:30 - 14:00

Tuesday 26th June, 2018

08:00 - 09:45 — Teatro Emerald

Session 2A1

Plenary Session I

Chaired by: Federico Capasso

08:00 : Plenary talk
Evolutionary metamaterials : the imitation game of Nature for renewable energy harvesting, artificial intelligent photonics and advanced material engineering
Andrea Fratalocchi
King Abdullah University of Science and Technology (Saudi Arabia)

In this presentation, I summarize recent research in the field, discussing both fundamental and applied aspects. These encompass the exploitation of irreversible chaotic dynamics for energy harvesting, the control of rare catastrophic events at nanoscale, coherent light generation from black-bodies, biomimetic nanomaterials with unique properties, record performing photocatalysis membranes generated by warped spaces, early stage cancer detection, and new types of optical neural networks.

08:35 : Plenary talk
Catching Light with Metamaterials
Vladimir Shalaev
Purdue University (USA)

In this presentation, emerging plasmonic, metamaterial and metasurfaces concepts as well as material platforms will be discussed with the focus on practical photonic technologies for communication, quantum optics, bio-medical and energy applications.

09:10 : Plenary talk
X-Y-Z-T Metamaterials
Nader Engheta
University of Pennsylvania (USA)

In this talk, I will present an overview of our ongoing efforts in exploring four-dimensional "X-Y-Z-T Metamaterials", i.e., the metastructures in which the material parameters can vary with time as well as with space. We will show how some of the exciting features such as "freezing and growing wavesïn combination with the non-Foster circuits, temporal effective parameters, temporal anti-reflection matching, etc. can be obtained by proper combinations of temporal and spatial variations of parameters in metamaterials. We will also show how we can expand this 4D metamaterials concept to higher-dimensional metamaterials using temporal anisotropy, which leads to other exciting features such as rainbow radiation". I will discuss some of our most recent results from my group and forecast future directions and potentials.

Break

09:45 - 10:30

10:30 - 12:10 — Birreria Dresden Green

Session 2A2

Photonic integration from devices to sub-systems

Organized by: Linjie Zhou and Xianshu Luo

Chaired by: Linjie Zhou

10:30 : Invited talk

Hot-Electron Photodetections by Planar Nanostructures

Cheng Zhang, Dong Ma, Xiaofeng Li
Soochow University (China)

There is an increasing interest in harvesting photoejected hot-electrons. However, the metallic nanostructures that excite surface plasmons to enhance photoemission of hot-electrons are complex with a high fabrication challenge. Here, we present two purely planar hot-electron photodetectors based on Tamm plasmons and microcavity, respectively. On resonance, the electric field is strongly increased in metal, leading to a high hot electron generation efficiency, a strong and unidirectional photocurrent and a photoresponsivity higher than that of the conventional nanostructured system.

10:50 : Invited talk

Silicon Photonic Integrated Circuits for High-speed Modulation and Polarization-independent Bandwidth-variable Filtering

Lei Zhang, Sizhu Shao, Haoyan Wang, Linchen Zheng, Hao Jia, Jincheng Dai, Jianfeng Ding, Xin Fu, Lin Yang
Chinese Academy of Sciences (China)

We report the design and experimental results of silicon optical modulators and filters. The optical modulators are based on Mach-Zehnder interferometers. We demonstrate 100Gbps on-off keying (OOK) and 50Gbaud 4-level pulse amplitude modulation (PAM-4) modulations. The optical filters are based on asymmetrical directional couplers and 2nd-order microring resonators. We show polarization-independent optical bandpass filtering with the 3dB bandwidth varying from 37.5 to 100 GHz.

11:10 : Invited talk

Polarization-insensitive 8-channel silicon DWDM Receiver

Chao Qiu, Yingxuan Zhao, Aimin Wu, Zhen Sheng, Haiyang Huang, Jun Li, Wei Li, Mingbin Yu, Fuwan Gan
Shanghai Institute of Microsystem and Information Technology (China)

Both benefits and suffers from the large index contrast between Si and SiO2, silicon photonics shows as a promising platform for next generation optical interconnections. By integrated a broadband silicon polarization-splitters and rotators (PSR) with arrayed-waveguide-gratings (AWG) and Germanium photodetectors (PDs, an integrated 8-channel silicon DWDM receiver is fabricated and polarization-insensitive operations at 10Gbps per channels is demonstrated.

11:30 : Invited talk

Magnetoplasmonic Biosensors Based on Low Loss Magnetism Oxide Thin Films

Jun Qin, Tongtong Kang, Yan Zhang, Bo Peng, Longjiang Deng, Lei Bi
University of Electronic Science and Technology of China (China)

In this presentation, we propose a MOSPR sensor based on low loss magnetism oxide thin films. Simultaneous transverse magneto-optical Kerr effect (TMOKE) and index sensitivity enhancement have been obtained.

11:50 : Invited talk

Silicon-organic Hybrid Waveguide for High Performance Photonic Integrated Devices

Xiuyou Han[1], Sicheng Yang[1], Linghua Wang[2], Shuhui Bo[2], Zhenlin Wu[1], Mingshan Zhao[1]
[1] *Dalian University of Technology (China),* [2] *Chinese Academy of Sciences (China)*

This paper reports the recent work in our group about the silicon-organic hybrid waveguide for improving the performance of silicon photonic integrated devices. The athermal silicon-on-isolator (SOI) based microring resonator and arrayed waveguide grating are realized by overlaying organic polymer with negative thermal-optic coefficient on the SOI waveguide. The electro-optic modulator with wide bandwidth and low half-wave voltage

is implemented by filling organic polymer with high electro-optic coefficient in the slot of SOI waveguide.

Lunch

12:30 - 14:00

Wednesday 27th June, 2018

08:00 - 10:00 — Birreria Dresden Green

Session 3A1

Terahertz Science and Technology I

Organized by: Masayoshi Tonouchi and Kodo Kawase

Chaired by: Koichiro Tanaka

08:00 : Invited talk
Nanoscale Laser Terahertz Emission Microscopy
Pernille Klarskov Pedersen, Angela Pizzuto, Daniel Mittleman
Brown University (USA)

We implement Laser Terahertz Emission Microscopy (LTEM) in a near-field microscopy configuration where we simultaneously perform THz nanoscopy. By studying the approach curves of the two methods we obtain a similar spatial confinement on the order of a few 10s of nanometers emphasizing LTEMs potential as a nanoscale imaging technique.

08:20 : Invited talk
Broadband Terahertz Wave Generation from Liquid-like media
Alexei Balakin[1], Vladimir Makarov[1], Nikolay Kuzechkin[1], Igor Kotelnikov[2], Peter Solyankin[3], Alexander Shkurinov[1]
[1] Lomonosov Moscow State University (Russia), [2] Budker Institute of Nuclear Physics (Russia), [3] Institute on Laser and Information Technologies of RAS (Russia)

We present results of the research on generation of THz radiation in ńliquid likeż media under irradiating them with high-intensity femtosecond optical pulses: gas clusters and liquid nitrogen. We used a dual-frequency scheme when emissions of the main laser frequency and its second harmonic are mixed in the same medium.

08:40 : Invited talk
Nonlinear THz Spectroscopy of Two-Dimensional Systems
Manfred Helm, Jacob Konig-Otto, Johannes Schmidt, Emmanouil Dimakis, Stephan Winnerl, Harald Schneider
Helmholtz-Zentrum Dresden-Rossendorf (Germany)

Nonlinear THz experiments using a free-electron laser are presented on Landau-quantized graphene as well as on intersubband transitions in a single GaAs quantum well.

09:00 : Invited talk
Recent progress in terahertz applications in industry
Philip F. Taday
St Johns Innovation Park (United Kingdom)

In this presentation we discuss the recent progress in the application of terahertz pulses to industry. A common theme with these applications is that the thickness of the coating of the order of the wavelength of light and the final products have high commercial value. In this paper I review progress in the pharmaceutial industry.

09:20 : Invited talk
Sensing and Control of Methylation of Cancer DNA by Terahertz Radiation
Hwayeong Cheon, Joo-Hiuk Son
University of Seoul (Korea)

By canceration, there is a chemical change in DNA which is a rearrangement of 5-methylcytidine distribution called methylation. This chemical change of methylation is directly observed with terahertz time-domain

spectroscopy, showing a resonance at 1.6 THz for various types of cancer. The resonance peak is reduced or controlled by illuminating high-intensity terahertz pulses and it is proved to be resonant process by applying a filter around the frequency.

09:40 : Invited talk

Linear and nonlinear optics of switchable terahertz metasurfaces

Nicholas Karl[1], George R. Keiser[1], Martin S. Heimbeck[2], Henry O. Everitt[2], Hou-Tong Chen[3], Antoinette J. Taylor[3], Igal Brener[4], John L. Reno[4], Daniel M. Mittleman[1]

[1]Brown University (USA), [2]US Army AMRDEC (USA), [3]Los Alamos National Laboratory (USA), [4]Sandia National Laboratories (USA)

We present experimental studies of the linear and nonlinearoptical response of switchable terahertz metasurfaces, usingterahertz ellipsometry and nonlinear transmissionspectroscopy with intense THz pulses.

Session 3P1

Poster Session

10:00 - 10:25

P1: Analysis of 2D Problems of Magnetic Cloaking Using Optimization Method

Gennady Valentinovich Alekseev[1], Yuliya Spivak[1], Aleksey Lobanov[1], Elizaveta Paklina[2]

[1]Institute of Applied Mathematics FEB RAS (Russia), [2]Far Eastern Federal University (Russia)

We consider the control problems for the 2D model of magnetic scattering by a permeable anisotropic obstacle. These problems arise while developing the design technologies of magnetic cloaking devices using the optimization method for solving the corresponding inverse problems. The solvability of direct and optimization problems for the magnetic scattering model is proved. The optimality system is derived. Based on its analysis local uniqueness and stability of optimal solutions are established.

P2: Structure-Function Relationship and Neuroimaging

Sara Liyuba Vesely[1], Alessandro Alberto Vesely[2], Sibilla Renata Dolci[3], Marco Emilio Vesely[4], Caterina Alessandra Dolci[5]

[1]ITB?CNR (Italy), [2]Via L. Anelli 13-Milan (Italy), [3]Via Bergognone 31 - Milan (Italy), [4]Via Bordighera 45 - Milan (Italy), [5]Politecnico di Milano (Italy)

Computationally expensive iterative image reconstruction techniques and sophisticated processing methods are deployed to map non-invasively the structure and function of the human brain. Multiscale methods are available for the visual representation of the local neural activity. Perhaps, by so doing the difference between the imaged brain functioning and that of a computer is expunged. In fact, understanding brain activity is not so much a matter of evolutionary ecology, but rather of clarifying in what sense it fits natural laws.

P3: Information Content of Images

Sara Liyuba Vesely[1], Caterina Alessandra Dolci[2], Sibilla Renata Dolci[3], Alessandro Alberto Vesely[4]

[1]ITB?CNR (Italy), [2]Politecnico di Milano (Italy), [3]Via Bergognone 31 - Milan (Italy), [4]Via L. Anelli 13-Milan (Italy)

Extraction of information from images is often hamperedby the ineffective definitions of information content as wellas by the growing image storage capabilities and by themultifarious processing algorithms themselves. Sometimesit is suggested that some duality/reciprocity principle ofphysics may help encapsulate useful imaging parameters.In our opinion for imaging purposes geometry is a betterbackground than optimization. We compare the customaryduality concepts with the corresponding geometric notion,and identify nonlinear features with the useful parameters.

P4: Dynamic Control of a split ring resonator via pneumatic levitation

Xutao Tang[1], Iryna Khodasevych[2], Wayne S.T. Rowe[1]

[1]RMIT University (Australia), [2]Melbourne Institute of Technology (Australia)

A pneumatically levitated azimuthally rotating split ring resonator system is proposed to provide dynamic tunability. Changes in orientation of the split ring due to the continuous spinning motion relative to a second static split ring forms a broad-side coupled resonator with dynamically swept resonant frequency. The speed

and acceleration of the frequency sweep can be controlled by the applied pneumatic pressure and the interchangeable platform design. The concept is validated by both simulations and measurements.

P5: Kron-Branin modelling for Multilayer PCB with SMA connectors
Zhifei Xu[1], Blaise Ravelo[1], Olivier Maurice[2]
[1] *Normandy University (France),* [2] *Ariane Group (France)*

This paper develops an equivalent Kron-Branin (KB) model for the SMA connector and multilayer interconnect structure. The structure under study consists of SMA combined with two port terminations on a six-layer PCB structure. The KB equivalent graph is established to compute S-parameters, the results are compared to a full wave 3D simulation tool.

P6: Substrate microgrid fiber effects on microstrip line
Zhifei Xu[1], Blaise Ravelo[1], Benoit Agnus[2], Stephane Carras[3]
[1] *Normandy University (France),* [2] *WAVE CONCEPTION (France),* [3] *FILIX SAS (France)*

This article analyses the influence on the microstrip line response of the substrate microgridded with transversal and longitudinal fiber layers. The transmission line behavior is investigated numerically in function of the grid hole physical dimensions. As application example, the main dielectric substrate presents a relative permittivity εr=4.4 and the fiber one is εr1=1. Different fibers with different rectangular sections placed in transversal and longitudinal layer with respect to the signal propagation direction are analyzed.

P7: Wave propagation in a band-pass transmission line with periodically modulated capacitors
Alexander Gomez Rojas, Uriel Algredo-Badillo, Peter Halevi
National Institute of Astrophysics, Optics and Electronics (Mexico)

We study wave propagation in a band-pass transmission line whose capacitances are modulated in time periodically. Kirchhoffs laws lead to an eigenvalue problem with exotic solutions for the dispersion relation, depending on the ratio of the modulation frequency and resonance frequency of a unit cell. Simulations with modulation sources and a signal source confirm that the current wave contains multiple harmonics and that it travels a distance given by the product of the group velocity and time of propagation.

P8: The Radiation Characteristics of Three-Element Vivaldi Antenna Array which Elements are Located on The Edge of an Equilateral Triangle
Armen Gevorkyan, Tatyana Privalova
Southern Federal University (Russia)

Showed the results of the study of the radiation characteristics of a single Vivaldi antenna and this antenna in the composition of three-element antenna array on the edges of an equilateral triangle. It is shown that the composition of the antenna arrays this antenna has a large bandwidth and the best form of the radiation pattern.

10:30 - 11:30 — Birreria Dresden Green

Session 3A2

Terahertz Science and Technology II

Organized by: Masayoshi Tonouchi and Kodo Kawase

Chaired by: Daniel M. Mittleman

10:30 : Invited talk
Photonic engineering of continuous wave THz quantum cascade resonators
Miriam Serena Vitiello
NEST/CNR - Istituto Nanoscienze and Scuola Normale Superiore (Italy)

The talk will provide an overview of our recent technological developments of miniaturized Terahertz quantum cascade lasers (QCLs) operating in continuous wave (CW) with state of the art performances, controlled and directional beam profiles and fine control of the spectral bandwidth.

10:50 : Invited talk
Femtosecond Acoustics and Terahertz Ultrasonics
Chi-Kuang Sun
National Taiwan University (Taiwan)

Taking advantage of the slow sound velocity in materials, here we show that femtosecond-time-resolved acoustic measurement, with a terahertz bandwidth, is capable to explore the material heat transport properties and to noninvasively monitor in situ an interface and sub-surface area under atmospheric conditions with sub-atomic layer sensitivity.

11:10 : Invited talk
High-Harmonic Generation in Transition Metal Dichalcogenide Monolayers
Koichiro Tanaka
Kyoto University (Japan)

Nonlinear optical phenomena under extremely high optical field have been studied in transition metal dichalcogenide monolayers with 60 THz excitation. High-harmonic gener- ation is clearly observed and enhanced around the absorp- tion band due to van Hove singularity of the joint density of states.

18:30 - 19:45 — Birreria Dresden Green

Session 3A3

Antennas and Propagation

Chaired by: Takehiko Kobayashi

18:30 : Microwave Propagation and Transmission within a Small Spacecraft for Replacing Wired Buses - Effects of Antenna Polarization
Miyuki Hirose, Takehiko Kobayashi
Tokyo Denki University (Japan)

Path gains and throughputs were measured within a small spacecraft for various antenna settings and polarizations. A use of ultra-wideband technology within spacecrafts has been proposed with a view to partially replacing wired interface buses with wireless connections. A series of microwave (wideband and ultra-wideband) measurement campaigns were conducted within the small spacecraft. Polarization configurations were found to produce almost no effect on average power delay profiles and substantially small effects on the throughputs.

18:45 : Exotic properties of Intrinsic Localized Modes (Discrete Breathers) in a transmission line in the microwave regime
Alexander Gomez, Peter Halevi
Instituto Nacional de Astrofisica, Optica y Electronica (INAOE) (Mexico)

In a lumped transmission line with modulated nonlinear capacitors, an Intrinsic Localized Mode or Discrete Breather can be anchored to an impurity lattice site for some threshold value of an inductive, capacitive, or resistive parameter. However, for appropriate values of the modulation frequency even multiple DBs can be created, only one of which coincides with the impurity site. Moreover, a DB can pull closer its DB neighbors on both sides, only to perish once they have gotten close.

19:00 : Transmission line with square modulation in time of the capacitance and/or inductance
José Gabriel Gaxiola Luna, Peter Halevi
National Institute of Astrophysics, Optics and Electronics (Mexico)

We studied wave propagation in a lumped transmission line with square modulation in time of the capacitances and/or inductances. Large band gaps in the propagation constant are obtained, although the case of equal, in-phase modulation is exceptional, with no gaps at all. Important to note, a finite resistance can be overcome with sufficiently strong modulation, resulting in no attenuation of the oscillations.

19:15 : Accurate Bi-static RCS Measurement for scaled Target using Noise Illuminated W-band Radio-

meter

Kiin Kim[1], **Jinmi Jeong**[2], **Yonghoon Kim**[1]
[1] *Gwangju Institute of Science and Technology (Korea),* [2] *Millisys Inc. (Korea)*

This paper is proposed the new type of RCS measuring method and system for scaled objects. Unlike any other conventional radar-based RCS measuring system, the proposed method uses W-band radiometer receiver with noise illumination and X-Y scanner which is compact and easy operation in samll size room. The measured RCS accuracy for reference metal object of rectangular plate, cylinder and sphere is smaller than 1.0 dB in the azimuth scan angle of +/- 5 degrees.

19:30 : Research on EMP Environment of SG-III Facility

Cui Meng[1], **Han Bing Jin**[1], **Yuansheng Jiang**[1], **Zhiqian Xu**[1], **Wanguo Zheng** [2]
[1] *Tsinghua University (China),* [2] *China Academy of Engineering Physics (China)*

In the high power laser-target matter interaction process within the high power laser facility, the movement of hot electron can excite high power electromagnetic pulse with electric field amplitude up to 10,000 V/m and frequency of GHz level. The measurement research and numerical simulation of the EM environment in high power laser facility SG III is introduced in this paper.

Thursday 28th June, 2018

08:00 - 09:10 — Teatro Emerald

Session 4A1

Plenary Session II

Chaired by: Nader Engheta

08:00 : Plenary talk
Microstructured Materials for Thermal Heating and Memory
Michelle L. Povinelli
University of Southern California (USA)

We explore the effect of microstructure on regulating the interaction light and heat. In particular, we examine the use of absorptive resonances in photonic crystal slabs. In the first part of the work, we use resonances to create selective on-chip heating for lab-on-chip applications. In the second part, we use an absorptive resonance to encode information in the internal device temperature, forming a hybrid optothermal memory. Such a device may prove useful for operation in highly fluctuating environments.

08:35 : Plenary talk
The Present and Future of Flat Optics: from Metalenses to Polarization Metaoptics and Arbitrarily Structured Light
Federico Capasso
Harvard University (USA)

Metasurfaces enable the redesign of optical components into thin, planar and multifunctional elements, promising a major reduction in footprint and system complexity as well as the introduction of new optical functions including arbitrary wavefront control. The planarity of flat optics will lead to the unification of semiconductor manufacturing and lens-making, where the planar technology to manufacture computer chips will be used to make CMOS compatible metasurface-based optical components, ranging from metalenses to novel polarization optics, areas where I foresee the greatest technological and scientific impact. New polarization optics results on an ultracompact metasurface polarimeter and polarization state generator, will be presented and applications to polarization sensitive imaging for a wide range of applications will be discussed. Finally structured light generation with metasurfaces based on J-Plates for arbitrary spin to orbital angular momentum converter will be discussed, along with the general problem of arbitrary vector beam generation.

Break

09:10 - 10:00

10:00 - 11:40 — Birreria Dresden Green

Session 4A2

Terahertz Science and Technology III

Organized by: Masayoshi Tonouchi and Kodo Kawase

Chaired by: Alexander Shkurinov

10:00 : Invited talk
Terahertz Microfluidic Devices coupled with Meta Atoms

Masayoshi Tonouchi
Osaka University (Japan)

We present a nonlinear optical crystal (NLOC)-based terahertz (THz) microfluidic chip with a few arrays of split ring resonators (SRRs) for ultra-trace and quantitative measurements of liquid solutions. Using this chip, we have succeeded in observing the 31.8 femtomol of ion concentration in actual amount of 318 picoliter water solutions This technique opens the door to microanalysis of biological samples with THz waves and accelerates development of THz lab-on-chip devices.

10:20 : Invited talk
Terahertz Spectroscopy of Semiconductors and Semiconductor Nanostructures
Coleen Nemes, Kevin Regan, John Swierk, Charles Schmuttenmaer
Yale University (USA)

Terahertz spectroscopy has proven to be an excellent noncontact probe of charge injection and conductivity with subpicosecond time resolution. One may exploit this capability to study a variety of materials, such as transient photoconductivity of wide band gap metal oxides such as TiO2, SnO2, and WO3. Our particular interest is the characterization and dynamics of the photoinduced carriers that are required for efficient oxidation at the metal oxide/electrolyte interface, as well as in situ probing of functioning photoelectrochemical devices.

10:40 : Invited talk
THz Pulse Radiation with GHz Repetition Rate in Silicon
M. Mahdi Assefzadeh, Aydin Babakhani
UCLA (USA)

In this paper, we report a single-chip array of THz pulse radiators with the ability to produce and radiate 5.4psec pulses. Elements of a 2x4 array radiate the picosecond pulses coherently with a jitter of 270fsec. Picosecond pulse radiation is achieved using a fully electronic laser-free scheme based on the technique of Direct-digital-to-Impulse (D2I) radiation. The chip is fabricated in 90nm SiGe BiCMOS process technology.

11:00 : Invited talk
Ultrastrong light-matter coupling beyond unity coupling strength
Christoph Lange, Andreas Bayer, Marcel Pozimski, Simon Schambeck, Rupert Huber, Dominique Bougeard
University of Regensburg (Germany)

We introduce a paradigm change in the design of THz light-matter coupled systems by treating the electronic and photonic components on equal footing instead of optimizing them separately. Exploiting both cavity and electronic excitation to confine the vacuum mode, we achieve $\Omega R/\omega c$=1.43 for cyclotron resonances ultrastrongly coupled to metamaterials. Under this condition, the vacuum ground state exhibits a record population of 0.37 virtual photons, massively facilitating the envisaged detection of quantum vacuum radiation by diabatic switching of $\Omega R/\omega c$.

11:20 : Invited talk
Multi wavelength injection-seeded THz parametric generator
Kosuke Murate, Kazuki Maeda, Guo Yunzhuo, Kodo Kawase
Nagoya University (Japan)

Recently, we have succeeded in the development of high power and high sensitivity THz wave spectral imaging system using injection-seeded THz parametric generation (is-TPG) and detection. A dynamic range of 100 dB has been obtained, and the peak output power of is-TPG approached 50 kW by introducing a microchip YAG laser with shorter pulse width of 420ps. Now we can detect drugs under much thicker obstacles than before using is-TPG spectroscopic imaging system.

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