VENUE

Capri is a beautiful and picturesque island in the Gulf of Naples, in the South of Italy. It has two towns: Capri and Anacapri. If the Piazzetta of Capri is the unrivalled focus of the island's glamorous social life, filled with elegant sidewalk cafes, the pretty historic centre of **Anacapri** located on the slopes of Mount Solaro is the exact opposite, with its peaceful piazzas and bougainvillea and geranium festooned lanes. It is a concentration of Mediterranean colours, scents, and sounds.

The EOS Topical Meetings in Capri will be held at the Conference Centre of the Consiglio Nazionale delle Ricerche, the former Royal Swedish Academy Solar Observatory, Via Ceselle, Anacapri (Na), Italy.

EOS Topical Meetings (OμS'19&ONS'19)

take place at the:

Conference Centre of the Consiglio Nazionale
delle Ricerche (former Royal Swedish Academy
Solar Observatory)
Via Ceselle, Anacapri (Na), Italy

GETTING AROUND AT CAPRI AND ANACAPRI

Getting around at Capri and Anacapri:

www.capri.com /en/come -muoversi

By car
Please note that during the tourist season (from Easter to the first weekend of November) non-resident vehicles are not allowed to circulate on the island of Capri. It is advisable to leave cars in one of the attended car parks close to the points of embarkation.

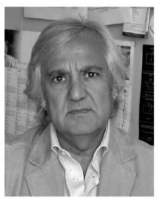
Further Information
> Directions to Capri island (by plane, car or train)
www.capritourism .com/en/how-to-reach-capri
> Map of the island www.capri.ne t/en/map
> Tourist information www.capritourism .com

SYNOPSIS

OμS'19 is the 8th edition of the international conference wholly dedicated to optical microsystems organized by the European Optical Society (EOS) and the Italian Society of Optics and Photonics (SIOF), Italian Branch of the EOS.

Optical microsystems are now able to perform complex sensing and actuation functions, taking advantage of the progress in micro- and nano-technologies to integrate in a smart way optical devices with electronic, mechanical and sensing components. The increasing interest in this field arises from the perspective applications that would significantly improve the quality of life. The list of possibilities offered by these enabling technologies is long and seems to increase day by day. Optical microsystems are finding applications not only in ICT, but also in biotechnologies, medicine, food and environmental monitoring, aerospace and automotive, homeland security, etc. The conference programme will focus on fundamental as well as more applied topics. Biosensors, biochips and lab-on-chip, microfluidic and optofluidic systems, non-linear and quantum optical devices, silicon-based optoelectronics and MOEMS, chemical and physical optical microsensors, new characterization methods for materials and devices, novel imaging techniques, biomimetic devices and systems are among the hot topics of the conference.

GENERAL CHAIRS



Ivo Rendina
Consiglio Nazionale delle Ricerche (IT)

Eugenio Fazio
Università di Roma La Sapienza (IT)

Pietro Ferraro
Consiglio Nazionale delle Ricerche (IT)

OμS'19 is organised in cooperation with the Italian Branch of the EOS:

SIOF Società Italiana di Ottica e Fotonica

TECHNICAL COMMITTEE

Ady Arie - Tel-Aviv University / Israel
Mario Bertolotti - Sapienza Università di Roma / Italy
Mathieu Chauvet , Univ. Franche Comté, Besancon / France
Stefano Cabrini - Lawrence Berkeley National Laboratories / Ca (USA)
Giuseppe Cocorullo - Università della Calabria / Italy
Principia Dardano - Consiglio Nazionale Ricerche / Italy
Richard De La Rue - University of Glasgow / United Kingdom
Alberto Diaspro - Istituto Italiano di Tecnologia /Italy
Emanuela Esposito - Consiglio Nazionale Ricerche / Italy
Gianluca Gagliardi - Consiglio Nazionale delle Ricerche / Italy
Hatice Duran - Sabanci University / Turkey
Mario Iodice - Consiglio Nazionale delle Ricerche / Italy
Bahram Jalali - UCLA / Ca (USA)
Bahram Javidi - University of Connecticut / USA
Fredrik Laurell - The Royal Institute of Technology, KTH / Sweden
Francesco Merola - Consiglio Nazionale delle Ricerche / Italy
Lisa Miccio - Consiglio Nazionale delle Ricerche / Italy
Humberto Michinel – University of Vigo and EOS President / Spain
Germano Montemezzani - Supelec, Metz / France
Wolfgang Osten - Institute of Technical Optics - University of Stuttgart / Germany
Demetri Psaltis - Ecole Polytechnique Fédérale de Lausanne / Switzerland
Graham Reed - University of Southampton / United Kingdom
Michael J. Sailor - UC San Diego / Ca (USA)
Ali Serpenguezel - Koç University / Turkey
Roberto Rella, Consiglio Nazionale delle Ricerche and President SIOF /Italy
Ralph Peter Tatam - Cranfield University / United Kingdom
Zeev Zalevsky - Bar-Ilan University / Israel

LOCAL ORGANIZING COMMITTEE

IMM, CNR

Valentina Di Meo
Principia Dardano

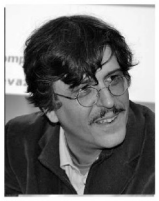
CONFERENCE SECRETARIAT

Monica Gigliotti
Vincenzo Mosca
Vincenzo Palmieri
Domenico Passaro
Loredana Salzano

SYNOPSIS

New properties in nanoscale structures can be dramatically tuned with size and shape of the nanostructures. Completely different optical behaviors are produced compared to the bulk counterparts, such as narrow line widths for emission, solar energy conversion, etc. Indeed materials and applications require strong effort to develop spectroscopy and microscopy tools allowing visualization and manipulation of optical properties with nanoscale resolution. Optics at Nanoscale is a Topical Meeting that covers a spectrum from applied to basic research of this domain providing a forum for all the aspects with the purpose of advancing the state-of-the-art of nanoscale optics.

GENERAL CHAIRS



Vito Mocella
Consiglio Nazionale delle Ricerche (IT)

Concita Sibilia
Università di Roma La Sapienza (IT)

ONS'19 is organised in cooperation with the Italian Branch of the EOS:

SIOF Società Italiana di Ottica e Fotonica

TECHNICAL COMMITTEE

Mario Agio, CNR-INO (IT)
Guillaume Bachelier, Neel Institute Grenoble (FR)
Sophie Brasselet, Institut Fresnel (FR)
Emanuela Esposito, Consiglio Nazionale delle Ricerche (IT)
Javier García de Abajo, Institut de Ciències Fotòniques (ES)
Philippe Lalanne, Institut d'Optique (FR)
Kauranen Martti, Tampere University of Technology (FI)
Walter Pfeiffer, Bielefeld University (G)
Gennady Shvets, Univ. of Texas, Austin (US)
Niek van Hulst, ICFO (ES)
Anatoly Zayats, King's College (GB)

LOCAL ORGANIZING COMMITTEE

IMM, CNR
Silvia Romano

CONFERENCE SECRETARIAT

Monica Gigliotti
Vincenzo Mosca
Vincenzo Palmieri
Domenico Passaro

CONFERENCE AT A GLANCE

Sunday, September 8th

18:00 20:00
Registration

Monday, September 9th

Optics at Nanoscale (ONS'19)	Optical Microsystems (OμS'19)
9:45 10:30 Plenary I: Anatoly Zayats, King's College London, United Kingdom	
10:30 11:05 Light-matter interactions: emission, sensing, imaging I	**10:30 11:00** Near Infared spectroscopy
11:05 11:40 Coffee break	**11:00 11:30 Coffee break**
11:40 12:45 Light-matter interactions: emission, sensing, imaging I	**11:30 12:55** Sensor devices
13:00 14:30 Lunch	
14:30 15:40 Emerging technologies: metamaterials, nonradiating modes, topological insulator I	**14:30 15:40** Special Session Optical biosensing and imaging: from fundamentals to applications
15:40 16:10 Coffee break	
16:10 17:30 Materials for photonics: quantum dots, perovskite nanostructures, 2D nanomaterials	**16:10 17:30** Special Session Optical biosensing and imaging: from fundamentals to applications **17:30 17:50** Smart Optics
18:30 20:00 Poster Session and Welcome Cocktail	

CONFERENCE AT A GLANCE

Tuesday, September 10th

Optics at Nanoscale (ONS'19)	Optical Microsystems (OμS'19)
9:15 10:00 Plenary II: Graham Reed, University of Southampton, UK	
10:00 11:05 Nanophotonics I	**10:00 11:05** Special Session Space exploration and Human spaceflight: new challenges for photonic and microsystems
11:05 11:30 Coffee break	
11:30 12:35 Emerging technologies: metamaterials, nonradiating modes, topological insulator II	**11:30 13:05** Special Session - Space exploration and Human spaceflight: new challenges for photonic and microsystems
13:00 14:30 Lunch	
14:30 15:30 Special session Waves in Complex Photonic Media: Fundamentals and Device Applications I	**14:30 15:25** Special Session Optical Systems for Solar Energy
15:30 16:00 Coffee break	**15:25 15:55 Coffee break**
16:00 17:15 Special session Waves in Complex Photonic Media: Fundamentals and Device Applications I	**15:55 16:30** Special Session Optical Systems for Solar Energy **16:30 17:55** Imaging and spectroscopy **17:55 18:25** Lab-on-chip devices

CONFERENCE AT A GLANCE

Wednesday, September 11th

Optics at Nanoscale (ONS'19)	Optical Microsystems (OμS'19)
9:00 9:45 Plenary III: Alberto Diaspro, Nanoscopy, IIT-CHT Erzelli, Italy	
9:45 11:00 Nanophotonics II	**9:45 11:00** Optical cavities sensors
11:00 11:30 Coffee break	
11:30 12:55 Light-matter interactions: emission, sensing, imaging II	**11:30 12:50** Digital holography
13:00 14:30 Lunch	
14:30 15:30 Special session: Waves in Complex Photonic Media: Fundamentals and Device Applications II	**14:15 15:40** Optical manipulation
15:30 16:00 Coffee break	**15:40 16:00 Coffee break**
16:00 16:40 Special session: Waves in Complex Photonic Media: Fundamentals and Device Applications II	**16:00 16:50** Special session: Optical Quantum Technologies **16:50 17:50** Plasmonic devices

Final Program

Optical Microsystems (OμS'19)

Sunday, September 8th

• 18:00 20:00 Registration

Monday, September 9th

• 08:30 09:45 Registration and opening

• 09:45 10:30 Plenary I: Anatoly Zayats
King's College London, United Kingdom
Spin-orbit interactions in nanophotonics

Near Infared spectroscopy

• 10:30 10:45 *Oral* - **Giovanni Maira** - CNR-IMM, Italy
Optimization of the use of silicon photomultipliers for continuous wave functional near infrared spectroscopy

• 10:45 11:00 *Oral* - **Valentina Di Meo** - CNR-IMM, Italy
Plasmonic Metasurface based on Cross-Shaped NanoAntennas for Surface Enhanced InfraRed Absorption Applications

11:05 11:40 Coffee break

Sensor devices

• 11:30 11:50 *Invited* - **Gilberto Brambilla** - University of Southampton, UK
Structured optical fibres for long-distance distributed sensing

• 11:50 12:05 *Oral* - **Emanuele Luigi Sciuto** - CNR-IMM, Italy
Miniaturizable and integrated sensor for Hg(II) optical detection in water

• 12:05 12:20 *Oral* - **Francesco Della Corte** - Università Mediterranea Reggio Calabria, Italy
Direct measurement of the junction temperature of Light Emitting Diodes through a non-invasive technique

• 12:20 12:35 *Oral* - **Agostino Occhicone** - Sapienza University of Rome, Italy
Experimental Evidence of Mid-infrared Bloch Surface Waves

• 12:35 12:55 *Invited* - **Paolo Antonio Netti** - Italian Institute of Technology, Italy
Material-cytoskeleton-nuclear-envelope axis: an engineering view of mechanobiology

13:00 14:30 Lunch

Optics at Nanoscale (ONS'19)

Sunday, September 8th

• 18:00 20:00 Registration

Monday, September 9th

• 08:30 09:45 Registration and opening

• 09:45 10:30 Plenary I: Anatoly Zayats
King's College London, United Kingdom
Spin-orbit interactions in nanophotonics

Light-matter interactions: emission, sensing, imaging I

• 10:30 10:50 *Invited* - **Assegid Mengistu Flatae** - University of Siegen, Germany
Plasmon-assisted ultrafast photodynamics in quantum dots

• 10:50 11:05 *Oral* - **Elisabetta Sepe** - Sapienza University of Rome, Italy
Anisotropic Fluorescence Emission due to Photobleaching at the Surface of 1D-Photonic Crystal Biochips

11:05 11:40 Coffee break

Light-matter interactions: emission, sensing, imaging I

• 11:40 12:00 *Invited* - **Giovanni Mattei** - University of Padova, Italy
Quantum emitters coupled to optically engineered nanostructures for enhanced emission and nanolasing

• 12:00 12:15 *Oral* - **Marinella Striccoli** - CNR-IPCF, Bari, Italy
Spectroscopic signature of quantum dot dimers

• 12:15 12:30 *Oral* - **Mohammad Abutoama** - University of the Negev, Israel
Field Enhancement Investigation using the Extended to Localized Surface Plasmon Coupling Configurations in the Prism and Grating Geometries

• 12:30 12:45 *Oral* - **Gur Lubin** - Weizmann Institute of Science, Israel
Quantum imaging with SPAD arrays

13:00 14:30 Lunch

Optical Microsystems (OμS'19)

Monday, September 9th

Special Session - Optical biosensing and imaging: from fundamentals to applications

• 14:30 14:50 *Invited* - **Katerina Kusova**
Institute of Physics of the Czech Academy of Sciences, Czech Republic
Silicon nanocrystals: indirect- and direct-bandgap luminescent material

• 14:50 15:05 *Oral* - **Anna Chiara De Luca** - CNR-IBBC, Italy
Raman microscopy for cellular investigations: from cell identification to imaging

• 15:05 15:20 *Oral* - **Maria Francesca Santangelo** - CNR-IMM, Italy
Real time ATP bioluminescence monitoring on 3D printed LoC by highly sensitive SiPM

• 15:20 15:40 *Invited* - **Paola Ceroni** - University of Bologna, Italy
Luminescent silicon nanocrystals as bioimaging probes

15:40 16:10 Coffee break

Special Session - Optical biosensing and imaging: from fundamentals to applications

• 16:10 16:30 *Invited* - **Francesca Santoro** - Italian Institute of Technology, Italy
Interfaces in 3D bioelectronics

• 16:30 16:45 *Oral* - **Bruno Miranda** - CNR-IMM, Italy
From rigid to flexible plasmonic sensors for biomedical applications

• 16:45 17:00 *Oral* - **Romuald Houdre** - Ecole Polytechnique Fédérale de Lausanne, Switzerland
Gram-type Differentiation via statistical analysis of optically trapped bacteria in hollow photonic crystal cavities

• 17:00 17:15 *Oral* - **Stefano Lettieri** - CNR-ISASI, Italy
Toward unconventional TiO2-based optodes for oxygen detection

• 17:15 17:30 *Oral* - **Chiara Schiattarella** - CNR-IMM, Italy
Time-gated imaging of luminescent microporous silicon nanoparticles in living Hydra polyps

Smart Optics

• 17:30 17:50 *Invited* - **Johannes Feldmann** - University of Muenster, Germany
All-optical neural networks with phase-change photonics

• 17:50 18:05 *Oral* - **Eugenio Fazio** - Sapienza University of Rome, Italy
Stigmergic reinforcement learning using all-optical solitonic x-junctions

• 18:05 18:20 *Oral* - **Tommaso Isernia** - Università Mediterranea of Reggio Calabria, Italy
Towards an effective inverse design of artificial materials based devices through the Scattering Matrix Method

Optics at Nanoscale (ONS'19)

Monday, September 9th

Emerging technologies: metamaterials, nonradiating modes, topological insulator I

• 14:30 14:50 *Invited* - **Boubacar Kanté** - University of California Berkeley, USA
Topological sources of light

• 14:50 15:10 *Invited* - **Didier Felbacq -** Université de Montpellier, France
An algebraic geometry approach to photonic topological insulators

• 15:10 15:25 *Oral* - **Silvia Romano -** CNR-IMM, Italy
Dual surface-enhanced fluorescence imaging and ultra-high FOM sensing in all-dielectric metasurfaces

• 15:25 15:40 *Oral* - **Hanan Ali**
College of Physical Science and Technology, China
Circular dichroism from sickle-shaped chiral metamaterial structure operating in the mid-infrared region

15:40 16:10 Coffee break

Materials for photonics: quantum dots, perovskite nanostructures, 2D nanomaterials

• 16:10 16:30 *Invited* - **Davide Boschetto** - École Polytechnique, France
Transient non thermal state and coherent phonon hardening in prototype Mott compound V_2O_3

• 16:30 16:45 *Oral* - **Felice Gesuele** - Università degli Studi di Napoli Federico II, Italia
Multi-imaging analysis of exciton states in monolayer transition metal dichalcogenides and van der Waals heterostructures

• 16:45 17:00 *Oral* - **Anna Vinattieri** - INSTM -Firenze, Italy
Non-linear exciton dynamics in CsPbBr3 nanometric thin films

• 17:00 17:15 *Oral* - **Naomi Falsini** - INSTM-Firenze, Italy
A new route to large-area thin film deposition of inorganic perovskites: RF-Magnetron sputtering deposition of CsPbBr3

• 17:15 17:30 *Oral* - **Tomasz Czyszanowski** - Lodz University of Technology, Poland
Monolithic deep-subwavelength grating as transparent electrode of polarized light

Poster Session and Welcome Cocktail

Optics at Nanoscale (ONS'19)
Optical Microsystems (OμS'19)

Monday, September 9th

18:30 20:00

Pasquale Memmolo
CNR-ISASI, Italy
Imaging of Diatoms species by Fourier Ptychographic Microscopy

Teresa Crisci
CNR-IMM, Italy
Near-infrared Erbium/Silicon Schottky photodetectors integrated with a silicon-on-insulator waveguide

Pasquale Memmolo
CNR-ISASI, Italy
Identification and classification of anemic erythrocytes by Holographic Learning

Eugenio Fazio
Sapienza University of Rome, Italy
Active Reflection and Refraction of Soliton Waveguides on Electric Interfaces

Nicola Lovecchio
Sapienza University of Rome, Italy
Electrowetting-based Lab-on-Chip System for Biosensing Applications

Teresa Cacace
CNR-ISASI, Italy
Scatterer thickness influence on "shift" optical memory effect range

Francesca Costantini
Sapienza University of Rome, Italy
Detection of Fluorescence-based Aptamer Assay Through Thin Film Optoelectronic

Davide De Maio
University of Napoli "Federico II", Napoli, Italy
Performance of a solar thermal collector based on Compound Parabolic Concentrator under high vacuum

Ota Kunt
Dresden Integrated Center for Applied Physics, Germany
Exceptional points in k-space optically anisotropic microcavities

Maurizio Artoni
University of Brescia, Italy
Color Entanglement in Metamaterials

Optical Microsystems (OμS'19)

Tuesday, September 10th

• 9:15 10:00 Plenary II: Graham Reed
Optoelectronics Research Centre, Southampton University, UK
Erasable Optical devices for Programmable Photonics

Special Session
Space exploration and Human spaceflight: new challenges for photonic and microsystems

• 10:00 10:20 *Invited* - **Maria Antonietta Ferrara** - CNR-IMM, Italy
Volume Holographic Optical Elements: new challenges in space applications

• 10:20 10:35 *Oral* - **Izabela Naydenova** - Technological University Dublin, Ireland
Photopolymer microstructures created by holographic recording for application in sensing and light shaping and redirection

• 10:35 10:50 *Oral* - **Stefano Guido** - University of Naples "Federico II", Italy
Blood-on-chip microfluidics for biomedical applications in space

• 10:50 11:05 *Oral* - **Christophe Minetti** - Université libre de Bruxelles, Belgium
Hydrodynamics of a large population of Red Blood Cells under shear flow with Digital Holographic Microscopy

11:05 11:30 Coffee break

Special Session - Space exploration and Human spaceflight: new challenges for photonic and microsystems

• 11:30 11:50 *Invited* - **Leonardo Surdo** - European Space Agency, Netherlands
European space strategies for future space human explorations

• 11:50 12:05 *Oral* - **Monica Monici** - University of Florence, Italy
NIR laser therapy by MLS-Mis device for treating neuropathic pain

• 12:05 12:20 *Oral* - **Gemma Rius** - Institute of Microelectronics of Barcelona, Spain
Customized micro and nano technologies to enable new miniaturized platforms and components for Space exploration

• 12:20 12:35 *Oral* - **Tianheng Zhao** - University of Cambridge, UK
Printing of Responsive Photonic Cellulose Nanocrystal Micro-Film Arrays as humidity sensors

• 12:35 12:50 *Oral* - **Vanja Miskovic** - Universite libre de Bruxelles, Belgium
Flexible Liquid Crystal Temperature Monitoring System for monitoring the Wound Healing Process

• 12:50 13:05 *Oral* - **Aniello Pelella** - CNR-IMM, Italy
Remote electrical powering over Fiber Optics in Space environment

13:00 14:30 Lunch

Optics at Nanoscale (ONS'19)

Tuesday, September 10th

• 9:15 10:00 Plenary II: Graham Reed

Optoelectronics Research Centre, Southampton University, UK
Erasable Optical devices for Programmable Photonics

Nanophotonics I

• 10:00 10:20 *Invited* - **Marco Centini** - Sapienza, University of Rome, Italy
Revisiting the Yagi-Uda Nanoantenna Design for Tailored Infrared Thermal Radiation

• 10:20 10:35 *Oral* - **Mariano Pascale** - Università degli Studi di Napoli "Federico II", Italy
Full-Wave Mode Hybridization in Nanoparticle Dimers

• 10:35 10:50 *Oral* - **Krzysztof Czajkowski** - University of Warsaw, Poland
Multipole analysis of amorphous arrays of dielectric nanoresonators

• 10:50 11:05 *Oral* - **Dominika Switlik** - University of Warsaw, Poland
On using bulk sensitivity parameters of single plasmonic nanodisks to quantify local layer thickness and refractive index

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11:05 11:30 Coffee break

Emerging technologies: metamaterials, nonradiating modes, topological insulator II

• 11:30 11:50 *Invited* - **Andrea Di Falco** - University of St Andrews, UK
Flexible holographic metasurfaces

• 11:50 12:05 *Oral* - **Quentin Flamant** - Univ. Bordeaux, CNRS, France
Optical magnetism in self-assembled metamaterials

• 12:05 12:20 *Oral* - **Concita Sibilia** - Sapienza, University of Rome, Italy
Enantioselectivity of chiral molecules on asymmetric hole array substrate

• 12:20 12:35 *Oral* - **Michael Mazilu** - University of St Andrews, UK
Optical eigenmodes description of photon eigenstates

13:00 14:30 Lunch

Optical Microsystems (OμS'19)

Tuesday, September 10th

Special Session- Optical Systems for Solar Energy

• 14:30 14:50 *Invited* - **Elisa Sani** - CNR-INO, Italy
Novel materials for sunlight absorption and energy transfer

• 14:50 15:05 *Oral* - **Davide De Maio** - CNR-IMM, Italy
A Solar Selective Absorber for high vacuum flat solar thermal panels

• 15:05 15:25 *Invited* - **Peter Bermel** - Purdue University, United States
Ultra-high efficiency compact solar modules enabled by photonic superprisms

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15:25 15:55 Coffee break

Special Session
Optical Systems for Solar Energy

• 15:55 16:15 *Invited* - **Salvatore Lombardo** - CNR-IMM, Italy
Bifacial Si heterojunction solar cells: impact of defects and optimization of bifaciality

• 16:15 16:30 *Oral* - **Carmine D'Alessandro** - CNR-IMM, Italy
An instrument to evaluated Selective Solar Absorber properties in operating conditions

Imaging and spectroscopy

• 16:30 16:50 *Invited* **Valerio Pruneri** - ICFO, Spain
Large field of view imaging with classical and quantum light

• 16:50 17:05 *Oral* - **Andrea Caroppo** - CNR-IMM, Italy
Experimental study on the use of a Time-of-Flight depth-camera for facial expression recognition in the field of AAL

• 17:05 17:25 *Invited* - **Roberto Pini** - CNR-IFAC, Italy
Strategies based on Surface and Tip Enhanced Raman Spectroscopy for detection and study of Alzheimer's biomarkers

• 17:25 17:40 *Oral* - **Filippo Causa** - University of Naples Federico II, Italy
miRNA quantification in-flow by coherent imaging technique

• 17:40 17:55 *Oral* - **David Dannhauser** - Istituto Italiano di Tecnologia, Italy
Label-free investigation and separation of cells using coherent imaging techniques and viscoelastic forces

Lab-on-chip devices

• 17:55 18:10 *Oral* - **Nicola Lovecchio** - Sapienza University of Rome, Italy
Lab-on-Chip System for Electrochemiluminescence Detection Based on Thin/Thick Film Technologies

• 18:10 18:25 *Oral* - **Sara Coppola** - CNR-ISASI, Italy
Pyro-electric effect for designing microfluidic chip and micro-optical components

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Social dinner

Optics at Nanoscale (ONS'19)

Tuesday, September 10th

Special session
Waves in Complex Photonic Media: Fundamentals and Device Applications I

• 14:30 14:50 *Invited* - **Claudio Conti** - Università di Roma La Sapienza, Italy
Deep reservoir computing in tumor cells and Ising machines by spatial light modulators

• 14:50 15:10 *Invited* - **Lucio Andreani** - University of Pavia, Italy
Slow Light to Reduce the Energy Dissipation of Mach-Zehnder Modulators in Silicon Photonics

• 15:10 15:30 *Invited* - **Francesco Riboli** - CNR-INO, Italy
Information Entropy of the Local Density of States in 2D disordered photonic systems

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15:30 16:00 Coffee break

Special session
Waves in Complex Photonic Media: Fundamentals and Device Applications I

• 16:00 16:20 I*nvited* - **Uwe Grimm** - The Open University, Walton Hall, UK
Diffraction of aperiodically ordered structures

• 16:20 16:40 *Invited* - **Marcel Filoche** - École polytechnique, France
Modeling light absorption and emission in disordered GaN-based semiconductors

• 16:40 17:00 *Invited* - **Cefe López** - Instituto de Ciencia de Materiales de Madrid, Spain
Establishing spectral correlations in random laser networks

• 17:00 17:15 *Oral* - **Marco Leonetti** - Istituto Italiano di Tecnologia, Roma, Italy
Transverse localization of light, applications, experiments and theory

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Social dinner

Optical Microsystems (OμS'19)

Wednesday, September 11th

9:00 9:45 Plenary III: Alberto Diaspro

Nanoscopy, IIT-CHT Erzelli, Italy - DIFILAB, Department of Physics, University of Genoa, Italy

Integrating micro- and nano- optical technologies to develop a multi-messenger microscope to address structure and function of biological macromolecules.

Optical cavities sensors

• 09:45 10:05 *Invited* - **Yves-Alain Peter** - Polytechnique Montreal, Canada
Sensing and Tuning with Optical Microresonators on Chip

• 10:05 10:25 *Invited* - **Gianluca Gagliardi** - CNR-INO, Italy
Optical sensing and opto-mechanics with liquid droplet microresonators

• 10:25 10:40 *Oral* - **Marco Pisco** - University of Sannio, Italy
Lab-on-fiber accelerometers using micro-mechanichal structure

• 10:40 11:00 *Invited* - **Maurizio Casalino** - CNR-IMM, Italy
Near-Infrared Resonant Cavity Enhanced Graphene/Silicon Photodetectors

11:00 11:30 Coffee break

Digital holography

• 11:30 11:50 *Invited* - **Fernando Mendoza**
Centro de Investigaciones en Optica, A.C., Optical Metrology, Mexico
Digital Holographic Interferometry with photons and electrons: looking at cells and nano materials

• 11:50 12:05 *Oral* - **Lisa Miccio** - CNR-ISASI, Italy
Photorefractive materials to interface biological samples

• 12:05 12:20 *Oral* - **Teresa Cacace** - CNR-ISASI, Italy
Compact modules for digital holographic microscopy in microfluidics

• 12:20 12:35 *Oral* - **Silvio Montresor** - Le Mans University, France
A deep learning based algorithm applied to the processing of phase data in digital holography

• 12:35 12:50 *Oral* - **Lisa Miccio** - CNR-ISASI, Italy
Label-free morphological biomarkers for early diagnosis in oncology

13:00 14:30 Lunch

Optics at Nanoscale (ONS'19)

Wednesday, September 11th

9:00 9:45 Plenary III: Alberto Diaspro

Nanoscopy, IIT-CHT Erzelli, Italy - DIFILAB, Department of Physics, University of Genoa, Italy

Integrating micro- and nano- optical technologies to develop a multi-messenger microscope to address structure and function of biological macromolecules.

Nanophotonics II

• 9:45 10:05 *Invited* - **Francesco Banfi** - Université Lyon 1 and CNRS, France
Photoacoustic investigation of nanogranular ultra-thin films

• 10:05 10:25 *Invited* - **Femius Koenderink** - Center for Nanophotonics, AMOLF, The Netherlands
Phase and polarization-resolved radiation patterns of single nano-objects and embedded eigenstates

• 10:25 10:45 *Invited* - **Stefano Trillo** - University of Ferrara, Italy
Topographic fibers: a platform for fundamental physical phenomena

• 10:45 11:00 *Oral* - **Shuwen Chen** - National University of Defense Technology, China
Squeezing of light with pyramidal horn nanoantenna

11:00 11:30 Coffee break

Light-matter interactions: emission, sensing, imaging II

• 11:30 11:50 *Invited* - **Cristian Ciracì** - Istituto Italiano di Tecnologia, Italy
Microscopic response of large plasmonic systems via quantum hydrodynamic theory: application to strong light-matter interactions

• 11:50 12:10 *Invited* - **Fabio Antonio Bovino** - Universita'di Roma La Sapienza, Italy
Coherence and simmetry properties of the Stokes vector of the photoluminescence generated by a periodic array of aluminum nanoantennas

• 12:10 12:25 *Oral* - **John Bigeon** - Institut Foton, Univ Rennes, France
Deep-red photoluminescence waveguiding in centimeters-long hybrid active microwires

• 12:25 12:40 *Oral* - **Xavier Zambrana-Puyalto** - Istituto Italiano di Tecnologia, Genova, Italy
Probing light-matter interactions with vortex beam-induced circular dichroism

• 12:40 12:55 *Oral* - **Li Wang** - Beijing University of Technology, China
Dual - parameter measurement for connecting of PCF and FBG with temperature - pressure by Sagnac interferometer

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13:00 14:30 Lunch

Optical Microsystems (OμS'19)

Wednesday, September 11th

Optical manipulation

• 14:15 14:35 *Invited* - **Mercedes Carrascosa** - Universidad Autónoma de Madrid, Spain
Photovoltaic optoelectronic platforms for micro and nanoobject manipulation and trapping

• 14:35 14:50 *Oral* - **Andres Puerto** - Universidad Autónoma de Madrid, Spain
Manipulation, trapping and splitting of water and aqueous bio-droplets by photovoltaic optoelectronic tweezers

• 14:50 15:05 *Oral* - **Stefania Privitera** - CNR-IMM, Italy
Photo-electrochemical water splitting through silicon based photovoltaics

• 15:05 15:25 *Invited* - **Alessandro Busacca** - Università degli Studi di Palermo, Italy
Ultra-broadband coherent detection of terahertz pulses
via CMOS-compatible solid-state devices

• 15:25 15:40 *Oral* - **Eljesa Murtezi** -Johannes Kepler Universität Linz, Austria
Controlling the photochemistry: Photo-oxidation confined to the nanoscale via stimulated emission depletion

15:40 16:00 Coffee break

Special session: Optical Quantum Technologies

• 16:00 16:20 *Invited* - **Lorenzo Colace** - University Roma Tre, Italy
Colloidal Quantum Dots: materials, technology and application prospects

• 16:20 16:35 *Oral* - **Mikhail Lisitskiy** - CNR-ISASI, Italy
A superconducting quantum network as a platform for quantum simulation of complex magnetic systems

• 16:35 16:50 *Oral* - **Mikkel Ejrnaes** - CNR-SPIN, Italy
Superconducting Nanowire Single Photon Detectors: properties, applications and recent developments

Plasmonic devices

• 16:50 17:05 *Oral* - **Massimo Rippa** - CNR-ISASI, Italy
Rotavirus detection by Octupolar Functionalized LSPR Nanosensors

• 17:05 17:20 *Oral* - **Bartolomeo Della Ventura** - Politecnico di Milano, Italy
Plasmonic Enhanced Fluorescence for Multiplexing Biosensing

• 17:20 17:35 *Oral* - **Marco Consales** - University of Sannio, Italy
Optical Fiber Meta-Tip: a Novel Platform for Highly Sensitive Detection of Molecular Interactions

• 17:35 17:50 *Oral* - **Armando Ricciardi -** University of Sannio, Italy
Smart Microgels for Lab on Fiber Technology

Optics at Nanoscale (ONS'19)

Wednesday, September 11th

Special session:
Waves in Complex Photonic Media: Fundamentals and Device Applications II

• 14:30 14:50 *Invited* - **Jacopo Bertolotti** - University of Exeter, UK
Blind Ghost Imaging

• 14:50 15:10 *Invited* - **Romolo Savo** - ETH Zurich, Switzerland
Second harmonic generation in complex assemblies of oxides nanoparticles

• 15:10 15:30 *Invited* - **Fabrizio Sgrignuoli** - Boston University, USA
3D light localization in hyperuniform sub-random media

15:30 16:00 Coffee break

Special session:
Waves in Complex Photonic Media: Fundamentals and Device Applications II

• 16:00 16:20 *Invited* - **Filippo Caruso** - LENS, Firenze, Italy
Optimal photonic state discrimination via quantum stochastic walks

• 16:20 16:40 *Invited* - **Amit Agrawal** - The National Institute of Standards and Technology (NIST), USA
Spatiotemporal Shaping of Optical Fields Using Metasurfaces

Optical Microsystems (OμS'19)

Monday, 9 September 2019

09:45-10:30 **Spin-orbit interactions in nanophotonics**
Anatoly Zayats, King's College London, United Kingdom
Plenary speaker

Monday, 09 September 2019 | Session 1: Near Infrared spectroscopy

10:30-10:45 **Optimization of the use of silicon photomultipliers for continuous wave functional near infrared spectroscopy (O1)**
G. Maira[1], S. Libertino[1], G. Fallica[2], and S. Lombardo[1]
[1] Institute for Microelectronics and Microsystems, National Research Council, Italy
[2] STMicroelectronics, Italy

We have investigated crucial aspects for the use of Silicon Photomultiplier (SiPM) devices in Continuous Wave functional Near Infrared Spectroscopy (CW fNIRS). We analyzed the after-pulsing effect, SiPM transients occurring as the SiPM device goes from the dark (LED in off state) to the illumination (LED in on state) conditions, and vice-versa, and the SiPM SNR in standard CW fNIRS operation.

10:45-11:00 **Plasmonic Metasurface based on Cross-Shaped NanoAntennas for Surface Enhanced InfraRed Absorption Applications (O2)**
V. Di Meo[1], A. Crescitelli[1], A. Caporale[2], M. Janneh[3], A. De Marcellis[3], E. Palange[3], M. Portaccio[4], M. Lepore[4], I. Rendina[1], R. Menotti[2] and E. Esposito[1]
[1]Institute for Microelectronics and Microsystems, National Research Council, Italy
[2]Institute of Biostructures and Bioimaging, National Research Council, Italy
[3]Dept. of Industrial and Information Engineering and Economics, University of L'Aquila, Italy
[4]Dept. of Experimental Medicine – University of Campania "L. Vanvitelli", Italy

In last years, Surface Enhanced InfraRed Absorption (SEIRA) spectroscopy has obtained a rising attention due to its capabilities to identify even very small concentrations of molecular species. In this work, we propose a plasmonic metasurface based on cross-shaped NanoAntennas (NAs) fabricated on silicon substrate which is suitable for SEIRA applications, showing a sensitivity of 600 nm/RIU at different wavelengths and a SEIRA enhancement factor of 48000.

11:00-11:30 **Coffee break**

Monday, 09 September 2019 | Session 2: Sensor Devices

11:30-11:50 **Structured optical fibres for long-distance distributed sensing (O3)**
A. Donko, M. Beresna, A. Masoudi, Gilberto Brambilla
University of Southampton, UK
Invited speaker

In the past, long distance distributed sensing (in particular vibration sensing) has been limited, amongst other factors, by the signal to noise ratio of the Rayleigh backscattered radiation. Although novel fibre designs have been proposed to increase the backscattered signal, they have often been associated with large losses, typically of the order of tens of dB/km. Weak gratings continuously written in fibres have been proposed as an effective solution to provide a strong backscattered signal with losses of the order of 1dB/km. Here we use a fs laser to structure a telecom optical fibre and

increase the signal to noise ratio, providing estimated losses comparable to the propagation losses in conventional telecom fibres.

11:50-12:05 **Miniaturizable and integrated sensor for Hg(II) optical detection in water (O4)**

E. L. Sciuto[1], M. A. Coniglio[2], D. Corso[1], J. R. van der Meer[3], F. Acerbi[4], A. Gola[4] and S. Liberio[1]
[1] Institute for Microelectronics and Microsystems, National Research Council, Italy
[2] University of Catania, Dept. of Medical, Surgical Sciences and Advanced Technologies "G.F. Ingrassia", Italy
[3] University of Lauzanne, Dept. of Fundamental Microbiology, Switzerland
[4] Bruno Kessler Foundation, Center for Material and Microsystems, Italy

We present a miniaturizable optical system for the detection of inorganic mercury, Hg(II), in water. The probe is a genetically modified Escherichia coli emitting 485 nm photons in presence of contamination. Optical detection is performed through a small area Silicon Photomultiplier. The limit of detection is comparable to the luminometer.

12:05-12:20 **Direct measurement of the junction temperature of Light Emitting Diodes through a non-invasive technique. (O5)**

R. Carotenuto, F. G. Della Corte, D. Iero, E. Mallemace, G. Pangallo, S. Polimeni and S. Rao
Università Mediterranea Reggio Calabria, Dept. DIEES, Italy

We present a novel technique for the estimation of the junction temperature of any light-emitting diode (LED), which is based on the measurements of its forward voltage at a fixed probe current. In particular, we demonstrate the existence of a linear dependence on temperature of the voltage drop across a power LED in the wide temperature range from T = 35 up to 175°C, in a wide current range.

12:20-12:35 **Experimental Evidence of Mid-infrared Bloch Surface Waves (O6)**

M. Ortolani[1], M. Pea[2], A. Occhicone[1], V. Giliberti[2], A. Sinibaldi[1], F. Mattioli[3], S. Cibella[3], R. Polito[1], A. Nucara[1], L. Baldassarre[1] and F. Michelotti[1]
[1] Sapienza University of Rome, Italy
[2] Center for Life Nanosciences, Italian Institute of Technology, Italy
[3] Institute for Photonics and Nanotechnologies, National Research Council, Italy

We have developed thin-film deposition technology on CaF2 prisms suitable for biosensing applications of Bloch Surface Waves (BSWs) in the mid-infrared. Bloch Surface Waves are surface electromagnetic waves with very low intrinsic losses, existing in both in-plane and out-of plane polarizations, supported by a one-dimensional photonic crystal with an in-gap defect. Here we report spectroscopic evidence of BSWs, in good agreement with theory, in the wavelength range from 4 to 6 micrometers.

12:35-12:55 **Material-cytoskeleton-nuclear-envelope axis: an engineering view of mechanobiology (O7)**

P. A. Netti
Italian Institute of Technology, Italy
Invited speaker

It is well known, that human cells are constantly exposed to mechanical stimuli emerging from the surrounding extracellular matrix. The intracellular molecular processes through which such physical cues are transformed into a biological cell response are generally called 'mechanobiology'. Such processes are fundamental for cells to adapt to the continuous dynamic modifications of their surrounding environment. Today, cell mechanobiology can be used as promising label-free sensor to investigate different cell states. Caused by increasing interest in cell mechanic studies, and the fundamental need of larger sample numbers, novel microfluidic approaches with optical read-outs have been developed in the last years. For instance, mechanobiology can be investigated using a quantitative deformability cytometry, which measures the transit time of a cell through a pore of known dimension, or an optical stretching method, which deforms cells under known light force. Such techniques are generally hindered by the lack of high throughput rates or the possibility of variable force conditions. Therefore, our working group propose a new microfluidic approach with optical read-out for mechanical cell deformation investigations at single cell level in-flow. We employ tuneable viscoelastic forces evoked from the encasing viscoelastic fluid and designed variations of the channel geometries. Our approach enables the characterization and classification of distinct biophysical cell properties in flow conditions. Also, investigations of cell actin cortex modifications, lamin B as well as lamin A/C disruptions or YAP/TAZ translocation activities

are possible, by imitation of deforming conditions on cytoskeleton-nuclear-envelope structure comparable to the classical AFM approach. We believe, that our microfluidic approach with optical read-out could be from major interest for researchers who works in the field of optical cell mechanics investigations.

12:55-14:30 **Lunch**

Monday, 09 September 2019 | Special Session: Optical biosensing and imaging: from fundamentals to applications

Chair: Luca De Stefano

14.30-14.50 **Silicon nanocrystals: indirect- and direct-bandgap luminescent material (O8)**

K. Kusova
Institute of Physics of the Czech Academy of Sciences, Czech Republic
Invited speaker

In contrast to bulk silicon, silicon nanocrystals have been known to exhibit luminescence visible to the naked eye for some twenty five years now. Although tremendous progress has been made since, many unanswered questions as to the origin of this luminescence in various types of silicon nanocrystals remain. In this contribution, we will briefly summarize the already-known facts about the luminescence of various types of silicon nanocrystals, mainly from the experimental point of view. We will focus on discussing the bandstructure of silicon nanocrystals, the possibility of transforming silicon into a direct-bandgap material and luminescence properties of the direct- and indirect-bandgap type. Luminescence spectroscopy on the single-nanocrystal level will also be introduced.

14:50-15:05 **Raman microscopy for cellular investigations: from cell identification to imaging (O9)**

S. Managò, G. Zito and A. C. De Luca
Institute of Biochemistry and Cell Biology, Italy

In this work, it is presented the development of an advanced Raman-based device and its integration/correlation with ultrasensitive microscopies (surface-enhanced Raman microscopy and confocal microscopy) for the molecular imaging and classification of cancer cells with significantly shorter spectrum/image acquisition times, thus allowing a higher sample throughput necessary for clinical applications. An overview of various Raman spectroscopy investigation is provided including interaction of cells with carrier system and drug molecules.

15:05-15:20 **Real time ATP bioluminescence monitoring on 3D printed LoC by highly sensitive SiPM (O10)**

M. F. Santangelo[1], D. Filippini[2], W. C. Mak[2], D. Corso[1], A. P. F. Turner[3] and S. Libertino[1]
[1] Institute for Microelectronics and Microsystems, National Research Council, Italy
[2] Linköping University, Sweden
[3] SATM, Cranfield University, UK

This work describes the development of a miniaturized sensing system for continuous and real time monitoring of adenosine triphosphate (ATP) bioluminescence based on highly sensitive Silicon Photomultiplier (SiPM) coupled to highly versatile 3D printed lab-on-chip (LoC).

15:20-15:40 **Luminescent silicon nanocrystals as bioimaging probes (O11)**

P. Ceroni
University of Bologna, Italy
Invited speaker

Si nanocrystals exhibit bright and long-lived (microsecond) luminescence that can be tuned from the near-infrared into the visible by decreasing their size. These nanostructures have potential applications in bioimaging, taking advantage of time-gated luminescence microscopy.

15:40-16:10 **Coffee break**

Monday, 09 September 2019 | Special Session: Optical biosensing and imaging: from fundamentals to applications

Chair: Luca De Stefano

16:10-16:30 **Interfaces in 3D bioelectronics (O12)**

F. Santoro
Italian Institute of Technology, Italy
Invited speaker

In this work we explore how the transition from planar to pseudo-3D nanopatterned materials (i.e. conductive vertical nanostructures, nanogrooves, nanofibers) have introduced a new strategy of integrating with biological cells. Although a spontaneous penetration does not occur, adhesion process are extremely distinct when bioelectronics devices are engineering with those patterned materials. These materials have been further exploited towards fully 3D dimensional solutions, moving closer to complex 3D architectures which could directly resemble tissue-like architectures. In this way, cells recognize the bioelectrodes as being embedded in their own matrix and thus fully integrate with the device.

16:30-16:45 **From rigid to flexible plasmonic sensors for biomedical applications. (O13)**

B. Miranda[1,3], S. De Martino[2], R. Moretta[1], P. Dardano[1], I. Rea[1], C. Forestiere[3] and L. De Stefano[1]
[1] Institute for Microelectronics and Microsystems, National Research Council, Italy
[2] Materias s.r.l., Italy
[3] University of Naples "Federico II", Italy

Gold plasmonic nanoparticles (Au-NPs) have received increasing attention for biological and chemical sensing. We propose some novel methodologies for a large-scale, cost-effective fabrication of optical systems based on Au-NPs. Both solid and flexible devices will be presented for biosensing applications.

16:45-17:00 **Gram-type Differentiation via statistical analysis of optically trapped bacteria in hollow photonic crystal cavities (014)**

R. Therisod[1], M. Tardif[2,3], N. Villa[1], P. R. Marcoux[4], E. Picard[3], E. Hadji[3], D. Peyrade[2] and R. Houdre[1]
[1] Ecole Polytechnique Fédérale de Lausanne, Switzerland
[2] University Grenoble Alpes, CNRS, LTM, France
[3] University Grenoble Alpes, CEA, INAC, PHELIQS, Laboratoire SINAPS, France
[4] University Grenoble Alpes, CEA, LETI, Minatec-Campus,France

We will report on the optical trapping in a photonic crystal optical cavity embedded in a microfluidic circuit of seven types of bacteria, featuring different morphologies. The analysis of the resonance shift allowed for distinction between Gram-positive and Gram-negative types.

17:00-17:15 **Toward unconventional TiO_2-based optodes for oxygen detection (015)**

S. Lettieri[1], M. Alfè[2], S. Amoruso[3], A. Fioravanti[4], F. Di Fonzo[5], V. Gargiulo[2] and P. Maddalena[3]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] Combustion Research Institute, National Research Council, Italy
[3] Dep. Of Physics, University of Naples "Federico II", Italy
[4] Institute for Agricultural and Earthmoving Machines, National Research Council, Italy
[5] Italian Institute of Technology, Italy

In this contribution we review on the optical detection of gaseous O_2 via photoluminescence (PL) response of titanium dioxide (TiO_2) nanoparticles. O_2 exposure to TiO_2 produces opposite responses in the two stable TiO_2 polymorphs (i.e. anatase and rutile). Such a peculiar behavior, which has no known equivalent for other metal oxides, allows in principle

to use mixed-phase TiO_2 as an unconventional, inorganic and ratiometric optical sensor of O_2. Future prospects for biological applications are discussed.

17:15-17:30 **Time-gated imaging of luminescent microporous silicon nanoparticles in living Hydra polyps (016)**

C. Schiattarella[1], M. Terracciano[2], T. Defforge[3], G. Gautier[3], C. Tortiglione[4], B. Della Ventura[2], R. Moretta[1,5], L. De Stefano[1], R. Velotta[2] and I. Rea[1]

[1] Institute for Microelectronics and Microsystems, National Research Council, Italy

[2] University of Naples "Federico II", Department of Physics, Italy

[3] University of Tours, France

[4] Institute of Applied Science and Intelligent Systems, National Research Council, Italy

[5] University of Naples "Federico II", Department of Chemistry, Italy

In this work, we exploit highly luminescent surface-modified porous silicon nanoparticles (PSiNPs) as label-free probes for in vivo imaging using Hydra vulgaris as model organism. The peculiar optical properties of the material (i.e. high quantum yield, long emission lifetime), coupled to its demonstrated stability and biocompatibility, allow the use of the time-gated imaging technique.

Monday, 09 September 2019 | Session 3: Smart Optics

17:30-17:50 **All-optical neural networks with phase-change photonics (O17)**

J. Feldmann[1], N. Youngblood[2], C.D. Wright[3], H. Bhaskaran[2] and W.H.P. Pernice[1]

[1] Institute of Physics, University of Muenster, Germany

[2] Department of Materials, University of Oxford, UK

[3] Department of Engineering, University of Exeter, UK

Invited speaker

Artificial neural networks lie at the heart of many solutions to tackle the huge amounts of data in deep learning applications, autonomous driving or speech recognition and are one of the key enabling technologies of this century. To date most of the implementations of brain-inspired computing are software-based and therefore suffer from the limitations of conventional computer architectures, especially the separation of memory and processor. A promising alternative to achieving fast and efficient computation of neuromorphic tasks is building direct hardware mimics of neurons and synapses that can be connected to larger neural networks and operate – in contrast to conventional computers – highly parallel and more analogous to brains. Here we present the implementation of an artificial neural network on the integrated photonics platform with phase-change materials capable of basic pattern recognition tasks that can be trained in a supervised as well as in an unsupervised way. By working entirely in the optical domain and exploiting wavelength division multiplexing techniques, such systems are promising for direct processing of visual data without electro-optic conversions accessing the high bandwidth and speed inherent to optical systems.

17:50-18:05 **Stigmergic reinforcement learning using all-optical solitonic x-junctions (O18)**

E. Fazio[1], M. Alonzo[1], A. Belardini[1], A. Bile[1] and C. Soci[2]

[1] Sapienza University of Rome, Italy

[2] Nanyang Technological University, Singapore

Ethology has shown that animal groups or colonies can solve complex problems distributing simple decision-making processes to the group members. This distributed intelligence is very diffuse in nature. It is based on stigmercy: the possibility of spreading information between subjects by modifying the environment inside which such subjects move on. For example ant colonies can optimize the trajectories towards the food by performing both a reinforcement (or a cancellation) of the pheromone traces they leave when they go scouting, and a switching from one path to another with much stronger pheromone signal. Such ant's processes can be implemented in a photonic hardware to reproduce stigmergic signal processing through reinforcement learning. We present an innovative, completely integrated X-junction realized using solitonic waveguides, which can provide ant-like decision-making processes. The solitonic waveguides act as pheromone traces: IR signals can follow them propagating inside. The intensity of pheromone is here reproduced by the refractive contrast of the waveguide which depends on the intensity of the writing pumping light. Crossing two

solitonic waveguides would result in the realization of a X-junction whose switching rate is fixed by the refractive contrasts of the single channels. The realized X-junction can switch from symmetric (50/50) to asymmetric behaviors (80/20) using optical feedbacks, letting unused output channels vanish or the used ones reinforced.

18:05-18:20 **Towards an effective inverse design of artificial materials based devices through the Scattering Matrix Method (O19)**

Roberta Palmeri and Tommaso Isernia
DIIES, Università Mediterranea of Reggio Calabria, Italy

In this contribution, the problem of design of artificial materials based devices is dealt with. In particular, a novel approach based on the Scattering Matrix Method is proposed as a potentially efficient and effective synthesis procedure.

Welcome cocktail and Poster Session

P1 **Exceptional points in k-space optically anisotropic microcavities**

O. Kunt, A. Palatnik, M. Sudzius, H. Fröb and K. Leo
Dresden Integrated Center for Applied Physics, Germany
Photonic Materials and Institute for Applied Physics, Germany

We report on the optical properties of dielectric and organic microcavities which possess certain degree of optical anisotropy in their cavity layer. The presence of exceptional points in -space due to the anisotropy is experimentally demonstrated both in linear and nonlinear operation regimes.

P2 **Performance of a solar thermal collector based on Compound Parabolic Concentrator under high vacuum**

D. De Maio[1,2], C. D'Alessandro[1,2], D. De Luca[2,3], D. Dalena[4,2], M. Musto[1], E. Di Gennaro[3] and R. Russo[2]
[1] Industrial Engineering Department, University of Napoli "Federico II", Napoli, Italy
[2] Institute for Microelectronics and Microsystems, National Research Council, Italy
[3] Physics Department, University of Napoli "Federico II", Napoli, Italy
[4] TVP Solar SA, Switzerland

We present simulation on the performances of a CPC system placed under high vacuum. The presence of high vacuum insulation allows to reach high operating temperature with good performances. Operating temperature and efficiency can be further increased by using a specially designed infrared mirror on the covering glass.

P3 **Near-infrared Erbium/Silicon Schottky photodetectors integrated with a silicon-on-insulator waveguide**

T. Crisci, M. Gioffrè, G. Coppola, R. Rajeeve, M. Medugno, M. Iodice and M. Casalino
Institute for Microelectronics and Microsystems, National Research Council, Italy

In this work we have investigated the performance of photodetectors at 1550nm based on Erbium/Silicon (Er/Si) Schottky junctions integrated with silicon-on-insulator (SOI) waveguides. Devices are based on the internal photoemission effect (IPE) which is a promising candidate as absorption mechanism for near infrared (NIR) photodetection in Si.

P4 **Imaging of Diatoms species by Fourier Ptychographic Microscopy**

P. Memmolo[1], D. Barone[2], V. Bianco[1], J. Behal[1,3], L. Miccio[1], M. Paturzo[1], A. M. Tulino[2,4] and P. Ferraro[1]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] DIETI, University of Naples "Federico II", Italy
[3] Department of Optics, Palacký University, Czech Republic
[4] Nokia Bell Labs, USA

In this paper we exploit the capabilities of Fourier Ptychographic Microscopy (FPM) to investigate diatoms samples. Thanks to the large field of view along with the resolution enhancement provided by FPM, we are able to image 50 different diatoms species in a single shot recording.

P5 **Identification and classification of anemic erythrocytes by Holographic Learning**

P. Memmolo[1], G. Aprea[2], M. Mugnano[1], L. Miccio[1], F. Merola[1], A. M. Tulino[2,3] and P. Ferraro[1]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] DIETI, University of Naples "Federico II", Italy
[3] Nokia Bell Labs, USA

In this paper, we investigate the possibility to identify erythrocyte diseases by digital holography and machine learning. In particular, two anemic blood samples, namely Thalassemia and iron-refractory iron-deficiency anemia (IRIDA) have identified respect to a control healthy sample.

P6 **Active Reflection and Refraction of Soliton Waveguides on Electric Interfaces**

E. Fazio[1], M. Alonzo[1], M. Chauvet[2], A. Belardini[1] and C. Soci[3]
[1] Sapienza University of Rome, Italy
[2] Universite de Franche Comte, France
[3] Nanyang Technological University, Singapore

A great deal of interest over the years has been directed to the optical spatial solitons for the possibility of realizing 3D waveguides with very low propagation losses. A great limitation in their use for writing complex circuits is represented by the impossibility of making curved structures. We show here that photo refractive spatial soliton waveguides can be reflected (or refracted) on electric walls acting as mirrors (or negative interfaces). Both numerical simulations and experiments show that electric interfaced can be actively driven in order to induce forced reflection or forced refraction on soliton beams, whose behavior is particle-like. We shaw that soliton reflection means waveguide reflection: in fact, soliton channels are used to carry information as 3D channel waveguides, can be reflected or refracted as well. Small or large curvature angles can be induced in the curved soliton waveguides, whose propagation losses, from the theoretical point of view, remain always much lower that those observed in waveguides obtained with traditional techniques (ion-implantation or layer-growing).

P7 **Electrowetting-based Lab-on-Chip System for Biosensing Applications**

N. Lovecchio[1], A. Nascetti[2], G. de Cesare[1], D. Caputo[1]
[1]Department of Information Engineering, Electronics and Telecommunications, University of Rome "La Sapienza", Italy
[2]School of Aerospace Engineering, University of Rome "La Sapienza", Italy

This work reports on the development of a compact and versatile optoelectronic platform able to implement the functionalities of a lab-on-chip system. In particular, the proposed platform includes three different modules designed for: (i) fluid handling through the ElectroWetting On Dielectric (EWOD) technique, (ii) thermal sample treatment performed through thin film heaters and amorphous silicon temperature sensors, and (iii) optical detection obtained thanks to the integrated photosensors and interferential filters.

P8 **Scatterer thickness influence on "shift" optical memory effect range**

T. Cacace[1,2], S. Ludwig[3], G. Pedrini[3], M. Paturzo[1] and P. Ferraro[1]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] University of Campania "Luigi Vanvitelli", Italy
[3] Institute of Applied Optics, Germany

The optical memory effect has been recently exploited for the non-invasive imaging of objects hidden behind scattering layers. In this work, we explore the range of the shift memory effect, investigating its relationship to the thickness of the scattering layer.

P9 **Detection of Fluorescence-based Aptamer Assay Through Thin Film Optoelectronic Devices**

F. Costantini[1,2], N. Lovecchio[1], A. Nascetti[3], G. de Cesare[1], D. Caputo[1]
[1]Department of Information Engineering, Electronics and Telecommunications, University of Rome "La Sapienza", Italy
[2] Department of Chemistry, University of Rome "La Sapienza", Italy
[3] School of Aerospace Engineering, University of Rome "La Sapienza", Italy

This work presents a bio-microsystem, based on thin film optoelectronic devices, for the on-chip detection of fluorescence-based aptamer assay. The on-chip fluorescence detection is achieved through the combination of amorphous silicon (a-Si:H) photosensors and a thin film interferential filter, while the aptamer-based biomolecular recognition takes place in a microfluidic network functionalized with polymer brushes. The system has been tested toward the detection of Ochratoxin A (OTA), a mycotoxin with toxic and carcinogenic effects, showing a limit of detection equal to 1.56 ng/mL.

Tuesday, 10 September 2019

09:15-10:00 **Graham Reed, University of Southampton, UK**

Plenary speaker

Tuesday, 10 September 2019 | Special Session: Space exploration and Human spaceflight: new challenges for photonic and microsystems

Chair: Giuseppe Coppola and Carlo Saverio Iorio

10:00:10:20 **Volume Holographic Optical Elements: new challenges in space applications (020)**

M. A. Ferrara and G. Coppola
Institute for Microelectronics and Microsystems, National Research Council, Italy

Invited speaker

To date, volume holographic optical elements (V-HOEs) are used in a wide variety of applications, ranging from solar concentrators, wearable sensors, displays for virtual and augmented reality, etc. Considering their versatility and the possibility to highly reduce both volume and weight, V-HOEs appear fascinating even for space applications, whose cost is strongly influenced by these aspects. However, in order to use V-HOEs also for space applications, new advanced photosensitive materials must be developed, which should possess unusual stability when exposed to severe environmental conditions, such as chemicals, electric fields, mechanical stress, and heat. An overview of V-HOEs possible applications in space and of their potentialities are reported.

10:20-10:35 **Photopolymer microstructures created by holographic recording for application in sensing and light shaping and redirection (021)**

S. Gul[1], M. Irfan[1], S. Keshri[1], K. Murphy[1], T. Mikulchyk[1], D. Cody[1], J. Cassidy[2], S. Martin[1] and I. Naydenova[1]
[1] Technological University Dublin, School of Physics and Clinical and Optometric Sciences/Centre for Industrial and Engineering Optics, FOCAS Institute, Ireland
[2] Technological University Dublin, School of Chemical and Pharmaceutical Sciences, FOCAS Institute, Ireland

Holographic recording in photopolymers is utilised to produce microstructures for use as sensors/indicators and optical devices for LED light shaping and redirection. We introduce the principles and challenges involved in the development in each of these applications and present experimental results of fabrication of three specific devices.

10:35-10:50 **Blood-on-chip microfluidics for biomedical applications in space (022)**

G. Tomaiuolo, V. Preziosi and S. Guido
University of Naples "Federico II", Italy

Microfluidics technologies are especially promising for space applications due to miniaturized device size and low reagents and energy consumption. Here, we focus on blood-on-chip microfluidics, which allows one to manipulate blood samples by applying shear flow in confined channel geometries. Deformation and aggregation of red blood cells in such conditions are investigated by using high speed video microscopy and offline image analysis techniques. The so obtained red blood cell shape characterization can be exploited to monitor health conditions in a microgravity environment, which has been shown to induce circulation disorders. In addition to possible diagnostic applications, microfluidics technologies coupled to photonic systems could also be used to carry out basic research on the effects of microgravity on blood flow in microcirculation.

10:50-11:05 **Hydrodynamics of a large population of Red Blood Cells under shear flow with Digital Holographic Microscopy (O23)**

C. Minetti[1], T. Podgorski[2], V. Audemar[2] and G. Coupier[2]
[1] Université libre de Bruxelles, Service de Chimie-Physique, Belgium
[2] Université Grenoble-Alpes, Laboratoire Interdisciplinaire de Physique, France

The transport mode of Red Blood Cells in shear flow is analyzed by Digital Holographic Microscopy. Depending on the shear rate and the viscosity ratio, RBC will flow as tank-treading membranes or as a tumbling, flipping or rolling cells. Those modes have direct consequences on the homogeneity of the hematocrit in micro-circulation networks.

11:05-11:30 **Coffee break**

Tuesday, 10 September 2019 | Special Session: Space exploration and Human spaceflight: new challenges for photonic and microsystems

Chair: Giuseppe Coppola and Carlo Saverio Iorio

11:30-11:50 **European space strategies for future space human explorations (024)**

L. Surdo
European Space Agency, Netherlands
Invited speaker

Unlike many other national space agencies, the European Space Agency (ESA) covers all areas of space activities: space science, human spaceflight, exploration, Earth observation, space transportation, navigation, operations and space safety, technology and telecommunications, plus active industrial development. This makes ESA unique. This presentation describes the activities pursued and the facilities available within the ESA Science in the Space Environment (SciSpacE) research programme in the fields of Life and Physical Sciences. Within the ESA Directorate of Human Spaceflight and Robotic Exploration, the SciSpacE programme is committed to pursue quality science in the space environment and forefront technology development with the aim to enable human long-term deep space exploration. Scientific fundamental questions as well as science and technology applications are addressed and implemented through several experiments utilising the vast ESA microgravity and space analogue platforms portfolio that includes: ground-based platforms (e.g. random positioning machines / 3D clinostats, large diameter centrifuge), parabolic flights, drop towers, sounding rockets, sub-orbital retrievable capsules and the International Space Station.

11:50-12:05 **NIR laser therapy by MLS-Mis device for treating neuropathic pain (025)**

M. Monici[1], F. Cialdai[1], L. Micheli[2], C. Ghelardini[2], A. Pacini[3], J. J. V. Branca[3], L. Morbidelli[4], V. Ciccone[4], L. Di Cesare Mannelli[2]
[1] ASAcampus Joint Laboratory, ASA Res. Div. – Dept. of Experimental and Clinical Biomedical Sciences "Mario Serio", University of Florence, Italy
[2] Pharmacology and Toxicology Section, Dept. of Neuroscience, Psychology, Drug Research and Child Health - NEUROFARBA – University of Florence, Italy
[3] Dept. of Experimental and Clinical Medicine, University of Florence, Italy
[4] Dept. of Life Sciences, University of Siena, Italy

This study was aimed to evaluate the pain-relieving and protective effect of Near Infrared NIR) laser therapy, administered with an MLS-MiS source (ASA srl, Vicenza, Italy), in a model of compressive mononeuropathy induced by chronic constriction of the sciatic nerve (CCI).

12:05-12:20 **Customized micro and nano technologies to enable new miniaturized platforms and components for Space exploration (026)**

G. Rius
Institute of Microelectronics of Barcelona, Spain

A brief overview of challenges and opportunities for miniaturized photonics platforms and components will be given.

12:20-12:35 **Printing of Responsive Photonic Cellulose Nanocrystal Micro-Film Arrays as humidity sensors (027)**
T. Zhao, R. M. Parker, B. Frka-Petesic, H.-L. Liang, M. Bay and S. Vignolini
Bio-inspired Photonics Group, Department of Chemistry University of Cambridge, UK

Cellulose nanocrystals (CNCs) have gained significant interest for their capability to produce sustainable and biocompatible/biodegradable photonic materials via a bottom-up approach. While various strategies have been applied to control this self-assembly process in the film geometry, intrinsic issues of disorder and low material efficiency have held back adoption in multiple practical applications. Herein, uniformly colored CNC micro-film arrays are prepared via confined self-assembly within nanoliter sessile droplets. Strong planar anchoring within such high-aspect ratio droplets combined with control over the drying process, suppresses the "coffee-ring" effect and gives rise to well-aligned photonic structures with few disclinations. The intense structural colour can be tuned through the initial ink formulation, enabling the printing of polychromatic dot matrix images. Finally, the pure CNC micro-films demonstrated a reversible, instantaneous and drastic color shift to changes in relative humidity. The interactive and uniform CNC photonic micro-films open new pathways for applications in printable responsive labels, edible sensors and anti-counterfeiting technology.

12:35-12:50 **Flexible Liquid Crystal Temperature Monitoring System for monitoring the Wound Healing Process (028)**
V. Miskovic[1], E. Malafronte[2], C. Minetti[1] and C. S. Iorio[1]
[1] Universite libre de Bruxelles, Belgium
[2] University of Naples "Federico II", Italy

In this work, we are presenting the fabrication and characterization of a flexible multilayer system for monitoring temperature, where liquid crystals were used as a sensing element. This system has the potential to be used as a wearable smart patch for real-life monitoring wound healing process.

12:50-13:05 **Remote electrical powering over Fiber Optics in Space environment (O29)**
A. Pelella, M. Indolfi, V. Tufano, D. Passaro, M. Iodice and G. Coppola
Institute for Microelectronics and Microsystems, National Research Council, Italy

The very next aim of space agencies all around the world is to send humans to a range of destinations beyond Low Earth Orbit, including cis-lunar space, near-Earth asteroids, the Moon, Mars and its moons. For this reason, spatial installations are supposed to have an exponential development. These installations, with a multi-module configuration, will be located in extreme hazardous scenarios. The absence of atmospheric protection and solar storm electromagnetic fields, indeed, can induce extreme currents in wires, disrupting power lines, causing wide-spread blackouts and affecting communication cables. Thus, in order to avoid long shield wires with weight ranging from 10 to 120 g/m, optical fibers can be used to transport optical energy to powering electric or electronic devices remotely.
This approach has unique advantages including total immunity to electromagnetic interference, electrical noise and complete isolation of the power source, as well as immunity to RFI. Moreover, the replacement of metallic cables with optical fibers can improve the reliability and the security of the spatial modules. Finally, size and weight of the optical fibers will allow to drastically reduce the freight cost and increase payload during the transportation flights.This paper will summarize the state of the art and potentialities of the Power-over-Fiber. The main elements, technologies, advantages and disadvantages will be discussed.

13:00-14:30 **Lunch**

Tuesday, 10 September 2019 | Special Session: Optical System for Solar Energy

Chair: Roberto Russo

14:30-14:50 **Novel materials for sunlight absorption and energy transfer (O30)**
E. Sani and L. Mercatelli
National Institute of Optics, National Research Council, Italy
Invited speaker

Materials science can provide a dramatic contribution for solar energy exploitation. We discuss three case-studies chosen in different solar energy technology fields, with the common focus on materials for effective sunlight capture and energy transfer.

14:50-15:05 **A Solar Selective Absorber for high vacuum flat solar thermal panels (O31)**

C. D'Alessandro[1,2], D. De Maio[1,2], D. De Luca[2,3], D. Dalena[4,2], M. Musto[1], E. Di Gennaro[3] and R. Russo[2]
[1] Industrial Engineering Department, University of Napoli "Federico II", Napoli, Italy
[2] Institute for Microelectronics and Microsystems, National Research Council, Italy
[3] Physics Department, University of Napoli "Federico II", Napoli, Italy
[4] TVP Solar SA, Switzerland

We present a selective solar absorbing multilayer based on Cr_2O_3 and Titanium layer on aluminum film substrate. The deposited multilayers are good candidates as absorber coating in new high vacuum flat solar thermal panels to extend the operating range at temperature higher than 200°C.

15:05-15:25 **Ultra-high efficiency compact solar modules enabled by photonic superprisms (O32)**

P. Bermel
Purdue University, United States
Invited speaker

There is currently a great demand for portable, flexible solar systems offering higher efficiencies than conventional single-junction photovoltaic modules. Here, I present a novel self-contained module design utilizing photonic crystal superprisms for high-performance spectral splitting and light trapping by multiple photovoltaic materials. Advantages of this approach include high spectral splitting performance, wide solar acceptance angles, low material deposition costs, and amenability to large-scale manufacturing utilizing flip-chip integration.

15:25-15:55 **Coffee break**

Tuesday, 10 September 2019 | Special Session: Optical System for Solar Energy

Chair: Roberto Russo

15:55-16:15 **Bifacial Si heterojunction solar cells: impact of defects and optimization of bifaciality (O33)**

F. R. Galluzzo[1], L. Zumbo[1], C. Colletti[2], A. Canino[2], C. Gerardi[2] and S. Lombardo[1]
[1] Institute for Microelectronics and Microsystems, National Research Council, Italy
[2] Enel Green Power, Italy
Invited speaker

In this talk we discuss our activity on Bifacial Silicon Heterojunction Photovoltaic Cells (HJT), focusing in particular on the role of defects on the HJT cell efficiency and on the modeling for the optimization of bifacial performance.

16:15-16:30 **An instrument to evaluated Selective Solar Absorber properties in operating conditions (O34)**

D. De Luca[2,3], D. De Maio[1,2], C. D'Alessandro[1,2], D. Dalena[4,2], M. Musto[1], E. Di Gennaro[3] and R. Russo[2]
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[2] Institute for Microelectronics and Microsystems, National Research Council, Italy
[3] Physics Department, University of Napoli "Federico II", Napoli, Italy
[4] TVP Solar SA, Switzerland

We present an instrument to evaluate the emittance and absorbance of Selective Solar Absorber (SSA) in operating conditions (temperature up to 300°C in high vacuum). Measurements were performed under direct sun illumination and under a calibrated led source. Results allow to define the efficiency of SSA in operating condition.

Tuesday, 10 September 2019 | Session 4: Imaging and spectroscopy

16:30-16:50 **Large field of view imaging with classical and quantum light (O35)**

R. Hussain, R. Camphausen, R. Terborg, L. Duempelmann. A. Cuevas and V. Pruneri
Institut de Ciències Fotòniques, Spain

Invited speaker

We will present recent developments in using images sensor arrays to detect minute quantities of transparent materials, small particles, micro-organisms and biomarkers. The designs of the large-field of view imagers are novel and exploit scattering and phase (interferometric) effects in the classical and quantum regime.

16:50-17:05 **Experimental study on the use of a Time-of-Flight depth-camera for facial expression recognition in the field of AAL (O36)**

A. Caroppo, A. Leone and P. Siciliano
Institute for Microelectronics and Microsystems, National Research Council, Italy

This paper presents an experimental study for Facial Expression Recognition (FER) in Ambient Assisted Living (AAL) context at varying of facial pose and environment lighting conditions, using both RGB and depth images captured by a commercial and low cost Time-of-Flight (ToF) depth-camera (Microsoft Kinect™ v2).

17:05-17:25 **Strategies based on Surface and Tip Enhanced Raman Spectroscopy for detection and study of Alzheimer's biomarkers (O37)**

R. Pini, M. Banchelli, C. D'Andrea, M. De Angelis and P. Matteini
Institute of Applied Physics, National Research Council, Italy

Invited speaker

We present some strategies recently implemented in our lab for label-free SERS detection and TERS analysis of proteins and biomarkers associated with neurodegenerative diseases, like Alzheimer's disease.

17:25-17:40 **miRNA quantification in-flow by coherent imaging technique (O38)**

F. Causa[1], D. Dannhause [2], D. Rossi[2], E. Battista[2] and P. A. Netti[1]
[1]University of Naples Federico II, Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Italy
[2] Center for Advanced Biomaterials for Healthcare@CRIB, Istituto Italiano di Tecnologia, Italy

In this work we will present an in-flow ultrasensitive fluorescence detection of microRNAs (miRNAs) using ad-hoc designed spectrally encoded microgels. For such reason, our working group has researched and employed in the last years viscoelastic fluids to achieve optimal alignment of microgels as well as human cells or particles in straight measurement channels. We applied a simple and inexpensive microfluidic layout, allowing continuous optical fluorescence signal read-out with several emission wavelengths. In particular, we chose microgels endowed with fluorescent emitting molecules designed for multiplex spectral analysis of specific miRNA types. We analysed in a quasi-real-time manner circa 80 microgel particles a minute at sample volumes down to a few microliters, achieving a significant low miRNA detection limit -in the femtomolar range- in microfluidic flow conditions. Such a combination of optical read-out with microfluidic investigation opens up new routes for biosensing applications of particles within microfluidic devices.

17:40-17:55 **Label-free investigation and separation of cells using coherent imaging techniques and viscoelastic forces (O39)**

D. Dannhauser[1], M. I. Maremonti[2], D. Rossi[1], P. Memmolo[3], P. Ferraro[3], P. A. Netti[2] and F. Causa[2]
[1] Center for Advanced Biomaterials for Healthcare@CRIB, Istituto Italiano di Tecnologia, Italy
[2] University of Naples Federico II, Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Italy
[3] CNR-Istituto di Cibernetica "E. Caianiello", Italy

This work combines optical single cell investigations -of precise viscoelastic aligned cells- with induced mis-alignment in downstream direction, for morphometric cell analysis and separation in flow. It is well known, that viscoelastic forces align cells in capillaries according to a dimensionless parameter Θ. But what happens if we want to purposefully mis-align

previously aligned cells? We found an elegant way to study biophysical cell properties from induced cell mis-alignment in flow direction. To accomplish such an outstanding target, we combined two well-known label-free coherent imaging approaches (static light scattering and digital holography microscopy) with a viscoelastic cell migration approach. We tested our system with subclasses of living peripheral blood stream cells, with the aim to characterize their biophysical (morphometric and optical) properties, and to track their position in downstream direction [8-10]. First cells were focused in the centre of a round shaped capillary (diameter of 50 µm) and subsequently investigated by coherent imaging approaches in a following wider square shaped channel (cross-section of 500 x 500 µm). The cross-section enlargement, misalign previous aligned cells according to their biophysical properties in the same microfluidic device. A crucial role beside the microfluidic geometry plays the elastic force (polyethylene-oxide), which directly acts on flowing cells and is generally balanced with the drag force. Results were obtained at two fixed measurement positions, the first one was chosen close to the entrance of the measurement channel to ensure perfect cell alignment in a streamline for scattering investigations; the second measurement position was placed 15 mm after to study additional cell properties by digital holography and to investigate the axial cell positions due to cell misalignment in flow direction. First, the refractive index, ratio of the nucleus over cytoplasm, and cell dimension were investigated from scattering investigations. Afterwards quantitative phase-contrast reconstructions by digital holography were employed to calculate surface area, dry mass and biovolume of cells using the scattering outcomes as input parameters. Exceeding beyond the 3D position of cell was investigated by digital holography microscopy. The 3D alignment in the entrance of the first measurement position could be confirmed by our working group. At the second measurement position a distinct vertical position -due to induced mis-alignment- for different cell classes was obtained and supported by viscoelastic force calculations. Such forces can be used to either align, deform and/or separate cells in viscoelastic flow conditions. In fact, our optical and morphometric results confirm the possibility to label-free differentiate cells with different biophysical properties in flow. Moreover, preliminary results allow the characterization of unknown objects, according to their individual properties, more exact their shape and density. Such outcomes open up new scenario of individual optical cell analysis and deep cell characterization in flow.

Tuesday, 10 September 2019 | Session 5: Lab-On-Chip Devices

17:55-18:10 **Lab-on-Chip System for Electrochemiluminescence Detection Based on Thin/Thick Film Technologies (O40)**

N. Lovecchio[1], F. Costantini[1], A. Nascetti[2], R. Petrucci[3], G. de Cesare[1] and D. Caputo[1]
[1] DIET, Sapienza University of Rome, Italy
[2] School of Aerospace Engineering, Sapienza University of Rome, Italy
[3] Dept. Basic & App. Sciences for Eng., Sapienza University of Rome, Italy

This work reports on design and fabrication of a compact lab-on-chip system, based on detection of electrochemiluminescence (ECL) through thin film sensors. The proposed system couples an optoelectronic platform, including amorphous silicon photosensors, to a disposable microfluidic chip, containing the ECL electrodes and the biological solutions to be analyzed.

18:10-18:25 **Pyro-electric effect for designing microfluidic chip and micro-optical components (041)**

S. Coppola, G. Nasti, V. Vespini and P. Ferraro
Institute of Applied Science and Intelligent Systems, National Research Council, Italy

We report a direct writing method for the fabrication of microfluidic footpaths and integrated micro-optics by pyro-Electrohydrodynamic (EHD) printing. Additionally, we describe an alternative procedure to self-assemble nanoparticles on a freestanding polymeric membrane that could be easily integrated into lab-on-chip (LOC) devices.

20:30 Social dinner

Wednesday, 11 September 2019

09:00-09:45 **Integrating micro- and nano- optical technologies to develop a multi-messenger microscope to address structure and function of biological macromolecules**
Alberto Diaspro, Nanoscopy, IIT-CHT Erzelli, Italy
Plenary speaker

Wednesday, 11 September 2019 | Session 6: Optical Cavities Sensors

09:45-10:05 **Sensing and Tuning with Optical Microresonators on Chip (O42)**
Y.-A. Peter
Polytechnique Montreal, Canda
Invited speaker

On chip optical microresonators are compact, robust and can be integrated with micro electro-mechanical components as well as microfuidics. They can efficiently sense acceleration, forces, gases, refractive index of liquids, living cells, and bacteria, as well as tune lasers. During the presentation I will report several sensors and tunable devices based on different types of optical microresonators, such as in-plane Fabry-Perot cavities, whispering gallery mode resonators and 2D photonic crystals.

10:05-10:25 **Optical sensing and opto-mechanics with liquid droplet microresonators (O43)**
G. Gagliardi
National Institute of Optics, National Research Council, Italy
Invited speaker

Over the last decade, optical whispering-gallery modes (WGMs) have been extensively investigated in solid micro-cavities of various geometries and materials achieving impressive quality (Q) factors. The peculiarity of WGMs supported by solid structures is that resonant light travels along closed paths at the interface between the resonator surface and the surrounding environment. Here, we use microcavities made directly from small, vertically-suspended liquid droplets showing excitation of whispering-gallery modes by free-space laser beams in various liquid media. The droplet itself serves as the cavity and the sample at the same time, where the internal optical field is fully exploited to probe dissolved analytes or particles. The Q-factor limit due to optical absorption in oils and liquid polymers is investigated by means of cavity ring-down spectroscopy, observing values between 105 and 107, from in the near-infrared and visible spectral regions, respectively. From direct cavity photon lifetime measurements, we show intrinsic optical Q-factors > 107 in the visible that may be ultimately limited by scattering due to surface distortions of thermodynamic origin. Mixtures made from different oils are also used for a proof-of-concept chemical sensing experiment. The droplet system proves appealing for applications to spectroscopy, biosensing, material characterization and non-linear optics. Indeed, the interaction between light and mechanical motion has also been investigated in these droplets. In our work, we show that liquid microresonators exhibit interesting non-linear properties that potentially allow for the generation of high-frequency surface acoustic waves and mechanical vibrations. Imaging and spectroscopic analysis on such effects will be presented.

10:25-10:40 **Lab-on-fiber accelerometers using micro-mechanichal structure (O44)**
F. Bruno[1], M. Pisco[1], G. Gruca[2], N. Rijnveld[2] and A. Cusano[1]
[1] Optoelectronic Division - Department of Engineering, University of Sannio, Italy
[2] Optics 11 B.V., Netherlands

The authors designed and developed Lab On Fiber accelerometers based on micro-opto-mechanical cavities on the optical fiber tip. They investigated the realization of Lab On Fiber vibration sensors based on a micro-mechanical structure suspended in close proximity to the end facet of a single-mode fibre.The resulting performance comparison highlights the potentiality and the versatility of this emerging technology to create a novel class of labs on fiber based on the integration of micro-opto-mechanical structures with the optical fibers.

10:40-11:00 **Near-Infrared Resonant Cavity Enhanced Graphene/Silicon Photodetectors (O45)**
M. Casalino, T. Crisci, M. Gioffrè, R. Russo, M. Iodice and G. Coppola
Institute for Microelectronics and Microsystems, National Research Council, Naples, Italy
Invited speaker

We report on vertically-illuminated Si-graphene Schottky photodetectors operating at both 1550nm and 2000nm and integrated with a 200 nm-thick Si optical microcavity obtained starting by a silicon on insulator (SOI) substrate. The photocurrent generation is based on the internal photoemission effect, where photoexcited carriers from graphene are emitted to Si over the Schottky barrier that exists at the graphene-Si interface. This device is able to enhance the graphene absorption thanks to the effect of optical microcavity obtained by depositing a metal mirror on the back of the Si substrate. The rectifying Schottky diode behaviour is shown from the IV curve, where both series resistance and Schottky barrier, are extrapolated. Thanks to the presence of the optical microcavity, we demonstrate an external responsivity higher than 20mA/W; this value is more than 4 times higher than state-of-the-art of vertically-illuminated Si-based PDs.

11:00-11:30 **Coffee break**

Wednesday, 11 September 2019 | Session 7: Digital holography

11:30-11:50 **Digital Holographic Interferometry with photons and electrons: looking at cells and nano materials (O46)**
F. Mendoza
Centro de Investigaciones en Optica, A.C., Optical Metrology, Mexico
Invited speaker

Dennis Gabor invented Holography in 1949. His main concern being the aberration correction in the recently created electron microscopes. At the time the lack of coherent electron sources meant that the hologram reconstruction was done using quasi-coherent light sources. As such Holography did not produce enough results to be considered a must use tool, even though a device called a wire-biprism was invented to combine the object and reference beams. The invention of the laser at the end of the 1950's gave a great leap to Holography since this light source was highly coherent, and hence led to the invention of Holographic Interferometry (HI) during the first lustrum of the 1960's. This new discipline in the Optics field has successfully evolved to become a trusted tool in a wide variety of areas. Coherent electron sources were made available by the late 1970's, a fact that also gave an outstanding impulse to electron holography not only due to the coherent field electron guns used in the hologram reconstruction process, but also because of the appearance of electron holographic interferometry (EHI) as a 'quasi-non-invasive' measurement tool in electron microscopes. Today nanomaterials and structures belonging to a wide variety of subjects can be characterized in regards to their physical and mechanical parameters using HI with light sources and EHI. This invited presentation will discuss the state of the art in HI and EHI applications to study the shape of nanostructures, cells and bacteria.

11:50-12:05 **Photorefractive materials to interface biological samples (O47)**
L. Miccio[1], J. Behal[2], P. Memmolo[1], M. Mugnano[1], B. Mandracchia[1], F. Merola[1], S. Grilli[1] and P. Ferraro[1]
[1] *Institute of Applied Science and Intelligent Systems, National Research Council, Italy*
[2] *Department of Optics, Palacký University, Czech Republic*

Lithium Niobate is a ferroelectric, piezoelectric and pyroelectric material widely used in Photonics. Among its properties, Lithium Niobate is Photovoltaic (PV) and Photorefractive (PR). Here we show how it's possible to interface living biological samples with LN surface by exploiting PV electric field and PR effect.

12:05-12:20 **Compact modules for digital holographic microscopy in microfluidics (O48)**
T. Cacace[1,2], B. Mandracchia[1], V. Bianco[1], P. Ferraro[1] and M. Paturzo[1]
[1] *Institute of Applied Science and Intelligent Systems, National Research Council, Italy*
[2] *University of Campania "L. Vanvitelli", Italy*

This paper presents a deep-learning-based algorithm dedicated to the processing of the speckle noise included in phase measurement in digital holography. We focus on the processing of decorrelation phase noise. This type of noise has the particularity of being non-Gaussian and highly non stationary. The deep learning architecture consists in a pre-trained

residual convolution neural network devoted to the de-noising of natural images. In order to specialize the network to de-noise phase maps a database is constituted by a set of noise free and noisy phase maps corresponding to realistic noise conditions. A ranking of the trained network is then achieved and show that this approach is close to state of the art. Furthermore deep learning is more efficient in terms of time consuming than the established best filtering with a factor of about 20.

12:20-12:35 **A deep learning based algorithm applied to the processing of phase data in digital holography (O49)**
S. Montresor and P. Picart
Le Mans University, France

This paper presents a deep-learning-based algorithm dedicated to the processing of the speckle noise included in phase measurement in digital holography. We focus on the processing of decorrelation phase noise. This type of noise has the particularity of being non-Gaussian and highly non stationary. The deep learning architecture consists in a pre-trained residual convolution neural network devoted to the de-noising of natural images. In order to specialize the network to de-noise phase maps a database is constituted by a set of noise free and noisy phase maps corresponding to realistic noise conditions. A ranking of the trained network is then achieved and show that this approach is close to state of the art. Furthermore deep learning is more efficient in terms of time consuming than the established best filtering with a factor of about 20.

12:35-12:50 **Label-free morphological biomarkers for early diagnosis in oncology (O50)**
L. Miccio[1], P. Memmolo[1], F. Merola[1], M. Mugnano[1], V. Bianco[1], I. Kurelac[2], M. M. Villone[3], P. L. Maffettone[3], M. Capasso[4], F. Cimmino[4] and P. Ferraro[1]
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[2] *University of Bologna, Italy*
[3] *Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, University of Naples "Federico II", Italy*
[4] *Dipartimento di Medicina Molecolare e Biotecnologie Mediche, University of Naples "Federico II", Italy*

Tomographic Phase Microscopy (TPM) of flowing cells is a recently developed label-free imaging technology that allow quantitative three-dimensional measurement at single cell level. Combination of TPM with engineered microfluidic devices is the new challenge for the detection of Circulating Tumor Cells (CTC) into the blood.

13:00 -14:15 **Lunch**

Wednesday, 11 September 2019 | Session 8: Optical Manipulation

14:15-14:35 **Photovoltaic optoelectronic platforms for micro and nanoobject manipulation and trapping (O51)**
M. Carrascosa, A. García-Cabañes, C. Sebastian-Vicente, A. Puerto and L. Arizmendi
Universidad Autónoma de Madrid, Spain
Invited speaker

Fundamentals and applications of optoelectronic photovoltaic tweezers for trapping and manipulation of nano-objects on the surface of lithium niobate crystals wil be presented.

14:35-14:50 **Manipulation, trapping and splitting of water and aqueous bio-droplets by photovoltaic optoelectronic tweezers (O52)**
A. Puerto, C. Sebastian-Vicente, L. Arizmendi, A. García-Cabañes and M. Carrascosa
Universidad Autónoma de Madrid, Spain

Manipulation, trapping and splitting of water and aqueous bio-droplets have been achieved by using photovoltaic optoelectronic tweezers, i.e. taking advantage of the light-induced electric fields generated in $LiNbO_3$:Fe substrates. Our results offer a new approach for manipulating water and biological solutions using the photovoltaic effect.

14:50-15:05 **Photo-electrochemical water splitting through silicon based photovoltaics (O53)**

S. Privitera, R. G. Milazzo, C. Bongiorno, F. La Via and S. Lombardo
Institute for Microelectronics and Microsystems, National Research Council, Naples, Italy

We discuss major aspects of our activity on the realization of efficient photoelectrochemical water splitting devices. For the realization of electrodes with high catalytic activity, we propose the use of Ni foam coated with a thin Pt layer for the hydrogen evolution reaction electrode and with IrOx for the oxygen evolution reaction electrode. These catalysts are deposited by spontaneous galvanic displacement, which allows to achieve uniform coverage and very low noble metal loading of the electrodes. We also report on the realization of a photocathode, made by p-type crystalline Si covered with an n-type 3C-SiC polycrystalline film, acting as protective layer and transparent emitter. By covering the 3C-SiC emitter with metal nanoparticles, in some cases higher saturated photocurrent is found. Optical and micro-structural studies on the origin of the observed effects are shown and discussed.

15:05-15:25 **Ultra-broadband coherent detection of terahertz pulses via CMOS-compatible solid-state devices (O54)**

A. Tomasino[1], R. Piccoli[1], Y. Jestin[1], S. Delprat[1], M. Chaker[1], M. Peccianti[2], M. Clerici[3], A. Busacca[4], L. Razzari1 and R. Morandotti [1,5,6]
[1] INRS-EMT, Canada
[2] Department of Physics and Astronomy, University of Sussex, United Kingdom
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[5] ITMO University, Russia
[6] Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, China.

The term "terahertz (THz) radiation" is used to indicate an electromagnetic wave whose frequency content conventionally spans the two-decade wide range 0.1-10x10 12 Hz. Various promising solutions for the generation and detection of THz pulses have been proposed so far, differing in their complexity, THz bandwidth, efficiency, and footprint. In particular, in the ultra-broadband regime –corresponding to the case of ultrashort THz pulses featuring at least 10-THz-wide spectra–direct detectors based on thermal absorption have been commonly employed. However, most of these solutions require elaborate cooling systems to reduce thermal background, and, more importantly, they are incoherent detectors, i.e. not sensitive to the waveform of the THz electric field. Electro-optic sampling (EOS) and Photoconductive switches (PCS) techniques have been demonstrated capable of recovering both the amplitude and phase of the THz electric field associated with a THz wave, yet their deployment is limited to the case of a few-THz-wide spectrum only. Besides, detection methods able to properly operate in the ultra-broadband regime are mainly gas-based techniques, which imply the use of equipment and experimental schemes particularly more complex and expensive with respect to those employed in either PCS or EOS techniques. The realization of a practical ultra-broadband detector in the THz domain is still a key challenge. Here, we present a compact, standalone, solid-state device, which can be easily fabricated and employed as general-purpose THz sensor, in both broadband (< 5 THz) and ultra-broadband regimes (> 10 THz). We named such a detection technique solid-state biased coherent detection (SSBCD) since it is based on a solid-state material and allows to simultaneously record the amplitude and phase of a THz transient. SSBCD relies on a biased metallic micro-slit filled with a centrosymmetric ($\chi^{(3)}$) material (silicon nitride) and realized via a CMOS-compatible process. SSBCD is based on the so-called terahertz-field-induced second harmonic (TFISH) effect: when the THz and probe pulsed beams are both spatially and temporally overlapped, the THz electric field breaks the symmetry of the $\chi^{(3)}$ -material, thus inducing the frequency doubling of the probe beam. If the interaction region between THz and probe beam is also biased by an external AC electric field, the detection process turns coherent and the generated TFISH pulse resembles the THz electric field waveform, yet being easily recordable via a common optical detector. We show that SSBCD allows to coherently reconstruct ultrashort THz pulses by employing unprecedented low both bias voltage (down to 5 V) and optical energy (down to 10 nJ). The fundamental advantage of the technique presented here is the virtually unlimited operating bandwidth in the whole THz range (ultimately constrained by the probe pulse duration only), thus potentially addressing many of the issues and limitation of those THz solutions, where the detection scheme represents a bottleneck in terms of the entire system frequency response. Moreover, the affordability of the SSBCD devices makes the proposed technique attractive for both a broad scientific and industrial audience.

15:25-15:40 **Controlling the photochemistry: Photo-oxidation confined to the nanoscale via stimulated emission depletion (STED) (O55)**

E. Murtezi[1,2], S. Puthukodan[1], J. Jacak[1,3] and T. A. Klar[1]
[1]Institute of Applied Physics, Johannes Kepler University, Austria

[2]Linz Institute of Technology (LIT), Johannes Kepler University, Austria
[3]University of Applied Sciences Upper Austria, Austria

In the early reports about Stimulated Emission Depletion (STED) microscopy, it was proposed that "…future applications may well include sub-diffraction resolution in pump–probe spectroscopy, three-dimensional photochemistry, and data storage". While polymer based STED lithography has been realized a few years ago, STED photochemistry has so far not been applied to single chemical reactions. Here, we show for the first time sub-diffraction control over photochemical reactions using STED inspired approach which goes beyond diffraction unlimited polymerization. The method exploits photobleaching of fluorophores to generate nano-patterns (lines) of proteins with sub-diffractional confinement down to 75 nm. Namely, the patterning of a biotinylated Atto390 fluorophore is realized through laser-assisted protein adsorption by photobleaching (LAPAP). Controlling the transition states of the molecules in the outer rim of the point spread function (PSF) through the doughnut shaped STED beam, photo-oxidationo in the outer rim of the PSF is suppressed by leaving the molecules in the center basically within the non-reactive S0 state. Atto390 biotin is used to covalently bind the molecules onto the surface by LAPAP, leaving the biotin functional for further applications. Alexa555 Streptavidin was used in order to interact with the biotin group of sub-diffractionally patterned Atto390 biotin. Atomic force microscopy (AFM), confocal and STED microscopy have been used to show the immobilization control on the single molecular level.

15:40-16:00 **Coffee break**

Wednesday, 11 September 2019 | Special Session: Optical Quantum Technologies

Chair: Francesco Cataliotti and Giampiero Pepe

16:00-16:20 **Colloidal Quantum Dots: materials, technology and application prospects (O56)**

L. Colace, A. De Iacovo, C. Venettacci and F. Mitri
University Roma Tre - Department of Engineering, Italy

Invited speaker

Colloidal quantum dots (CQD) are semiconductor nanoparticles that can be chemically synthesized and suspended in solutions. Their relevant potentialities were understood at the beginning of the eighties after the pioneering work on CQD band-gap engineering associated to quantum confinement. In the past two decades CQD, as a completely new class of materials, have attracted increasing interest due to their unique optical and electronic properties and started to be effectively employed in several fields, including bio imaging, color displays, photovoltaics and optical sensing. Three-dimensional quantum confinement produced in quantum dots dramatically enhances their optical emission and absorption thus providing ideal optical materials for thin film optoelectronic devices. The recently developed synthesis methods produce nanoparticles with diameter sizable over more than one decade with very low standard deviation allowing a very wide tunability of the optical properties. In addition, due to their solution processability, CQD accept a wide variety of substrates, allowing their integration with other microelectronic technologies with simple and flexible techniques. In this review, we will present highlights and major milestones in the field of CQDs, starting from their optical and electronic properties tailored by the atomic composition, their size, shape and surface functionalization. We will also touch on CQD synthesis, processing and assembly, emphasizing their flexibility, low cost, low temperature and scalability. We will review the recent advances in the fabrication of optoelectronic devices based on semiconductor colloidal quantum dots, with emphasis on light emitters, detectors and solar cells. The last part of the work will be focused on our recent progress on near infrared photodetectors based on lead sulphide CQD. We will conclude with a short discussion on the large potentialities of this new class of materials as well as the challenges that must be addressed in the move to solution-processed functional optoelectronic nanomaterials for their practical applications.

16:20-16:35 **A superconducting quantum network as a platform for quantum simulation of complex magnetic systems (O57)**

M. Lisitskiy[1], M. Fistul[2,3], B. Ruggiero[4] and P. Silvestrini[4,5]
[1] Institute for Superconductors, Oxide and Other Innovative Materials and Devices, National Research Council, Italy
[2] Center for Theoretical Physics of Complex Systems, Institute for Basic Science, Korea
[3] Russian Quantum Center, National University of Science and Technology MISiS, Russia
[4] Institute of Applied Sciences and Intelligent Systems, National Research Council, Italy
[5] Department of Mathematics and Physics, Università della Campania "Luigi Vanvitelli", Italy

The large (up to 200 devices) superconducting quantum networks (SQNs) of interacting Josephson junctions (JJ) and flux-qubits arranged in various one- and two-dimensional lattices embedded into a microwave resonator are discussed in terms of possible platforms for analog quantum simulation to study the novel quantum phases and quantum phase transitions in frustrated magnetic systems. In SQNs the long-range interaction between qubits or JJs is provided by the geometrical constraints and electromagnetic coupling between qubits and photon modes of the resonator. The key idea is to explore theoretically and experimentally spatial and temporal quantum correlations of frustrated quasi-1D and 2D kagome –type SQNs of driven superconducting flux qubits and Josephson junctions. In the experiments, the control of quantum states of SQNs with frustrated geometries can be provided by a sequence of resonant pulses, and embedding the SQNs in the low-dissipative cavity allows one to monitor spatial and temporal quantum correlations by measuring the amplitude and phase of the microwave radiation transmitted through the cavity. The possibility to employ the SQN platform for the quantum simulation of real magnetic molecules is discussed.

16:35-16:50 **Superconducting Nanowire Single Photon Detectors: properties, applications and recent developments (O58)**

M. Ejrnaes[1], D. Salvoni[1,2], L. Parlato[1,2], D. Massarotti[3], R. Caruso[2], F. Tafuri[2], X.Y. Yang[4], L. You[4,5], Z. Wang[4,5], G. Pepe[1,2] and R. Cristiano[1]

[1] National Research Council, Institute of Superconductors, Innovative Materials and Devices, Italy

[2] University of Naples "Federico II", Dept. of Physics, Italy

[3] University of Naples "Federico II", DIETI, Italy

[4] Chinese Academy of Sciences, Shanghai Institute of Microsystem and Information Technology, China

[5] Chinese Academy of Sciences, Center for Excellence in Superconducting Electronics, China

The Superconducting Nanowire Single Photon Detector is a very useful quantum technology currently in use in many experiments, although their operation is still poorly understood. We will show that a proper choice of the SNSPD material strongly influences key performance parameters.

Wednesday, 11 September 2019 | Session 9: Plasmonic devices

16:50-17:05 **Rotavirus detection by Octupolar Functionalized LSPR Nanosensors (O59)**

M. Rippa[1], R. Castagna[1], G. Fusco[2], M. Monini[3], J. Zhou[4], J. Zyss[5] and L. Petti[1]

[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy

[2] UOC Virologia, Istituto Zooprofilattico Sperimentale del Mezzogiorno, Italy

[3] Department of Food Safety, Nutrition and Veterinary Public Health, Istituto Superiore di Sanità, Italy

[4] Institute of Photonics, Faculty of Science, Ningbo University, China

[5] Laboratoire de Photonique Quantique et Moléculaire, CNRS and Ecole Normale Paris-Saclay, France

Plasmonic sensors are powerful devices for real-time detection of various chemical and biological analytes. Sensors based on plasmonic technologies are a rapidly growing field that aims to be a valid alternative to conventional diagnostic methods. Through the use of plasmonic nanostructures, it is possible to engineer novel bio-sensing systems characterized by a sensitive and specific responses. Among the main pathogenic contaminant Rotaviruses are known to be the main cause of childhood viral gastroenteritis in humans. Every year in the world, rotavirus gastroenteritis, causes about half a million deaths among children under 5 years. At present, its diagnosis is mainly carried out with expensive and time-consuming methods (ELISA, electron microscopy or latex agglutination assay) and, to date, in the literature there are very few alternative methods developed for the detection of this kind of virus. In this work, we realize functionalized plasmonic nanosensors to detect low concentration of Rotavirus in water. Our bio-sensing system is based on a two-dimensional gold nanostructure realized using Electron Beam Lithography (EBL) tool. Nanostructures were optically and morphologically characterized and successively functionalized using the antibody Rotavirus capsid (2B4) for a specific Rotavirus detection. As result, our nanostructures can be used as sensors based on the spectral frequency shift of the Localized Surface Plasmonic Resonance (LSPR). As widely reported in literature, LSPR sensors represent a good platform for developing highly efficient portable systems for a real-time, label-free and low cost bio-detection. Using our functionalized nanostructures as LSPR sensors, we demonstrate the possibility to detect small amounts (<103 PFU/ml) of the investigated virus with sample volume requirement for the assay of about 1 μl. Moreover, we realized first tests of specificity using two different viruses (BHV1 and EVA) and the results are promising. Our preliminary results suggest that this device can be used to develop a rapid, sensitive and specific immunoassay for detection of Rotavirus in water integrable with other biological on-chip devices to realize inexpensive portable point-of-care medical diagnostics.

17:05-17:20 **Plasmonic Enhanced Fluorescence for Multiplexing Biosensing (O60)**

B. Della Ventura[1,2], F. Gentile[3] and R. Velotta[2]
[1] *Physics Department, Politecnico di Milano, Italy*
[2] *Physics Department, University of Naples "Federico II", Italy*
[3] *DIETI Department, University of Naples "Federico II", Italy*

In this work we propose a multiplexing biosensing platform based on Plasmonic Enhanced Fluorescence (PEF) from gold nanostructured surfaces functionalized by Photochemical Immobilization Technique (PIT), a reliable and easy-to-use method to anchor covalently antibodies upright on metal surfaces.

17:20-17:35 **Optical Fiber Meta-Tip: a Novel Platform for Highly Sensitive Detection of Molecular Interactions (O61)**

M. Consales[1], G. Quero[1], S. Spaziani[1], M. Principe[1,2], A. Micco[1], V. Galdi[1], A. Cutolo[1] and A. Cusano[1]
[1] *University of Sannio, Italy*
[2] *Centro Studi e Ricerche Enrico Fermi, Italy*

We report on a novel biosensing platform, based on the integration of a plasmonic metasurface on the tip of a single-mode optical fiber, able to detect biomolecular interactions with very high sensitivity. Specifically, here we demonstrate the capability of the proposed platform to detect very low concentrations of streptavidin in running buffer solutions with a Limit of detection as low as 4ng/ml.

17:35-17-50 **Smart Microgels for Lab on Fiber Technology (O62)**

M. Giaquinto[1], A. Aliberti[1], A. Micco[1], E. Bobeico[2], M. Ruvo[3], A. Cutolo[1], A. Ricciardi[1] and A. Cusano[1]
[1] *Optoelectronics group, Department of Engineering, University of Sannio, Italy*
[2] *ENEA, Portici Research Center", Italy*
[3] *Institute of Biostructures and Bioimaging, National Research Council, Italy*

The integration of smart polymers such as microgels allow to enhance the performances of Lab on Fiber optrodes. A numerical model for studying the light-microgel interaction and a reliable fabrication path for controlling the microgels deposition are successfully demonstrated. Further responsivity increase can be obtained with the cavity enhanced configuration.

Optics at Nanoscale (ONS'19)

Monday, 9 September 2019

09:45-10:30 **Spin-orbit interactions in nanophotonics**
Anatoly Zayats, King's College London, United Kingdom
Plenary speaker

Monday, 9 September 2019 | Light-matter interactions: emission, sensing, imaging I

10:30-10:50 **Plasmon-assisted ultrafast photodynamics in quantum dots (O1)**
A.M. Flatae, [1] F. Tantussi, [2] G.C. Messina,[2] F. De Angelis,[2] M. Agio[1,3]
[1]University of Siegen, Laboratory of Nano-Optics and Cμ, Siegen, Germany
[2] Istituto Italiano di Technologia, Genova, Italy
[3]National Institute of Optics (INO-CNR), Florence, Italy
Invited speaker

We demonstrate a high degree of control on the emission dynamics of a bare core quantum dot by plasmon coupling, showing that surface defect state emission and Auger processes from a trap-rich quantum dot can be significantly quenched by enhancing the band-edge state emission by more than three orders of magnitude.

10:50-11:05 **Anisotropic Fluorescence Emission due to Photobleaching at the Surface of 1D-Photonic Crystal Biochips (O2)**
E. Sepe[1], A. Sinibaldi[1], N. Danz[2], P. Munzert[2], F. Michelotti[1]
[1]Department of Basic and Applied Science for Engineering, SAPIENZA University of Rome, Rome, Italy
[2]Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Jena, Germany

Nowadays, photonic crystals are widely used in several areas of biosensing applications due to their great versatility and the great advantages provided. Due to the increasing demand for new cancer treatments an emerging area of application is for cancer biomarker detection. Herein, we present disposable one-dimensional photonic crystal biochips (1DPC) that are used for breast cancer biomarker detection at low concentrations (sub ng/mL) in biological complex matrices. Such 1DPCs, under proper illumination conditions, sustains Bloch surface waves (BSW), which are strongly confined at the surface due to total internal reflection from one side and to the photonic bandgap from the other side. Such field confinement can be translated in a strong field enhancement at the surface, which is exploited in biosensing.

11:05-11:40 **Coffee break**

11:40-12:00 **Quantum emitters coupled to optically engineered nanostructures for enhanced emission and nanolasing (O3)**
D. Piccotti,[1] G. Pirruccio,[2] B. Kalinic, [1]I. Balasa, [1] C. Scian,[1] T. Cesca,[1] G. Mattei[1]
[1]Univ. of Padova, Dept. of Physics and Astronomy, NanoStructures Group, Padova, Italy
[2]UNAM, Solid State Department of the Physics Institute, México City, Apartado Postal, México
Invited speaker

The possibility to enhance the optical properties of quantum emitters (Eu or fluorescent dyes, in the present case) is investigated by tailoring their near-field coupling with nanostructures with engineered density of optical states, like hyperbolic metamaterials and ordered nanoparticle array, which are able to sustain coherent emission

12:00-12:15 **Spectroscopic signature of quantum dot dimers (O4)**
C. N. Dibenedetto,[1], E. Fanizza,[1,2] R. Brescia,[3] Y. Kolodny,[4] S.i Remennik,[4] A.Panniello,[1] N. Depalo,[1] S. Yochelis,[4] R. Comparelli,[1] A. Agostiano,[1,2] M. L. Curri,[1,2] Y. Paltiel,[4] M. Striccoli [1]
[1] CNR-Istituto per i Processi Chimico-Fisici SS Bari, Bari, Italy
[2] Dipartimento di Chimica, Università degli Studi di Bari Aldo Moro, Bari, Italy
[3] Electron Microscopy Facility, Istituto Italiano di Tecnologia, Genova, Italy

[4] *Department of Applied Physics and Center for Nanoscience and Nanotechnology, Hebrew University of Jerusalem, Israel*

We present a simple procedure for the fabrication of dimers of CdSe quantum dots in solution with tunable distance between the two inorganic nanoparticles. Alkyl dithiols were used as bifunctional linkers to bridge the two nanoparticles, modulating, through the alkyl chain length, the interparticle distance in the nanometric and subnanometric range, in which strong interactions are expected. Morphological characterization by TEM confirm the effectiveness of the dimers formation and the spectroscopic investigation highlights recombination dynamics attributed to coupling between the two quantum dots, affecting the excitons dissociation rate.

12:15-12:30 **Field Enhancement Investigation using the Extended to Localized Surface Plasmon Coupling Configurations in the Prism and Grating Geometries (O5)**

M. Abutoama[1], L. Jiang[2], S. Li[3]and I. Abdulhalim[1]
[1]Department of Electro-Optic Engineering and The Ilse Katz Institute for Nanoscale Science and Technology, Ben Gurion University of the Negev, Beer Sheva, Israel
[2] Institute of Functional Nano & Soft Materials Laboratory (FUNSOM), Jiangsu Key Laboratory for Carbon-Based Functional Materials & Devices, Collaborative Innovation Center of Suzhou Nano Science and Technology, Soochow University, Suzhou, Jiangsu, China
[3] School of Materials Science and Engineering, Nanyang Technological University, Singapore, China

Metal nanoparticles over metal film configuration, is under wide investigation during the last few years. In this configuration a strong electromagnetic field is generated at the gap between the nanoparticles and the metal film. An optimized design was shown for the excitation of the Localized Surface Plasmons (LSPs) through the Extended Surface Plasmons (ESPs) that propagate at the surface of the metal film in the Kretschmann−Raether configuration in which significant enhancement of the electromagnetic field in comparison to the conventional metal nanoparticles over metal film configuration was exhibited and demonstrated experimentally using SEF and SERS.

12:30-12:45 **Quantum imaging with SPAD arrays (O6)**

G. Lubin,[1] R. Tenne,[1]I.M. Antolovic[2], E. Charbon[2], C. Bruschini[2], D. Oron[1]
[1]Weizmann Institute of Science, Department of Physics of Complex Systems, Rehovot, Israel
[2]Ecole Polytechnique Fédérale de Lausanne (EPFL), School of Engineering, Neuchâtel, Switzerland

We present a novel quantum imaging modality based on photon correlation measurement with a single photon avalanche diode (SPAD) array in a confocal setup. This enables unprecedented simplicity in realization of photon correlation measurements, demonstrated via measuring of second and third order photon correlations of quantum light sources, and the implementation of a quantum based super-resolution technique.

13:00-14:30 **Lunch**

Monday, 9 September 2019 | Emerging technologies: metamaterials, nonradiating modes, topological insulator I

14:30-14:50 **Topological sources of light (O7)**

Boubacar Kanté
University of California Berkeley, United States
Invited speaker

14:50-15:10 **An algebraic geometry approach to photonic topological insulators (O8)**

Didier Felbacq
Université de Montpellier, Montpellier, France
Invited speaker

Topological insulators are generally characterized by means of integral invariants defined over the Bloch bundle (e.g.: Chern or Stiefel characteristic classes). In the case of photonic topological insulators made of continuous media, I will show that the invariants result from the consideration of a projective algebraic curve and of the bundle of eigenvectors over it. The main result is that photonic Chern insulators do not exist in continuous media.

15:10-15:25 **Dual surface-enhanced fluorescence imaging and ultra-high FOM sensing in all-dielectric metasurfaces (O9)**

S. Romano[1], M. Mangini[2], S. N. Lara Yépez[1], E. Penzo[3], S. Cabrini[3], I. Rendina[4], A. C. De Luca[2], V. Mocella[1], G. Zito[2]
[1]Institute for Microelectronics and Microsystems, National Research Council, Napoli, Italy
[2]Institute of Biochemistry and Cell Biology, National Research Council, Napoli, Italy
[3]Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, USA
[4] Institute of Applied Sciences & Intelligent Systems, National Research Council, Pozzuoli, Italy

Here we demonstrate that the field enhancement in proximity of an all-dielectric photonic crystal metasurface supporting bound states in the continuum can be explored to boost the light-matter interaction. We design and realize an innovative refractometric sensing scheme for bulk and surface measurement with ultra-high figure of merit and exponential sensitivity. The recognition scheme can be coupled to a fluorescence-based sensing approach, which exploits the capability of the sensor to strongly enhance fluorescence signals, providing new solutions for light manipulation at the nanoscale, especially for biosensing.

15:25-15:40 **Circular dichroism from sickle-shaped chiral metamaterial structure operating in the mid-infrared region (O10)**

Hanan Ali[1, 2]
[1]Key Laboratory of Quark and Lepton Physics (MOE), College of Physical Science and Technology, Central China Normal University, Wuhan, China.
[2]College of Natural Science, Department of Physics, Albaath University, Syria

In this work, we demonstrate a new shape of chiral metamaterial with the shape of a sickle with strong chirality. Strong chiral behavior such as circular dichroism is observed in the mid-infrared wavelength regime. Moreover, the structure may have potential use in sensing applications.

15:40-16:10 **Coffee break**

Monday, 9 September 2019 | Materials for photonics: quantum dots, perovskite nanostructures, 2D nanomaterials

16:10-16:30 **Transient non thermal state and coherent phonon hardening in prototype Mott compound V_2O_3 (O11)**

D. Boschetto, [1] N. Nilforoushan,[1] M. Weisz,[1] J. Zhang,[2] J. Caillaux,[2] M. Zaghrioui,[3] M. Marsi,[2]
[1]LOA, CNRS, Ecole Polytechnique, ENSTA Paris, Institut Polytechnique de Paris, Palaiseau, France
[2]Laboratoire de Physique des Solides, CNRS, Universite Paris-Sud, Universite Paris-Saclay, Orsay, France
[3]GREMAN, Universite de Tours, Tours, France
Invited speakers

We show a time resolved study on femtosecond time scale of lattice and electrons dynamics in a prototype Mott compound, namely the V_2O_3. In particular, we show that the coherent A_{1g} optical phonon mode increases its frequency after photoexcitation, manifesting a non-thermal transient phase.

16:30-16:45 **Multi-imaging analysis of exciton states in monolayer transition metal dichalcogenides and van der Waals heterostructures (O12)**

Felice Gesuele[1]
[1]Dipartimento di Fisica "E. Pancini", Università degli Studi di Napoli Federico II, Napoli, Italia
The electronic and optical properties of 2D transition metal dichalcogenides (TMD) are the subject of intense research due to their unprecedented quantum and physicochemical properties. Here we combine high resolution confocal and near-field optical microscopy with Photoluminescence (PL), Reflectance and Raman spectroscopy on CVD-grown WS2 monolayers of different sizes and shape. We correlate the local emission and absorption properties with the morphology obtained by means of Atomic Force Microscopy.

16:45-17:00 **Non-linear exciton dynamics in $CsPbBr_3$ nanometric thin films (O13)**

N. Falsini,[1,2] C. Borri,[1,3] N. Calisi, [1,3] S. Caporali, [1,3] F. Biccari, [1,2,4] and A. Vinattieri[1,2,4,5]
[1] INSTM - National Interuniversity Consortium of Materials Science and Technology, Firenze, Italy
[2] University of Florence, Dept. of Physics and Astronomy, Sesto Fiorentino, Italy
[3] University of Florence, Dept. of Industrial Engineering, Firenze, Italy

[4] LENS - European Laboratory for Non-Linear Spectroscopy, Sesto Fiorentino, Italy
[5] INFN - National Institute for Nuclear Physics, Sesto Fiorentino, Italy

The exciton dynamics in $CsPbBr_3$ thin films prepared by RF-magnetron sputtering technique is investigated at the picosecond time scale and compared with results on spin-coated films. Significant differences are found in the linear and non-linear regime, possibly related to the sample morphology.

17:00-17:15 **A new route to large-area thin film deposition of inorganic perovskites: RF-Magnetron sputtering deposition of $CsPbBr_3$ (O14)**

N. Falsini,[1,2] C. Borri,[1,3] N. Calisi, [1,3] S. Caporali, E. Galvanetto, [1,3] D. Balestri,[2] F. Biccari,[1,2,4] and A. Vinattieri[1,2,4,5]
[1] INSTM - National Interuniversity Consortium of Materials Science and Technology, Firenze, Italy
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[3] University of Florence, Dept. of Industrial Engineering, Firenze, Italy
[4] LENS - European Laboratory for Non-Linear Spectroscopy, Sesto Fiorentino, Italy
[5] INFN - National Institute for Nuclear Physics, Sesto Fiorentino, Italy

The RF-magnetron sputtering technique is proposed and successfully applied for the realization of inorganic $CsPbBr_3$ perovskite thin films on several substrates. The characterization of the so-deposited materials proves that they can be employed for the fabrication of large-area perovskite-based devices.

17:15-17:30 **Monolithic deep-subwavelength grating as transparent electrode of polarized light (O15)**

T. Czyszanowski[1], A. Sokół[1], M. Wasiak[1]
[1]Lodz University of Technology, Institute of Physics, Łódź, Poland

This paper proposes a design for the transparent electrode based on monolithic high contrast grating (MHCG) of deep-subwavelength period integrated with metal. We discuss properties of the electrode that enables low electrical resistance below 1 ΩSq-1 and infrared polarized light transmittance above 90%.

18:30 -20:30 Poster session & Welcome cocktail

P1 **Exceptional points in k-space optically anisotropic microcavities**

O. Kunt, A. Palatnik, M. Sudzius, H. Fröb and K. Leo
Dresden Integrated Center for Applied Physics, Germany
Photonic Materials and Institute for Applied Physics, Germany

We report on the optical properties of dielectric and organic microcavities which possess certain degree of optical anisotropy in their cavity layer. The presence of exceptional points in -space due to the anisotropy is experimentally demonstrated both in linear and nonlinear operation regimes.

P2 **Performance of a solar thermal collector based on Compound Parabolic Concentrator under high vacuum**

D. De Maio[1,2], C. D'Alessandro[1,2], D. De Luca[2,3], D. Dalena[4,2], M. Musto[1], E. Di Gennaro[3] and R. Russo[2]
[1] Industrial Engineering Department, University of Napoli "Federico II", Napoli, Italy
[2] Institute for Microelectronics and Microsystems, National Research Council, Italy
[3] Physics Department, University of Napoli "Federico II", Napoli, Italy
[4] TVP Solar SA, Switzerland

We present simulation on the performances of a CPC system placed under high vacuum. The presence of high vacuum insulation allows to reach high operating temperature with good performances. Operating temperature and efficiency can be further increased by using a specially designed infrared mirror on the covering glass.

P3 **Near-infrared Erbium/Silicon Schottky photodetectors integrated with a silicon-on-insulator waveguide**

T. Crisci, M. Gioffrè, G. Coppola, R. Rajeeve, M. Medugno, M. Iodice and M. Casalino
Institute for Microelectronics and Microsystems, National Research Council, Italy

In this work we have investigated the performance of photodetectors at 1550nm based on Erbium/Silicon (Er/Si) Schottky junctions integrated with silicon-on-insulator (SOI) waveguides. Devices are based on the internal photoemission effect (IPE) which is a promising candidate as absorption mechanism for near infrared (NIR) photodetection in Si.

P4 **Imaging of Diatoms species by Fourier Ptychographic Microscopy**

P. Memmolo[1], D. Barone[2], V. Bianco[1], J. Behal[1,3], L. Miccio[1], M. Paturzo[1], A. M. Tulino[2,4] and P. Ferraro[1]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] DIETI, University of Naples "Federico II", Italy
[3] Department of Optics, Palacký University, Czech Republic
[4] Nokia Bell Labs, USA

In this paper we exploit the capabilities of Fourier Ptychographic Microscopy (FPM) to investigate diatoms samples. Thanks to the large field of view along with the resolution enhancement provided by FPM, we are able to image 50 different diatoms species in a single shot recording.

P5 **Identification and classification of anemic erythrocytes by Holographic Learning**

P. Memmolo[1], G. Aprea[2], M. Mugnano[1], L. Miccio[1], F. Merola[1], A. M. Tulino[2,3] and P. Ferraro[1]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] DIETI, University of Naples "Federico II", Italy
[3] Nokia Bell Labs, USA

In this paper, we investigate the possibility to identify erythrocyte diseases by digital holography and machine learning. In particular, two anemic blood samples, namely Thalassemia and iron-refractory iron-deficiency anemia (IRIDA) have identified respect to a control healthy sample.

P6 **Active Reflection and Refraction of Soliton Waveguides on Electric Interfaces**

E. Fazio[1], M. Alonzo[1], M. Chauvet[2], A. Belardini[1] and C. Soci[3]
[1] Sapienza University of Rome, Italy
[2] Universite de Franche Comte, France
[3] Nanyang Technological University, Singapore

A great deal of interest over the years has been directed to the optical spatial solitons for the possibility of realizing 3D waveguides with very low propagation losses. A great limitation in their use for writing complex circuits is represented by the impossibility of making curved structures. We show here that photo refractive spatial soliton waveguides can be reflected (or refracted) on electric walls acting as mirrors (or negative interfaces). Both numerical simulations and experiments show that electric interfaced can be actively driven in order to induce forced reflection or forced refraction on soliton beams, whose behavior is particle-like. We shaw that soliton reflection means waveguide reflection: in fact, soliton channels are used to carry information as 3D channel waveguides, can be reflected or refracted as well. Small or large curvature angles can be induced in the curved soliton waveguides, whose propagation losses, from the theoretical point of view, remain always much lower that those observed in waveguides obtained with traditional techniques (ion-implantation or layer-growing).

P7 **Electrowetting-based Lab-on-Chip System for Biosensing Applications**

N. Lovecchio[1], A. Nascetti[2], G. de Cesare[1], D. Caputo[1]
[1]Department of Information Engineering, Electronics and Telecommunications, University of Rome "La Sapienza", Italy
[2]School of Aerospace Engineering, University of Rome "La Sapienza", Italy

This work reports on the development of a compact and versatile optoelectronic platform able to implement the functionalities of a lab-on-chip system. In particular, the proposed platform includes three different modules designed for: (i) fluid handling through the ElectroWetting On Dielectric (EWOD) technique, (ii) thermal sample treatment performed

through thin film heaters and amorphous silicon temperature sensors, and (iii) optical detection obtained thanks to the integrated photosensors and interferential filters.

P8 **Scatterer thickness influence on "shift" optical memory effect range**

T. Cacace[1,2], S. Ludwig[3], G. Pedrini[3], M. Paturzo[1] and P. Ferraro[1]
[1] Institute of Applied Science and Intelligent Systems, National Research Council, Italy
[2] University of Campania "Luigi Vanvitelli", Italy
[3] Institute of Applied Optics, Germany

The optical memory effect has been recently exploited for the non-invasive imaging of objects hidden behind scattering layers. In this work, we explore the range of the shift memory effect, investigating its relationship to the thickness of the scattering layer.

P9 **Detection of Fluorescence-based Aptamer Assay Through Thin Film Optoelectronic Devices**

F. Costantini[1,2], N. Lovecchio[1], A. Nascetti[3], G. de Cesare[1], D. Caputo[1]
[1]Department of Information Engineering, Electronics and Telecommunications, University of Rome "La Sapienza", Italy
[2] Department of Chemistry, University of Rome "La Sapienza", Italy
[3] School of Aerospace Engineering, University of Rome "La Sapienza", Italy

This work presents a bio-microsystem, based on thin film optoelectronic devices, for the on-chip detection of fluorescence-based aptamer assay. The on-chip fluorescence detection is achieved through the combination of amorphous silicon (a-Si:H) photosensors and a thin film interferential filter, while the aptamer-based biomolecular recognition takes place in a microfluidic network functionalized with polymer brushes. The system has been tested toward the detection of Ochratoxin A (OTA), a mycotoxin with toxic and carcinogenic effects, showing a limit of detection equal to 1.56 ng/mL.

P10 **Color Entanglement in Metamaterials**

M.Artoni,[1] G. La Rocca,[2] J.H. Wu[3]
[1] Department of Information Engineering, University of Brescia, Brescia, Italy
[2] Scuola Normale Superiore, Pisa, Italy
[3] Center for Quantum Sciences, Northeast Normal University, Changchun, China

Indistinguishability between two nonlinear spontaneous four-wave mixing (SFWM) processes can be harnessed to achieve heralded generation of single-photon colorentangled states. A scheme for the generation of such states is discussed along with its potential applications to low-loss efficient metadevices.

Tuesday, 10 September 2019

09:15-10:00 **Graham Reed, University of Southampton, UK**

Plenary speaker

Tuesday, 10 September 2019 | Nanophotonics I

10:00-10:20 **Revisiting the Yagi-Uda Nanoantenna Design for Tailored Infrared Thermal Radiation (O16)**

Marco Centini[1]
[1] *Sapienza, University of Rome, Department of Basic and Applied Sciences for Engineering, Roma, Italy*

Invited speakers

We investigate the possibility of spatially and spectrally controlling the thermal infrared emission by exploitation of the Yagi–Uda antenna design. Hybrid antennas composed of alternating SiC and Au elements are considered and the contributions of emission from all the elements are taken into account. Numerical results show that the optimal parameters and performances significantly differs from the standard predictions obtained by considering deterministic, coherent feeders.

10:20-10:35 **Full-Wave Mode Hybridization in Nanoparticle Dimers (O17)**

M. Pascale, [1] *G. Miano,* [1] *R. Tricarico,* [1,2] *C. Forestiere*[1]
[1]*Department of Electrical Engineering and Information Technology, Università degli Studi di Napoli "Federico II", Naples, Italy*
[2] *ICFO Institut de Ciències Fotòniques, The Barcelona Institute of Science and Technology, Castelldefels, Barcelona, Spain*

We propose a hybridization theory for sphere dimers, based on the full-Maxwell equations, including retardation, radiation losses, and magnetic interactions. This theory unlocks the description of dielectric dimers and refines the understanding of metallic dimers.

10:35-10:50 **Multipole analysis of amorphous arrays of dielectric nanoresonators (O18)**

K.M. Czajkowski[1] *and T. J. Antosiewicz*[1]
[1] *University of Warsaw, Faculty of Physics, Pasteura, Warsaw, Poland*

We propose a coupled multipole model of amorphous arrays of dielectric nanoresonators. Their optical response is governed by single particle multipole moments and intra-array coupling. We show that the minimal interparticle separation is a useful parameter for tailoring the array properties.

10:50-11:05 **On using bulk sensitivity parameters of single plasmonic nanodisks to quantify local layer thickness and refractive index (O19)**

D. Switlik, [1] *K. Czajkowski,* [1] *T.J. Antosiewicz*[1]
[1]*University of Warsaw, Faculty of Physics, Pasteura, Warsaw, Poland*

The response of a plasmonic nanodisk for a broad range of radii r and heights h is quantified to prove that bulk sensitivity is enough to use an array with a binomial disk distribution as a very accurate sensor of simultaneous measurement of thickness and refractive index of a layer deposited on the nanodisks.

11:05-11:30 **Coffee break**

Tuesday, 10 September 2019 | Emerging technologies: metamaterials, nonradiating modes, topological insulator II

11:30-11:50 **Flexible holographic metasurfaces (O20)**

Andrea Di Falco
SUPA, School of Physics and Astronomy, University of St Andrews, St Andrews, UK
Invited speaker

In this presentation I will discuss the physics and applications of flexible holographic metasurfaces, for applications including imaging, anti-counterfeiting, biophotonics and antennas applications, from the visible to the mm-waves range.

11:50-12:05 **Optical magnetism in self-assembled metamaterials (O21)**

Q. Flamant,[1] M. Tréguer-Delapierre,[2] E. Duguet,[2] J.B. Salmon,[3] J. Leng,[3] S. Gomez-Graña,[2,4] D. Torrent,[1,5] A.N. Grigorenko,[6] V.G. Kravets,[6] P. Barois,[1] V. Ponsinet,[1] A.Baron[1]
[1]Univ. Bordeaux, CNRS, CRPP, Pessac, France
[2]Univ. Bordeaux, CNRS, ICMCB, Pessac, France
[3]Univ. Bordeaux, CNRS, Solvay, LOF, Pessac, France
[4]Currently at Departamento de Química Física, CINBIO, Universidade de Vigo, Vigo, Spain
[5]Currently at GROC, INIT, Universitat Jaume I, Castellón, Spain
[6]University of Manchester, School of Physics & Astronomy, Manchester, UK

The magnetic susceptibility of all natural materials is vanishingly small at high frequencies. By taking advantage of resonance phenomena, it has been demonstrated that artificially structured metamaterials composed of subwavelength resonators (the so-called meta-atoms) can overcome this limitation. However, the first attempts to achieve optical magnetism relied on top-down fabricated structures, which suffer from two potential limitations: they are essentially two-dimensional and their response is strongly anisotropic. In this contribution, we will show the benefits of self-assembling techniques for producing isotropic bulk optical metamaterials. Furthermore, we will emphasize the difficulties inherent to the characterization of materials with such an unusual electromagnetic behavior.

12:05-12:20 **Enantioselectivity of chiral molecules on asymmetric hole array substrate (O22)**

A. Belardini[1], E. Petronijevic[1], G. Leahu[1], T. Cesca[2], G. Mattei[2], L. Mattiello[1], C. Sibilia[1]
[1]Universita'di Roma La Sapienza, Dipartimento SBAI, Roma, Italy
[2]Università di Padova, Dipartimento di Fisica e Astronomia, Padova, Italy

The enantioselectivity of chiral molecules has been studied by means of a suitable patterned substrate. In order to enhance the optical enantioselectivity of chiral molecules suitable substrate must be adopted. Self-assembled approach allows realizing plasmonic metasurfaces with a low cost reliable procedure. By using self-organised polystyrene spheres deposited on glass substrate, it is possible to produce a holes array on a metal thin film.

12:20-12:35 **Optical eigenmodes description of photon eigenstates (O23)**

Michael Mazilu
SUPA, School of Physics and Astronomy, University of St Andrews, United Kingdom

Photon states can be represented using many families of orthogonal fields, such as plane waves, Laguerre-Gaussian beams, Bessel beams, etc... Optical eigenmodes offer a particular useful description of single photon quantum state in light-matter interaction. We exemplify this on the case of momentum transfer to dielectric microparticles.

13:00-14:30 **Lunch**

Tuesday, 10 September 2019 | Special session - Waves in Complex Photonic Media: Fundamentals and Device Applications I

Chair: Luca Dal Negro, Boston University, USA

14:30-14:50 **Deep reservoir computing in tumor cells and Ising machines by spatial light modulators (O24)**

Claudio Conti
Universita'di Roma La Sapienza, Roma, Italy
Invited speakers

Photonic structures require materials with a high index of refraction that can also be patterned with high resolution without degradation, silicon being the point of reference. In this talk I will present the transition metal dichalcogenide (TMD) tungsten disulfide as a new photonic material with properties surpassing silicon in the near-infrared and a set simple fabrication techniques enabling 3D photonic structures never before possible. Atomic layer deposition of transition metal oxides followed by chalcogen annealing allows for conformal patterning and high-resolution structuring while maintaining material quality. Three exemplar structures and their optical behaviors are demonstrated: 2D patterned, 2D templated, and 3D templated photonic crystals. We have modeled these results and present a theoretical framework which we hope will aid the photonics community in developing new structures that can take advantage of this new material and flexibility of fabrication.

14:50-15:10 **Slow Light to Reduce the Energy Dissipation of Mach-Zehnder Modulators in Silicon Photonics (O25)**

M. Passoni,[1] D. Gerace,[1] Liam O'Faolain,[2,3] L.C. Andreani[1,4]
[1] Physics Department, University of Pavia, Pavia, Italy
[2] Cork Institute of Technology, Cork, Ireland
[3] Tyndall National Institute, Cork, Ireland
[4] Istituto di Fotonica e Nanotecnologie, IFN-CNR, Milano, Italy
Invited speakers

Integrated Mach-Zehnder modulators are key components in silicon photonic devices, which rely on a reverse-biased p-n junction to modulate the optical signal via a change of the waveguide refractive index. Reducing their energy consumption is a crucial issue towards applications of silicon photonics to optical communication. In this presentation, we shall describe the design of slow light structures consisting of silicon grating waveguides, which have an increased group index close to the photonic band edge. Also, we discuss how the design of p-n junctions that are interleaved along the waveguide direction and with the same periodicity of the grating structure, in order to optimize spatial matching between the optical field mode and the depletion region. The combination of slow light and interleaved p-n junction improves the modulation efficiency and reduces the energy dissipation per bit of the modulator, while maintaining a wide bandwidth and modulation rate. This design may allow implementation of slow light concepts in actual silicon photonic devices.

15:10-15:30 **Information Entropy of the Local Density of States in 2D disordered photonic systems (O26)**

Francesco Riboli
Istituto Nazionale di Ottica (INO), CNR, Firenze, Italia
Invited speakers

I will present preliminary results about an experimental and numerical measurement of the entropy and information content of the local density of states (LDOS) in two-dimensional disordered photonic systems. We focus on the Shannon entropy of LDOS, taking into account both spatial and frequency correlations with short-, long- and infinite range correlations. We have measured the information entropy of the LDOS in samples showing a wide range of structural disorder strength, form kl*=4 to kl*=22, by building the hyperspectral covariance matrix of the statistical ensemble and studying its scaling properties to extract the asymptotic entropy rate associated to the LDOS. This quantity can be compared with the configurational entropy of the disordered dielectric function of the corresponding samples, which have been designed following a random sequential adsorption algorithm. We found that the two entropic estimators are linked with a simple relation, meaning that the amount of optical information encoded in the electromagnetic field via the LDOS can be, in principle, simply retrieved by the configurational entropy of the dielectric function. Experimental results show good agreement with full ab-initio numerical solution of Maxwell equations.

This preliminary study suggests a new approach to the study of mesoscopic physics of light in disordered systems based on information theory, which is surprisingly oblivious/independent of the usual scattering parameters that we commonly use to describe these materials.

15:30-16:00 **Coffee break**

16:00-16:20 **Diffraction of aperiodically ordered structures (O27)**

Uwe Grimm
School of Mathematics and Statistics, The Open University, Walton Hall, UK
Invited speakers

Aperiodically ordered structures show a rich variety of diffraction patterns, including examples of pure point, singular continuous or absolutely continuous diffraction, or any combination of these spectral types. This talk presents an overview of recent results, focusing on self-similar structures obtained by inflation.

16:20-16:40 **Modeling light absorption and emission in disordered GaN-based semiconductors (O28)**

Marchel Filoche
École polytechnique, France
Invited speakers

Nitride-based materials are widely used nowadays for producing light-emitting diodes in the visible range due to their large range of accessible bandgaps. However, their alloys also exhibit significant intrinsic spatial fluctuations of composition that can induce strong modifications of the electron and hole wave functions, hence of the transport properties, recombination rates, and light emission efficiency. Accounting for this carrier localization requires solving self-consistently the Schrödinger equation (for electrons and holes) in the random potentials induced by these fluctuations, the Poisson equation, and possibly the transport equations when current is flowing. The computational cost for solving these equations can become prohibitive, especially in the case of realistic 3D multi-quantum-well structures.
The localization landscape (LL) theory is a mathematical theory which allows one to accurately predict the localization regions of the carriers, the corresponding wave functions and eigen-energies of the confined states, and the density of states (DOS) in the disordered potential created by the fluctuations of material composition without having to solve the Schrödinger equation. We present here the implementation of this tool into a semi-classical drift-diffusion transport model of semiconductor devices. In light emitting LEDs, it allows us to compute the percolation currents by the use of LL energy and wave functions associated with classical drift-diffusion equations, yielding a LLP-DD modeling tool, as well as light emission in realistic 3D structures. We thus account for quantum localization effects at the nanoscale, with a 300-1000 speed-gain in computation time as compared to classical SP-DD solvers.

16:40-17:00 **Establishing spectral correlations in random laser networks (O29)**

N. Caselli,[1] A. Consoli,[1,2] C. Lopez[1]
[1] Instituto de Ciencia de Materiales de Madrid (ICMM), Madrid, Spain
[2] Universidad Rey Juan Carlos, ETSI de Telecomunicación, Madrid, Spain
Invited speakers

Networks of random lasers can open up new perspectives in the roadmap of alternative light sources and integrated optical circuits. The influence exerted on a single random laser when it is placed in a network of connected peers is investigated in terms of the correlations of spectral intensity fingerprint.

17:00-17:15 **Transverse localization of light, applications, experiments and theory (O30)**

M. Leonetti[1,2], A. Mafi[3], B. Abaie[3], W. Schirmacher[4], G. Ruocco[1,5]
[1] Center for Life Nano Science@Sapienza, Istituto Italiano di Tecnologia, Roma, Italia
[2] CNR NANOTEC–Institute of Nanotechnology, Lecce, Italy
[3] Department of Physics and Astronomy and Center for High Technology Materials, University of New Mexico, Albuquerque, USA
[4] Institut für Physik, Universität Mainz, Staudinger Weg, Mainz, Germany
[5] Department of Physics, University Sapienza, Roma, Italy

Localized states trap waves propagating in a disordered potential and play a crucial role in Anderson localization, which is the absence of diffusion due to disorder. Some localized states are barely coupled with neighbors because of

differences in wavelength or small spatial overlap, thus preventing energy leakage to the surroundings. This is the same degree of isolation found in the homogeneous core of a single-mode optical fibre. Here we show that localized states of a disordered optical fibre are single mode: the transmission channels possess a high degree of resilience to perturbation and invariance with respect to the launch conditions. Our experimental approach allows identification and characterization of the single-mode transmission channels in a disordered matrix, demonstrating low losses and densely packed single modes.

20: 30 Social dinner

Wednesday, 11 September 2019

09:00-09:45 **Integrating micro- and nano- optical technologies to develop a multi-messenger microscope to address structure and function of biological macromolecules**
Alberto Diaspro, Nanoscopy, IIT-CHT Erzelli, Italy
Plenary speaker

Wednesday, 11 September 2019 | Nanophotonics II

09:45-10:05 **Photoacoustic investigation of nanogranular ultra-thin films (O31)**
M. Gandolfi[1,2], G. Benetti[2], S. Peli[3], C. Giannetti[2], E. Cavaliere[2], L. Gavioli[2], F. Banfi[4]
[1] Laboratory for Soft Matter and Biophysics, Department of Physics and Astronomy, Leuven, Belgium
[2] Interdisciplinary Laboratories for Advanced Materials Physics (I-LAMP) and Dipartimento di Matematica e Fisica, Università Cattolica del Sacro, Brescia, Italy
[3] Elettra - Sincrotrone Trieste S.C.p.A., Trieste, Italy
[4] FemtoNanoOptics group, Institut Lumière Matière (iLM), Université Lyon 1 and CNRS, Villeurbanne, France
Invited speaker

Ultrathin metal nanoparticles coatings are emerging as go-to materials in a variety of fields ranging from pathogens control to sensing. Accessing their mechanical properties is a crucial issue limiting their exploitation in real-life applications. The mechanical properties of metallic nanogranular thin films are unveiled exploiting ultrafast photoacoustic nanometrology in conjunction with bottom-up and top-down approaches based on more traditional techniques. Building on the acquire knowledge a variety of applications are proposed, ranging from nano-fluid infiltration sensing to gas-phase separation and bendable electronics.

10:05-10:25 **Phase and polarization-resolved radiation patterns of single nano-objects and embedded eigenstates (O32)**
A. F. Koenderink
Center for Nanophotonics, AMOLF, Science Park 104, XG, Amsterdam, The Netherlands
Invited speaker

The radiation pattern of single nano-antennas and nanosources in plasmonics and metamaterials contexts in principle contains a wealth of information: the full complex superposition of electric and magnetic multipole moments, bi-anisotropy and chirality, as well as the physics related to OAM and spin-orbit optical interactions. I will present polarimetric and interferometric k-space microscopy to measure the radiation pattern of single nano-objects and 2D photonic systems, showing the wealth of information available to assess OAM/spin selection rules in scattering by nano-antennas and to assess the origin of topological protection of embedded eigenstates. Finally, I will touch upon our recent efforts to attain phase-resolution in fluorescence radiation patterns, where no reference beam for interferometry is available.

10:25-10:45 **Topographic fibers: a platform for fundamental physical phenomena (O33)**
A. Mussot,[1] A. Kudlinski,[1] M. Conforti,[1] F. Copie,[1] F. Bessin,[1] S. Trillo,[2]
[1]Univ. Lille, CNRS, UMR 8523-PhLAM-Physique des Lasers Atomes et Molecules, Lille, France
[2] Department of Engineering, University of Ferrara, Ferrara, Italy
Invited speaker

We review the fundamental physical phenomena associated with parametric resonance which can be successfully investigated in topographic fibers characterized by suitably engineered oscillating dispersion.

10:45-11:00 **Squeezing of light with pyramidal horn nanoantenna (O34)**
Shuwen Chen, Jianguo Liu, Bin Jiang

National University of Defense Technology, College of Information and Communication, Wuhan, China

We develop an analytic approach of mode matching to squeeze electromagnetic waves via pyramidal horn nanoantenna. We numerically demonstrate that an efficiently nanofocusing nanospots is achieved with the analytically determined dimensions.

11:00-11:30 **Coffee break**

Wednesday, 11 September 2019 | Light-matter interactions: emission, sensing, imaging II

11:30-11:50 **Microscopic response of large plasmonic systems via quantum hydrodynamic theory: application to strong light-matter interactions (O35)**

C. Ciracì,[1] R. Jurga,[1,2] M. Khalid,[1] F.Della Sala[1,3]
[1] Istituto Italiano di Tecnologia, Center for Biomolecular Nanotechnologies, Arnesano, Italy
[2] Universita del Salento, Dipartimento di Matematica e Fisica "E. De Giorgi", Lecce, Italy
[3] Istitute for Microelectronics and Microsystems (IMM-CNR), Lecce, Italy
Invited speaker

Coupling between electromagnetic cavity fields and fluorescent molecules can be strongly enhanced by reducing the cavity mode volume. We introduce a quantum hydrodynamic theory to account for quantum effects in extended plasmonic systems and investigate coupling properties of an emitter at nanometer distances from metallic systems.

11:50-12:10 **Coherence and simmetry properties of the Stokes vector of the photoluminescence generated by a periodic array of aluminum nanoantennas (O36)**

Fabio Antonio Bovino
Universita'di Roma La Sapienza, Dipartimento SBAI, Roma, Italy
Invited speaker

We investigate the coherence and simmetry properties of the Stokes vector of the photoluminescence generated by a periodic array of aluminum nanoantennas embedded in a light-emitting layer of PMMA. The measurements of the Stokes parameters of the photoluminescence were performed by imping on the sample with a weakly focused laser (wavelenght 532 nm, vertical polarization), and reconstructing the polarization state of the zeroth-order emission spectrum of the array as a function of the angle of sample. The emission was collected from the backside by a fiber coupled spectrometer after a polarimeter. We reconstructed the density matrix of the photoluminescence for a range of wavelength and rotation angles of the sample. We recovered the coherence, the entropy and the symmetry maps of the polarization state of the light emitted. The symmetries and the anti-symmetries properties of the Stokes parameter characterize the polarization output of the photoluminescence at different angles and wavelengths, and suggest a control method for hybridized plasmonic-photonic devices.

12:10-12:25 **Deep-red photoluminescence waveguiding in centimeters-long hybrid active microwires (O37)**

J. Bigeon, [1]S. Khlifi,[2] M. Amela-Cortes,[2] Y. Molard,[2] S. Cordier,[2] G. Loas[1]
[1] Institut Foton, Univ Rennes, CNRS UMR 6082, Rennes, France
[2] Institut des Sciences Chimiques de Rennes, Univ Rennes, CNRS UMR 6226, Rennes, France

We report the deep-red photoluminescence waveguiding in microwires based on the mixture of polymer matrix and highly phosphorescent nanoclusters. By combining the high O2 permeability of polydimethylsiloxane (PDMS) and the O2 quenching of phosphorescence, this microfiber seems to be a good candidate for sensing application.

12:25-12:40 **Probing light-matter interactions with vortex beam-induced circular dichroism (O38)**

X. Zambrana-Puyalto
Istituto Italiano di Tecnologia, Genova, Italy

Recent works have shown that vortex beams can be used to obtain giant circular dichroism values with non-chiral samples. We explain why this effect occurs and show that vortex beam-induced circular dichroism can be used to obtain hidden information on light-matter interactions.

12:40-12:55 **Dual - parameter measurement for connecting of PCF and FBG with temperature - pressure by Sagnac interferometer (O39)**

H. Yan, L. Wang, S. Li, J. Wang
Beijing University of Technology, College of Applied Sciences, Beijing, 100124, China

The sensor of combination of photonic crystal fiber (PCF) and fiber Bragg grating (FBG) is designed based on Sagnac interferometer for measuring variation of temperature and stress simultaneously. The mutual interference of dual-parameter is avoided in this sensor system successfully. The measured stress sensitivity is -0.150 nm/KN and the temperature sensitivity is 0.0113 nm/°C on the dual-parameter system.

13:00-14:30 **Lunch**

Wednesday, 11 September 2019 | Special session - Waves in Complex Photonic Media: Fundamentals and Device Applications I

Chair: Luca Dal Negro, Boston University, USA

14:30-14:50 **Blind Ghost Imaging (O40)**

Jacopo Bertolotti
University of Exeter, Exeter, United Kingdom
Invited speaker

When light is multiply scattered by a disordered medium, the spatial information gets scrambled to the point that anything one would like to image appears as a shapeless halo. Conventional imaging technique are not applicable to this case as, without a detailed knowledge of the scattering medium, it is impossible to predict the paths followed by the light. Although the information is scrambled, it is not lost, and it leaves a signature in the correlations of the scattered intensity patterns. Here we will show that the light transmitted and the light reflected by a optically dense disordered slab are correlated, and that these correlations can be exploited to perform Ghost Imaging without ever knowing the patterns illuminating the object, thus allowing us to reconstruct the image of an object hidden behind a scattering layer using only the reflected light, which never interacts with the object.

14:50-15:10 **Second harmonic generation in complex assemblies of oxides nanoparticles (O41)**

R. Savo[1], A. Morandi[1], F. Kaufmann[1], F. Timpu[1], M. R. Escal[1], M. Zanini[2], L. Isa[2] and R. Grange[1]
[1]Optical Nanomaterial Group, Institute for Quantum Electronics, Department of Physics, ETH Zurich, Switzerland
[2] Laboratory for Interfaces, Soft Matter, and Assembly, Department of Materials, ETH Zurich, Zurich, Switzerland
Invited speaker

Second Harmonic Generation (SHG) is a well-known process exploited to generate new optical frequencies in nonlinear crystals and requires strict phase-matching conditions to work efficiently, limiting the applications of single crystals to a specific pump wavelength. Complex photonic materials with χ(2) nonlinearity offer a valuable approach to overcome these limitation by exploiting their structural disorder to create relaxed phase-matching conditions in the so-called Random Quasi-Phase Matching (RQPM) regime. So far, RQPM has been observed only in macroscopic polycrystalline structures with crystalline domains of several microns, but this scheme is expected for any domain size. Evidences of RQPM in aggregates with nano-sized domains are missing, mainly due to fabrication limitations, although scaling down this peculiar phase-matching mechanism to miniaturized structures might open for applications in integrated photonics.

15:10-15:30 **3D light localization in hyperuniform sub-random media (O42)**

F. Sgrignuoli[1], and L. Dal Negro [1,2,3]
[1] Department of Electrical and Computer Engineering & Photonics Center Boston University, Boston, USA
[2] Department of Physics, Boston University, Boston, USA
[3] Boston University, Division of Materials Science and Engineering, Brookline, USA
Invited speaker

Since the discovery by P.W Anderson that strong disorder can inhibit electronic transport, the quest for an optical counterpart of light localization has motivated an intense research activity. Indeed, the understanding of the mechanism of vector wave localization in dielectric systems opens exciting opportunities for the realization of more efficient active photonic devices. However, the light localization transition in three-dimensional (3D) random media has not been

unambiguously demonstrated. Moreover, recent theoretical work shows that near-field coupling effects between resonant particles prevents the occurrence of Anderson localization of light, thus rekindling the effort to develop novel strategies. In this talk, we will discuss our theoretical work on light localization in random media with hyperuniform geometry and novel structural correlation properties. In particular, we will discuss the transport and vector localization properties of novel aperiodic 3D structures generated from sub-random low-discrepancy sequences. These sequences, which are used in Quasi-Monte Carlo sampling where they reduce undesired structural correlations, offer unique opportunities for the design of a novel class of complex media with enhanced localization properties. By using the rigorous dyadic Green's matrix spectral method with electric and magnetic scattering contributions, we will discuss the light localization properties of complex media generated according to the Halton, Sobol, and Latin-Hypercube quasi-random sequences. Our study demonstrates vector light localization in these media by evaluating the Thouless conductance and by performing a finite-size scaling analysis. These results establish hyperuniform sub-randomness as a novel approach to 3D light localization beyond traditional uniform random media.

15:30-16:00 **Coffee break**

16:00-16:20 **Optimal photonic state discrimination via quantum stochastic walks (O43)**

Filippo Caruso

Invited speaker

Recent theoretical and experimental efforts have shown the remarkable and counterintuitive role of noise in enhancing the transport efficiency of complex systems and biological light-harvesting structures. In the last years we have successfully simulated these effects with optical fiber-cavity networks, integrated waveguide arrays, and even via genetically engineered excitonic networks. Here, since quantum tomography is very expensive in terms of resources, we analytically and numerically exploit bio-inspired quantum stochastic walks on complex networks to optimally and efficiently discriminate between multiple quantum states. In the case of binary discrimination of equally probable pure two-level photonic states, we show that the network dynamics asymptotically implements the effect of the already-known optimal measurement projectors for the discrimination problem. These results pave the way for novel optimal learning quantum machines becoming crucial for dealing with quantum data with quantum processors, as classical supervised learning does with classical data.

16:20-16:40 **Spatiotemporal Shaping of Optical Fields Using Metasurfaces (O44)**

Amit K. Agrawal

The National Institute of Standards and Technology (NIST), USA

Invited speaker

We demonstrate the ability of dielectric metasurfaces to both shape (a) the temporal evolution of ultrafast optical pulses, and (b) the spatial wavefront of light, in an arbitrary way. We finally discuss their applications towards creating integrated nanophotonic interfaces with quantum systems.

EOS Membership

ABOUT EOS

History

The European Optical Society (EOS) was founded in 1991. The purpose of the society is to contribute to progress in optics and related sciences, and to promote their applications at the European and international levels, by bringing together individuals and legal entities involved in these disciplines and their applications. EOS is a not for profit organisation and serves as the joint forum for all individuals, companies, organisations, educational institutions, and learned and professional societies, who recognise the opportunity and challenge that a common European base provides for the development of optics in its broadest sense. EOS organises recognized topical meetings, conferences, workshops and other events, publishes journals and is an important player on the European level. 22 national optical societies and a great number of individuals and companies are currently members of EOS (www.myeos.org).

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- Publication of JEOS:RP, the electronic Journal of the European Optical Society - Rapid Publications (https://jeos.springeropen.com/)
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