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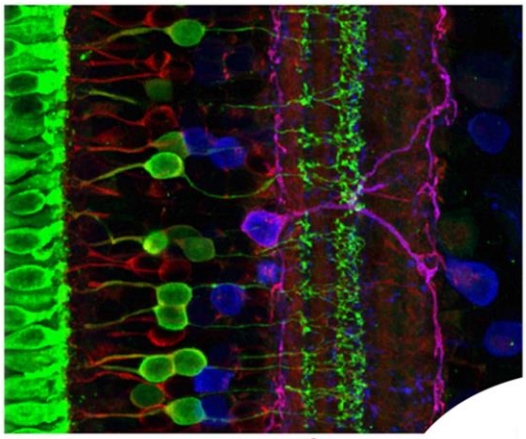
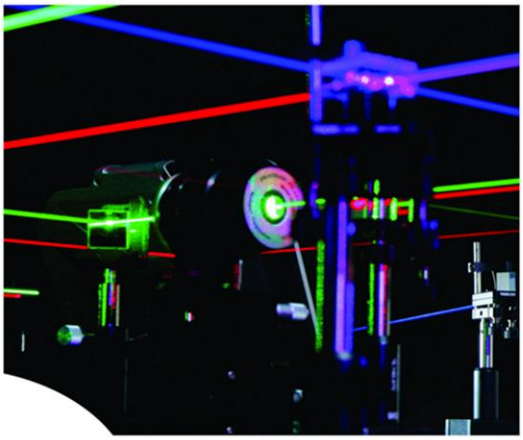
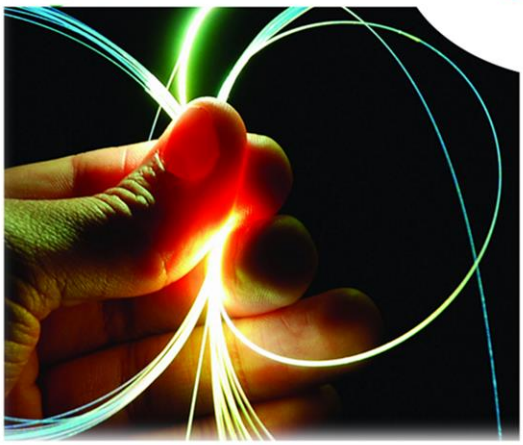




International School on Light Sciences and Technologies



Core: Light in Sources, Health and Medicine

Santander 20-24 de junio de 2022
(Sala Riancho, Palacio de la Magdalena, Santander)

PROGRAM

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Summary

Photonics is the science and technique of generating, controlling, propagating, storing and detecting light waves and photons, which are particles of light. Photonics is the field of Light Sciences and Technologies.

Light plays a vital role in our daily lives and is being an imperative cross-cutting discipline of science in the 21st century. It has revolutionized medicine, made possible international communication via the internet, enabled sustainable development and provided solutions to global challenges in education, energy, environment and agriculture. It continues to be a key discipline to link cultural, economic and political aspects of the global society. Today, it is widely accepted that the present century will depend as much on Photonics as the 20th century depended on electronics.

The United Nations Organization (UN) has recognized the **key or essential** role of Light Sciences and Technologies to raise global awareness and proclaimed 2015 as the International Year of Light and Light-based Technologies (IYL 2015). Aware of the key role of Photonics in the economies and in the societies of the XXI century, the UIMP has decided to create the "**International School on light Sciences and Technologies (ISLiST)**".

This school is envisioned to be a worldwide top International forum (every fourth week of June) on *Light Sciences and Technologies* in the framework of a *"special top university" that is recognized as the "university of universities"* and in a privileged environment "the Royal Magdalena Palace" in Santander, Cantabria, Spain. Each edition of this international school will have an intensification or main core in a specific application area and additional current hot topics. ***Light Energy and Advanced Fabrication*** is the core of this 2022 edition.

ISLIST has been conceived as a great opportunity to review, actualize and improve the knowledge of ***scientists, professionals and technicians***; to contribute to the education and to enhance the motivation of ***PhD students***; to offer an ideal frame for ***networking*** and also to contribute to the education of the **citizens.** It is also a great opportunity to ensure that **policymakers, entrepreneurs**, and other key "actors" will be aware of the problem-solving potential of Photonics.

Fifteen (15) **highly renowned** professors and researchers from the most prestigious worldwide institutions and, as well, responsibles of most reputed international Photonic Scientific Organizations and some politicians will participate in this meeting.

The **City Council of Santander** will offer to ISLIST attendees a **Reception** at the Royal Palace of Magdalena**.** This Santander Happy Hour (with snacks and drinks) will be an optimum time to networking.

In this edition, Justiniano Casas Award from the image committee of SEDOPTICA will be delivered at the end of the afternoon, June 20, 2022**.**

To be able to reach this ambitious program this International School of UIMP is sponsored by **Gobierno de Cantabria** covering a very relevant part of the organization costs of V ISLIST edition.

The international grants and other additional costs are covered by the very generous and key contribution of our collaborators: **Gold** (**Fyla Lasers and Prysmian**), **Silver** (**Aragón Photonics** and **Ambar Telecommunications**) and **Bronze** (**Ayuntamiento de Santander, ERZIA, Lasing** and the **Photonics Engineering Group** of the University of Cantabria.

Without these Sponsor and Collaborators, this top quality school and over 30 Student Grants (already allocated from over 14 different nationalities) would not have been possible. The UIMP, the direction of this event and the scientific community using Light are grateful with the generosity of all these Organizations and all the Invited Speakers. Thank you so much!

Goals

To actualize and improve the knowledge of ***scientists, professionals and technicians***; to contribute in the education and to enhance the motivation of ***PhD students***; to offer an ideal frame for ***networking***. It is also a great opportunity to ensure that policymakers, politicians and citizens in general terms will be made aware of the problem-solving potential of Photonics.

Overview

The event will take place from Monday (June 20, 2022) to Friday (June 24, 2022). Two and half first days one and will be focused on key subjects concerning Light in Energy and the associated impact in the society. The rest of the week will be focused on the review of the current situation and the identification of challenges and trends in Light in Advanced Fabrication. Two round-tables will also take place. The first one (Tuesday afternoon) to analyse challenges of light technologies on energy and, the second one, (Thursday afternoon), to identify challenges face on the creation of photonic technology based new companies.

General Schedule

Time	Monday 20th	Tuesday 21st	Wednesday 22nd	Thursday 23rd	Friday 24th
9:30		**Prof. Christian Sattler** Head, of solar Chemical Engineering German A. Center, Germany Solar Fuels and Electricity by using Sunlight concentrating Systems	**Prof. Carlos Molpeceres** Director, Laser Institute, UPM, Spain Laser Technology in Photovoltaics	**Dr. Habil. César Jauregui Misas** Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany Fiber Optic Ultrafast laser for Advanced Fabrication: currents and trends	Prof. **Beat Neuenschwander** Lead Scientist, laser processing Expert University of Berna, Suiza High throughput and high quality laser ablation and Texturing techniques with pulsed lasers
10:15	Opening Remarks				
10:40	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00	**Prof. Christian Bressler** Lead Scientist and Group Leader, XFEL, Hamburg, Germany Extremely intense X-ray Free Electron Laser looking for new Science and Tech. Opportunities	**Mr. Mikel Bengoa** General Director, Coherent Rofin, Spain Laser technology in Advanced Batteries fabrication	**Prof. E. Michael Campbell** Director, Lab. For laser Energetics (LLE), University of Rochester, USA Laser driven fusion energy: status, challenges and the future (RTalk)	**Prof. Carlos Molpeceres** Director, Laser Institute, UPM, Spain Microaditive Manufacturing using Laser Direct Write	**Prof. Beat Neuenschwander** Lead Scientist, laser processing Expert University of Berna, Suiza Light manipulation and control techniques in industrial processes with pulsed lasers
12:10	**Prof. JM López-Higuera** Head, Photonic Engineering Group, University of Cantabria, Spain Light in Energy and Advanced Manufacturing	**Prof. Jordi Martorel** Leader, organic nanostructured Photovoltaic, ICFO; Spain Organic Nanostructured Photovoltaics	**Prof. Javier Solis** Director, Ultrafast Nonlinear and nanoscale Photonics Department, Optics Institute/CSIC,Madrid, Spain Direct writing of photonic structures and element redistribution processes with femtosecond laser light	**Prof. Maite Flores** EOS´s Secretary, Group Leader, Univ. of Santiago of Compostela, Spain Intense light, a potential tool to be applied in medical imagin	12:30 Closing Remarks, ISLIST-2023 Announcement and Diploma Delivery
13:30-15:00	Lunch	Lunch	Lunch	Lunch	
15:30	**Prof. Carlos del Cañizo** Director, IES, UPM Photovoltaics for highly efficient energy conversion and storage	Round Table I Light on Energy: Challenges to face *Prof. Christian Sattler* *Prof. Michael Campbell (on-line)* *Prof. Carlos del Cañizo* *Prof. A. Gómez-Expósito* Moderator: JM López-Higuera	**Prof. Martin Wegener** Director, Institute of Nano-technology, KIT, co- Founder of Nanoscribe, Germany 3D and 4D Nanoprinting	Round Table II Challenges on advanced manufacturing and creation of New Photonic companies *Prof. Martin Wegener,* *Dr Fabien Guillemot* *Prof. Molpeceres* Moderator: JM López-Higuera	
16:40	**Prof. Antonio Gómez Expósito** Lead Scientist, energy systems Expert Solar Energy in the electrical systems: the Spanish case 2050		**Dr. Fabien Guillemot** CEO, POIETIS, France Towards a 4D Bioprinting Industry in the fourth industrial revolution		
17:55	**Justiniano Casas AWARD Ceremony (SEDOPTICA)**		**Family Photo** **Santander City Council Reception**		

PROGRAM

Monday, 20

10:15 h

Opening Ceremony

10:40 h / **Break**

11:00 h / Opening Invited Talk

Extremely intense X-ray Free Electron Laser looking for new Science and Technology Opportunities

Prof. Christian Bressler

Lead Scientist and Group Leader, Max Planck Institute for the Structure and dynamics of matter, European XFEL, Hamburg, Germany

12:10 h / Invited Talk

Light in Energy and Advanced Fabrication

Prof. José Miguel López-Higuera

Director, ISLIST and Head of Photonic Engineering Group of UC, CIBER-BBN and IDIVAL, Spain

13:30-15:00 h / **Lunch Time**

Afternoon: **Light in energy**

15:30 h / Invited Talk

Photovoltaics for highly efficient energy conversion and storage

Prof. Carlos del Cañizo

Director, Solar Institute of the Polytechnic University of Madrid, Spain

16:40 h / Invited Talk

Solar Energy in the Electrical Systems: The Spanish case for 2050

Prof. Antonio Gómez Expósito

Lead Scientist and expert in energy systems, University of Seville, Spain

17:55 h / Special Event

Justiniano Casas Award Ceremony

Image Committee of SEDOPTICA

Tuesday, 21

Morning

9:30 h / Invited talk

Solar Fuels and Electricity by using Sunlight concentrating Systems

Prof. Christian Sattler

Director of DLR´s Institute of Future Fuels, German Aerospace Centre (DLR), Germany

10:40 h **/ Break**

11:00 h / Invited Talk

Laser technology in Advanced Batteries fabrication

Mr. Mikel Bengoa

General Director, Coherent Rofin Spain, Pamplona, Spain

12:10 h / Invited Talk

Nano-photonics in energy conversion and solar fuel production

Prof. Jordi Martorell

Group Leader, Organic Nanostructured Photovoltaics, ICFO, Barcelona, Spain

13:30-15:00 h / **Lunch Time**

Afternoon*:* **Light in Energy: Challenges to face**

15:30 h- 17:55 / Round Table I

Light in Energy: Challenges to face

Prof. **Christian Sattler, Director** of DLR´s Institute of Future Fuels, German Aerospace Centre (DLR), Germany

Challenges to face to reach profitable green energy systems based on Solar Fuels

Prof. **E.M. Campbell, Director,** Laboratory for laser Energetics (LLE), University of Rochester, USA **(online)**

Challenges to face to reach profitable laser driven fusion energy

Prof. Carlos del Cañizo, Director IES, Universidad Politécnica de Madrid, Spain.

Challenges to face to improve the efficiency of Photovoltaic solar cells

Prof. Antonio Gómez-Expósito, Lead Scientist expert in energy systems, University of Seville, Spain

Challenges to face to reach efficient and sustainable Solar energy systems.

Prof. JM López-Higuera, Director ISLiST, **Moderator**

Wednesday, 22

Morning
9:30 h / Invited Talk
Laser Technology in Photovoltaics

Prof. Carlos Molpeceres
Director Laser Centre of Polytechnic University of Madrid, Spain

10:40 h / **Break**

11:00 h / Invited Talk
Laser driven fusion energy: status, challenges and the future (recorded)

Prof. Michael Campbell
Director, Laboratory for laser Energetics (LLE), University of Rochester, USA

12:10 h / Invited Talk

Direct writing of photonic structures and element redistribution processes with femtosecond laser light
Prof. Javier Solis
Director of Laser Processing Group, Optics Institute Daza de Valdes, CSIC, Madrid, Spain

13:30 -15:00h / **Lunch Time**

Afternoon:

15:30 h / Invited Talk
3D and 4D Nanoprinting
Prof. Martin Wegener
Director, Institute of Nanotechnology at KIT, Karlsruhe, Co-founder of Nanoscribe, Germany

16:40 h / Invited Talk
Towards a 4D Bioprinting Industry in the fourth industrial revolution
Dr. Fabien Gullemot
CEO and Co-founder of, Poietis, Aquitanie, France

17:55 h ISLiST Family Photo

18:05 h / Special Event

Santander Council Reception

The Santander City Council will offer to ISLiST attendees a special reception that, in addition, will be an optimum time to share experiences and promote networking.

Thursday, 23

Morning
9:30 h / Invited Talk
Fiber Optic Ultrafast lasers for Advanced Fabrication: currents and trends

Dr. Habil. César Jauregui Misas
Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany

10:40 h / **Break**

11:00 h / Invited Talk
Microaditive Manufacturing using Laser Direct Write
Prof. Carlos Molpeceres
Director Laser Centre of Polytechnic University of Madrid, Spain

12:10 h / Invited Talk
Intense light, a potential tool to be applied in medical imaging

Prof. Maite Flores
Group Leader and Secretary of the European Optical Society University of Santiago de Compostela, Spain,

13:30-15:00 h / **Lunch Time**

Afternoon: **Challenges on Light in Medicine**

15:30h- 17:45 / Round Table II
Creation of New Photonic companies: Challenges to face

Prof. Martin Wegener, **Director and Chair,** Nanophotonic Research Institute of Nanotechnology at KIT, Karlsruhe, Germany
Dr. Fabien Guillemot, Founder, Chief Executive Officer, CEO, Poietis, France
Prof. Robert R. Thomson, Co-founder of Optoescribe, Heriot Watt University, Edinburgh, UK
Prof. Carlos Molpeceres, Director of Laser Centre of University Polytechnic of Madrid, Spain

Prof. JM López-Higuera, Director ISLiST, **Moderator**

Friday, 24

Morning

9:30 /Invited Talk

High Throughput and high quality laser ablation and texturing techniques with pulsed lasers

Prof. Beat Neuenschwander
Head, Institute for Applied Laser, Photonics and Surface Technologies ALPS, Switzerland.

10:40 h / **Break**

11:00 /Invited Talk

Light manipulation and control techniques in industrial processes with pulsed lasers

Prof. Beat Neuenschwander
Head, Institute for Applied Laser, Photonics and Surface Technologies ALPS, Switzerland.

12:15 h

Closing Remarks, Announcement of ISLiST 2023 and Diploma Delivery

The UIMP official diploma will be delivery to each attendee by ISLIST invited speakers.

Abstracts/Bios

Highly renowned Professionals and Scientists from the most prestigious Organizations will highlight the importance of Photonics for a new world. Key trends and challenges will be identified in several areas of paramount importance.

Invited Speaker

Prof. Christian Bressler

Group Leader
Max Planck Institute for the Structure and dynamics of matter

European XFEL

June 20 / 11:00 h
Opening Invited talk

Prof. José Miguel López-Higuera

Head
Photonic Engineering Group of University of Cantabria, CIBER-BBN and IDIVAL, Spain

June 20 / 12:10 h
Round Tables I &II moderator

Talk&Abstract

Extremely intense X-ray Free Electron Laser looking for new Science and Technology Opportunities

European XFEL is a highly brilliant femtosecond x-ray source, enabling structural dynamics experiments atomic-scale spatial and femtosecond temporal resolution. It features currently 6 operational beamlines covering the soft and hard x-ray spectral regions, each specialized for dedicated studies in various scientific disciplines including physics, chemistry, biology and material sciences.

In this overview I will present the arsenal of scientific tools available at European XFEL and provide a few case examples, where brilliant XFEL radiation sheds new light on contemporary problems. These include the early dynamics in potential functional molecular systems for photovoltaic and molecular switching applications, but also in fundamental studies of many-body interactions in disordered media. We have recently created a *Virtual Lab*, which fully simulates femtosecond x-ray experiments at one of the beamlines, and a brief presentation will be given.

Light in Energy and Advanced Fabrication

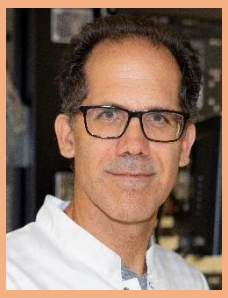
Light Science and Technologies (Photonics) now touches almost every area of our lives. It is considering a key technology for the development of the counties in this 21st century. Photonics is essential in the conversion of sunlight to electrical, thermal, and chemical energy and in the meantime it makes an important and significant contribution to reducing energy consumption. Light based technologies are also essential for the industry 4.0 and many of their involved processes including the manufacturing using laser based techniques.

In this talk, after a brief mention of what should be understood as the Photonics Field we will go into the potential uses of light based technologies in Energy and Advanced Manufacturing in a wide set of their processes. Several significant cases will be presented and discussed in the presentation. After that, the attendees will be aware of the significant impact of Light Sciences and Technologies on hot topics concerning the core of this V ISLIST edition.

Biography

Prof. Christian Bressler is Leading Scientist at European XFEL and Professor of Physics at the University of Hamburg. He has been developing the field of ultrafast x-ray science over the past 20 years at several synchrotron and free electron laser facilities. He received his PhD from the Free University of Berlin, and spent his postdoctoral period at SRI International in Menlo Park, California. He relocated to Switzerland, where he became 2002 assistant professor for physics at the University of Lausanne and then at the Ecole Polytechnique Fédérale de Lausanne (EPFL). In 2009 he moved to Hamburg as Leading Scientist and designed, implemented and inaugurated the Femtosecond X-Ray Experiments Instrument at European XFEL, while pursuing a rigorous research programme in structural dynamics research. This was accompanied by several research campaigns with his group at several FEL and SR facilities leading to an improved instrument design. He has served on several national and international advisory boards, and connected to the scientific community via more than 180 invited presentations and more than 80 publications. His current research interests include aqueous solvation dynamics of reacting solutes and ultrafast properties of functional molecular materials.

Prof. López-Higuera is the founder and head of the Photonics Engineering Group of the University of Cantabria, CIBER-BBN of Institute of Health Carlos III and IDIVAL of Hospital Universitario Marqués de VAldecilla, Spain. He is a Member of a wide set of international Committees of Conferences, R&D Institutions, and Companies in the area of photonic sensing. His work is focused on optical sensor systems and instrumentations for any sector application. He has worked in a wide range of R&D&i projects, acting in more than 100 of them as manager. He has contributed with more than 800 research publications and 25 patents and also directed 20 PhD theses. He has worked as an editor and co-author of four R&D international books, as a co-editor of several conference proceedings and Journals. He is co-founder of three technology-based companies. Prof. López-Higuera is a Fellow of OSA, Fellow of SPIE, Fellow IAAM, Fellow VEBLEO, Senior of IEEE and a Member of the Royal Academy of Medicine of Cantabria.



Prof. Carlos del Cañizo
Director
Solar Energy Institute, University Politechnique of Madrid, Spain

June 20 /15:30 h
June 21 / 15:30
Round Table I

Photovoltaics for highly efficient energy conversion and storage

Photovoltaic Solar Energy (PV) is becoming a keystone of a decarbonized energy system, making the dream of using directly the sun radiation to produce electricity come true. In the talk, the fundamentals of photovoltaic conversion will be reviewed to better understand the technology improvements that have succeeded in making PV a scalable, cost-competitive and reliable power source. The efficiencies reached by current PV devices will be benchmarked against the theoretical limiting ones, bringing to light the challenges ahead to keep the technology progress up.

In a second part of the talk, a proposal to address the need of storage coming from the intermittent nature of the solar resource will be presented, in which the energy stored at ultrahigh temperature is converted back into electricity by thermophotovoltaic devices.

Prof. Carlos del Cañizo is full professor at UPM, active in photovoltaics since 1994. He is Director of the Instituto de Energía Solar, an R&D center belonging to the UPM founded in 1979. He has lengthy experience in the manufacturing and characterization of solar cells, and also in the field of silicon refinement. He has participated in around 50 R&D projects, published more than 60 papers, presented more than 110 contributions in conferences, and contributed to 5 patents. He has been visiting scientist at MIT and Harvard Real Colegio Complutense in the academic year 2014-2015. He is co-founder of the spin-off company Thermophoton, created in 2021 to develop a novel technology for energy storage.

Prof. Antonio Gómez Expósito

Lead Scientist expert in energy systems
University of Seville, Spain

June 20 / 16:40 h

June 21 / 15:30
Round Table I

Solar Energy in the Electrical Systems: The Spanish case for 2050

After a review and analysis of the evolution of solar energy in the world, the potential of Photovoltaic (PV) energy in Spain is analysed, focusing especially on self-consumption. Finally, taking as a starting point the PNIEC (National Integrated Energy and Climate Plan 2021-2030) scenario for 2030, a hypothetical scenario for the 2050 horizon is analysed, where the gap left by the substitution of the nuclear and combined cycle power plants by solar energy, and an estimate of costs and storage needs are made to meet current demand plus that of a fully electrified light vehicle fleet.

Prof. Antonio Gómez Expósito, is the Endesa Chair Professor at the Department of Electrical Engineering, University of Seville, Spain, which he chaired for twelve years. He has coauthored over 350 publications, including a dozen textbooks and monographs about Circuit Theory and Power System Analysis. He is a Fellow of the IEEE and past editor of IEEE Transactions on Power Systems. Currently, he serves as Vice Editor-in-Chief of the Journal of Modern Power Systems and Clean Energy. He has received many recognitions, such as the IEEE/PES Outstanding Power Engineering Educator Award (2019), the Golden Insignia granted by the Spanish Association for the Development of Electrical Engineering (2013) and the Research and Technology Transfer Award, granted by the Government of Andalusia (2011). In 2013 he was elected a member of the Royal Sevillian Academy of Sciences, and became engaged with the Board of Managers of the Spanish TSO (REE) since 2018 to 2020.

MONDAY END

Prof. Christian Sattler

Director
DLR´s Institute of Future Fuels,
German Aerospace Center (DLR)
Germany

June 21 / 9:30:00 h

June 21 / 15:30
Round Table I

Solar Fuels and Electricity by using Sunlight concentrating Systems

The production of electricity and fuels by concentrated solar radiation is an option for efficient large-scale processes.

The radiation can either be used to replace fossil fuels for heating established processes like steam or dry reforming of methane. Or at higher temperature to drive thermochemical cycles for water or CO_2 splitting into hydrogen, oxygen and CO. Presently most of the technologies are developed with high flux solar simulators. However, some scale-up demonstrations on solar towers have been operated and the first industrial plants are foreseen to be set-up until 2024. The concentrator systems, mainly heliostat fields, are similar to installations for power production. However, the chemical reactions require a different heating regime. Therefore, a special optics and control systems have to be developed to achieve the very high temperatures necessary to carry out thermochemical cycles constantly and homogeneously in the whole solar receiver efficiently.

The presentation will give an overview of the concentrating solar fuel production processes. It will give insight in how to design the required heliostat fields, secondary optics, and control systems including the integration of AI.

Prof. Sattler is acting Divisional Board member for Energy and Transport of the German Aerospace Center (DLR) and director of DLR's Institute of Future Fuels. Since 2015 he is also professor for solar fuel production at the Technical University of Dresden. The main area of his work is the production of fuels especially hydrogen by solar thermo- and photochemical processes. He serves as vice president of the research association Hydrogen Europe Research a member of the European Clean hydrogen Partnership and is the national representative to tasks of the IEA's SolarPACES.

Mikel Bengoa

General Director
Coherent Rofin Spain
Pamplona, Spain

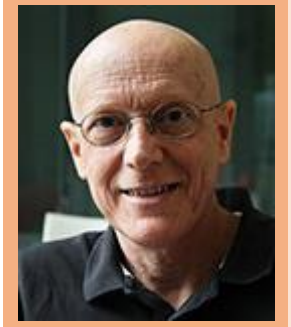
June 21 /11:00 h
Invited Talk

Laser technology in Advanced Batteries fabrication

The transition from internal combustion engines to electrical power drives in automotive industry is generating a number of challenges and opportunities for laser material processing applications. The presentation will introduce the new demands created by the e-Mobility transformation and, in particular, in battery fabrication, and the strategies that have been followed to overcome those challenges from a laser design perspective.

Mr. Mikel Bengoa is and Industrial Engineer with an executive Master in Marketing and Sales Management.
He has more than 30 years' experience in industrial laser applications and in different positions including technical, sales and management. Mr Bengoa has been worked as directly responsible of the integration of laser technology for materials processing in industries like automotive, white goods, flexible packaging, machine tools, medical devices, etc.

In the currents, he is Sales Manager Industrial Laser Sources South Europe in the company COHERENT Inc.



Prof. Jordi Martorell

Nano-photonics in energy conversion and solar fuel production

In the talk I will review why the implementation of nano-photonic structures is key to achieve high performance organic solar cells, paying special attention on semi-transparent devices. Later, I will introduce novel photonic structures that can be used in combination with wide bandgap perovskite

Since 2011 **Prof. Jordi Martorell** (JM) has been focusing the core of his research in studying the role played by optics or photonics in the transformation of sun energy into other forms of energy. Among the significant contributions made stand out the world record performance for semi-transparent single junction organic photovoltaic (OPV) cells by applying a novel photonic control on such kind devices, the implementation of a new

Group Leader
Organic nanostructured Photovoltaics, ICFO, Barcelona, **Spain**

June 21 /12:10 h

photovoltaic cells for stray light recycling in a system emitting broadband polarized light. I will also discuss photon recycling and antireflection dielectric multilayers for achieving ultimate efficiencies in a planar geometry perovskite solar cell. Finally, I will discuss the role of nano-photonics in photo-electrochemical cells for an optimal hydrogen generation or CO_2 reduction for the production of solar fuels.

light trapping configuration to enhance the performance of thin film cells, and the design of a new cavity concept capable to confine electromagnetic energy in a non-harmonic two-resonant mode for the most effective light absorption in OPVs. More recently, JM considered novel nano-photonic concepts to achieve an efficient transformation of sun energy into chemical energy or, in other words, an energy that can be effectively stored. In 2021 Jordi Martorell was one of the co-founders of VITSOLC, an ICFO spin-off company with the mission to develop a transparent photovoltaic technology.

Round Table I

June, 21 / 15:30 h

Light in Energy: Challenges to face

Prof. Christian Sattler, Director, Solar Chemical Engineering Aerospace Centre, Institute of Solar Research, Germany

Prof. E.M. Campbell, Director, Laboratory for laser Energetics (LLE), University of Rochester, USA (online)

Prof. Carlos del Cañizo, Director IES, Universidad Politécnica de Madrid, Spain.

Prof. Antonio Gómez-Expósito, Lead Scientist expert in energy systems, University of Seville, Spain

Prof. JM López-Higuera, Director ISLiST, **Moderator**

Prof. Carlos Molpeceres

Director
Centro Láser, Universidad Politécnica de Madrid, Spain

June 22 /9:30 h

June 23, Round Table II

Laser Technology in Photovoltaics

Lasers have been used in microelectronic and photovoltaic (PV) industry for decades but, more recently, laser processing has appeared as a key enabling technology to improve efficiency and to reduce production costs in high efficiency solar cells fabrication.

In this presentation we will discuss the present role of laser technology in the photovoltaic industry, both in cell and module manufacturing with specific examples of wafer and cell processing and contact formation in silicon PV technologies, monolithic interconnection in thin film technologies and solutions for soldering and encapsulation in module fabrication. In addition, the will discuss the impact of laser technology in the present and future development of Building Integrated Photovoltaics (BIPV), and area in which lasers offer outstanding solutions for product customization.

Finally we will present the impact that laser-based advanced manufacturing techniques, and in particular those based in ultrafast laser processing, are having in the present research of cutting edge concepts that will define the photovoltaics of the future.

Prof. Carlos Molpeceres, Director of the Laser Center UPM (www.upmlaser.upm.es) and Full Professor at Department of Applied Physics and Materials Engineering at Universidad Politécnica de Madrid, the largest and oldest Technical University in Spain. He is also Leader of the UPM Research Group Advanced Laser-Based Manufacturing mainly focused in the development of laser micro and nano processing of materials. His group coordinates the activity in Spain of Appolo Hub (www.appolohub.eu), an European network of laser laboratories that provides laser micromachining assessment services for industry partners. He has been or still is Member of different International Committees of Conferences (SPIE, PVSEC, ICALEO, LANE, etc.). Currently his research activity is focused in the development of new laser micro and nano processing techniques, using state of the art laser technology, in the fields of energy, flexible electronics, tissue engineering and translational oncology research.

Prof. Michael Campbell
Director
Laboratory for laser Energetics (LLE), University of Rochester, **USA**

June 22 / **11:00 h**

June 21 / 15:30
Round Table I

Laser driven fusion energy: status, challenges and the future

Recorded talk

Prof. Campbell is an internationally known expert in inertial fusion, high-energy-density physics, high-power lasers and their applications, and advanced energy technologies including Generation IV nuclear fission reactors and biofuels. He has won numerous awards including the Department of Energy's E. O. Lawrence Award, the American Nuclear Society's Edward Teller Award, the American Physical Society's John Dawson Award, the Department of Energy's Excellence in Weapons Research Award, and the Leadership Award of Fusion Power Associates. He is a Fellow of the Optical Society of America, American Physical Society, and the European Institute of Physics. Dr. Campbell has been a member of numerous committees providing advice and strategy, including the Department of Defense, Missile Defense Agency, National Academy of Sciences, Los Alamos National Laboratory, Berkeley National Laboratory, University of Texas, the National Research Council of Canada, Missile Defense Agency, and Lockheed Martin Corporation. He served on the Board of Evans and Sutherland Corporation and has worked in various scientific and leadership positions at both federal laboratories and the private sector including Lawrence Livermore National Laboratory, General Atomics, Logos Technologies, and Sandia National Laboratories.

Prof. Javier Solis

Director

Ultrafast, Nonlinear and Nanoscale Photonics Department,
Institute of Optics,
National Research Council (CSIC), Madrid, Spain.

June 22 / 12:10 h

Direct writing of photonic structures and element redistribution processes with femtosecond laser light

In 1996, two different research groups independently demonstrated the feasibility of using a focused fs-laser beam to modify the refractive index of a small volume inside a transparent material, enabling the production of optical waveguides in a direct writing approach. Since the pioneering works of the groups of K. Hirao and E. Mazur, and in spite of the relatively small refractive index change accessible by conventional fs-laser direct writing, this technique has been used to produce a wide variety of photonic (and also micro-fluidic) devices ranging from simple passive waveguides to waveguide lasers or photonic lanterns.
During the first part of the talk I will describe the fundamentals of this direct writing technique, its main advantages and limitations, as well as a number of relevant application examples. In the second part I will describe an alternative route for the production of high index contrast photonic components based on using high repetition rate fs-lasers to generate controlled, local compositional changes in a pre-designed glass. Femtosecond laser induced element redistribution (*FLIER*) processes provide an excellent route generate high contrast, refractive structures for photonics applications but also for other applications like local glass hardening.

Dr. Javier Solis is Research Professor at the Institute of Optics (IO) of the National Research Council of Spain (CSIC) where he is presently Head of the Department of Ultrafast, Nonlinear and Nanoscale Photonics. He has also been Director (2003-2008) and Deputy Director (2000-2003) of the IO. Since 1992 he is responsible of the Ultrashort Laser Pulse Laboratory of the Laser Processing Group (LPG). At present his research interests include: laser-matter interaction, laser processing for optical applications, ultrafast laser micro-and nano-structuring of materials, ultrafast dynamics and non-linear optics. He has published more than 200 research papers in international research journals in these topics. He is Senior Member of OPTICA.

Prof. Martin Wegener

Director
Institute of Nanotechnology at KIT, Karlsruhe, Co-founder Nanoscribe, Germany

June 22 / 15:30 h
June 23 / 15:30 , Round Table II

3D and 4D Nanoprinting

After an introduction into the field of 3D laser micro- and nanoprinting based on two-photon absorption and a description of the current state-of-the art, I review our recent progress. This includes stimulus responsive 3D architectures ("4D") based on liquid-crystal elastomers, the 3D director field of which is imposed during the laser printing process, and our work on replacing two-photon absorption by two-step absorption. Unlike two-photon absorption, which requires modelocked femtosecond lasers, two-step absorption can be induced by compact low-power continuous-wave semiconductor laser diodes.

Prof. Martin Wegener, after completing his Diplom and PhD in physics at Johann Wolfgang Goethe-Universität Frankfurt (Germany) in 1986 and 1987, respectively, he spent two years as a postdoc at AT&T Bell Laboratories in Holmdel (U.S.A.). From 1990-1995 he was professor (C3) at Universität Dortmund (Germany), since 1995 he is professor (C4, later W3) at Institute of Applied Physics of Karlsruhe Institute of Technology (KIT). Since 2001 he has a joint appointment as department head at Institute of Nanotechnology (INT) of KIT, since 2016 he is one of the three directors at INT. From 2001-2014 he was the coordinator of the DFG-Center for Functional Nanostructures (CFN) at KIT. Since 2018 he is spokesperson of the Cluster of Excellence 3D Matter Made to Order.

Dr. Fabien Guillemot

CEO and Co-founder

Poietis, Aquitanie, France

June 22 / 16:40 h
June 23 / 15:30
Round Table II

Towards a 4D Bioprinting Industry in the fourth industrial revolution

Main challenges for the manufacturing of tissue engineered advanced therapy medicinal products (ATMPs) relate to the standardisation of manufacturing processes and the improvement of tissue functionality, and cost-effectiveness and profitability of related treatments. Producing advanced therapy medicinal products remains a cumbersome process with costs, reproducibility and scalability issues.

Poietis develops biomanufacturing solutions based on Next-Generation Bioprinting (NGB). Based on Laser-Assisted Bioprinting, this new platform integrates automation and robotics technologies, and is coupled with online sensors – including cell microscopy. NGB is a paradigm shift since its driven by the Biology, and the need to control the cellular environment at the cell level to promote tissue self-organization.

Based on our experience on bioprinting full-thickness skin equivalents, we discuss how next-gen bioprinting technology should make it possible to overcome current tissue manufacturing bottlenecks and also provide new therapeutic opportunities.

Dr. Fabien Guillemot is the founder of Poietis, a bioprinting company which harnesses the Laser-Assisted Bioprinting technology to fabricate complex and customized tissues for regenerative medicine and pharmaceutical applications. He obtained his PhD in Materials Science in 2000 from the National Institute for Applied Sciences (Rennes, France). He was appointed in 2005 Senior Researcher at the National Institute for Health and Medical Research (INSERM, France). He initiated and led till 2014 the project Tissue Engineering Assisted by Laser (TEAL) which aimed at developing laser-assisted technologies for fabricating artificial tissues into which cells are organized into defined 3D micro-environments. Dr. Guillemot is the author of more than 50 articles in peer-reviewed journals and about 100 invited conferences.

Dr. Habil. César Jauregui Misas

Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany

June 23 /9:30 h

Fiber Optic Ultrafast lasers for advanced fabrication: currents and trends

This talk aims at providing the audience with a general overview on high-power, high energy ultrafast fiber lasers and some of their applications. In particular, the current state-of-the-art of ultrafast, high-power fiber lasers for advanced fabrication processes and light-matter interaction experiments will be reviewed. Additionally, the main challenges that this technology has been facing will be presented and the most practical solutions to them will be presented. Finally, an incursion in the future of high-power lasers will be made, including their architecture and predicted performance for the coming decades.

Dr. Habil. César Jauregui was born in Santander, Spain, in 1975. He received both his Telecommunication Technical Engineering degree and his Telecommunication Engineering degree at the University of Cantabria. In 2003, he got his Ph.D. degree at that same University. In 2005 he began a two-year post-doc stay at the Optoelectronics Research Centre, where he investigated the phenomenon of slow-light in optical fibers. Since 2007 he is working at the Institute of Applied Physics at the Friedrich-Schiller University in Jena. His primary research concerns are high-power fiber lasers, non-linear and thermal effects in optical fibers, as well as the design and fabrication of advanced fibers. César Jáuregui has co-authored several book chapters and more than 300 papers presented in conferences and published in scientific journals. He is a member of the technical program committees of the foremost conferences in fiber lasers as well as an editor in the J. Physics: Photonics.

Prof. Carlos Molpeceres

Director
Laser Centre, University Polytechnic of Madrid, **Spain**

June 23/11:00 h

June 23/ 15:30, round table

Microaditive Manufacturing using Laser Direct Write

Laser Direct Write Techniques, and in particular those encompassed under the general term Laser-Induced Forward Transfer (LIFT) are technologies intended to deposit small volumes of material into user-defined, high-resolution patterns preserving its characteristics and functionality. In this presentation we discuss their development from its origins to the present in which they are becoming a promising tool for the development of 2D and 3D microadditive processes.
In this presentation we will discuss the fundamentals of the technique together a general overview of the different materials and applications addressed, from simple metals and oxides to complex ceramics, polymers, biomolecules, and even living cells. Two particular examples, developed at Laser Center UPM, metallization of photovoltaic and flex electronics devices and single cell isolation and cell sorting for biomedical applications we will presented in greater detail to give an idea of the huge potential of these technologies in completely different strategic technological fields.

Prof. Carlos Molpeceres is the Director of the Laser Center UPM (www.upmlaser.upm.es) and Full Professor at Department of Applied Physics and Materials Engineering at Universidad Politécnica de Madrid, the largest and oldest Technical University in Spain. He is also Leader of the UPM Research Group Advanced Laser-Based Manufacturing mainly focused in the development of laser micro and nano processing of materials. His group coordinates the activity in Spain of Appolo Hub (www.appolohub.eu), an European network of laser laboratories that provides laser micromachining assessment services for industry partners. He has been or still is Member of different International Committees of Conferences (SPIE, PVSEC, ICALEO, LANE, etc.). Currently his research activity is focused in the development of new laser micro and nano processing techniques, using state of the art laser technology, in the fields of energy, flexible electronics, tissue engineering and translational oncology research.

Prof. Maite Flores

Group Leader
and
Secretary
of the European Optical Society
University of. Santiago of Compostela, Spain.

June 20 / 12:10 h

Intense light, a potential tool to be applied in medical imaging

High power laser is overcoming as a new technology for the production of short half-life PET (positron-emission tomography) radioisotopes (11C, 13N,...) that are produced by a self-shielded laser accelerator

The advantages of using some radioisotopes as the 11C-based as radiotracers are offset by the difficulties of distributing a product with a half-life of only about twenty minutes. The possibility of having a compact, self-shielded and low-cost production system for radio-tracers would make it possible to move from a regional production mode to local production, thus avoiding the problem of distribution, and thereby expanding the range of radiotracers and their applications.

Laser accelerator could generate different types of beams (gamma, protons, deuterons, ions) that can be used to produce different radioisotopes of interest in diagnostic imaging and therapy.

Prof. Flores is Full Professor at the Department of Applied Physics at the University of Santiago de Compostela (USC). She has a doctorate in Physics from USC. She is currently coordinator of the singular facility L2A2 (Laser Laboratory for Acceleration and other Applications). She has published more than 150 articles in journals indexed in JCR and has presented more than 170 communications at national and international conferences. She has 2 patents and is co-founder of the company BFlow S.L.
She is a member of the scientific committees of 20 international and 6 national congresses. She organized 4 summer schools and 5 conferences. She is a member of several quality research project evaluation agencies. She is a member of the steering committee of the European Optical Society, currently being the secretary of its executive committee.
She was recognized in 2019 with the Technology Transfer Award in Galicia.

Round Table II

15:30- 17:45 h

Creation of New Photonic companies and AF : Challenges to face

Prof. Martin Wegener, **Director and Chair**, Nanophotonic Research, Institute of Nanotechnology at KIT, Karlsruhe, Germany

Dr. Fabien Guillemot, Founder, Chief Executive Officer, CEO, Poietis, France

Prof. Carlos Molpeceres, Director of Laser Centre of University Polytechnic of Madrid, Spain

Prof. JM López-Higuera, Director ISLiST, Moderator

Prof. Beat Neuenschwander

Head
Institute for Applied Laser, Photonics and Surface Technologies ALPS, **Switzerland**.

June 24 /9:30 h

High Throughput and high quality laser ablation and texturing techniques with pulsed lasers

Ultra-short pulsed laser systems are often the tool of choice if highest quality is demanded in laser micromachining. Especially for metals the laser ablation process shows an optimum going with highest efficiency and quality. This point is directly linked to the threshold fluence and the energy penetration depth for the material to be machined and depending on their part from the wavelength and the pulse duration. As a rule of thumb shorter pulses and wavelengths lead to higher efficiencies. However, the main effect hindering an efficient scale up to high throughput is the fact, that at this optimum point the desired pulse energy i.e. fluence is only moderate and therefore high average powers used for high throughput demand high repetition rates where heat accumulation and shielding effects can become a serious issue. We will discuss the requirements and limits of an efficient scale up process to high throughput.

Prof. Beat Neuenschwander, studied physics at the University of Bern and realized 1996 his PhD at the Institute of Applied Physics in the field of diode pumped solid state lasers. From 1997 to 2002 he joined the company Numerical Modelling and since 2000 he is also at the Bern University of Applied Sciences BUAS where he lectures physics and applied laser technology. There he built up the laboratory for laser micro machining and laser surface engineering, became full professor in 2005 and is actually heading the institute for applied laser, photonics and surface technologies ALPS. His main research topic is laser micromachining with ultra-short pulses and its industrial application. He was chair of the LASE Symposium 2018-2021 and is founder member of the national thematic network NTN Swiss photonics, which he headed from 2008 – 2011 as managing director. Actually, he is also serving as expert for the Swiss founding agency innosuisse.

Prof. Beat Neuenschwander

Head
Institute for Applied Laser, Photonics and Surface Technologies ALPS, **Switzerland**.

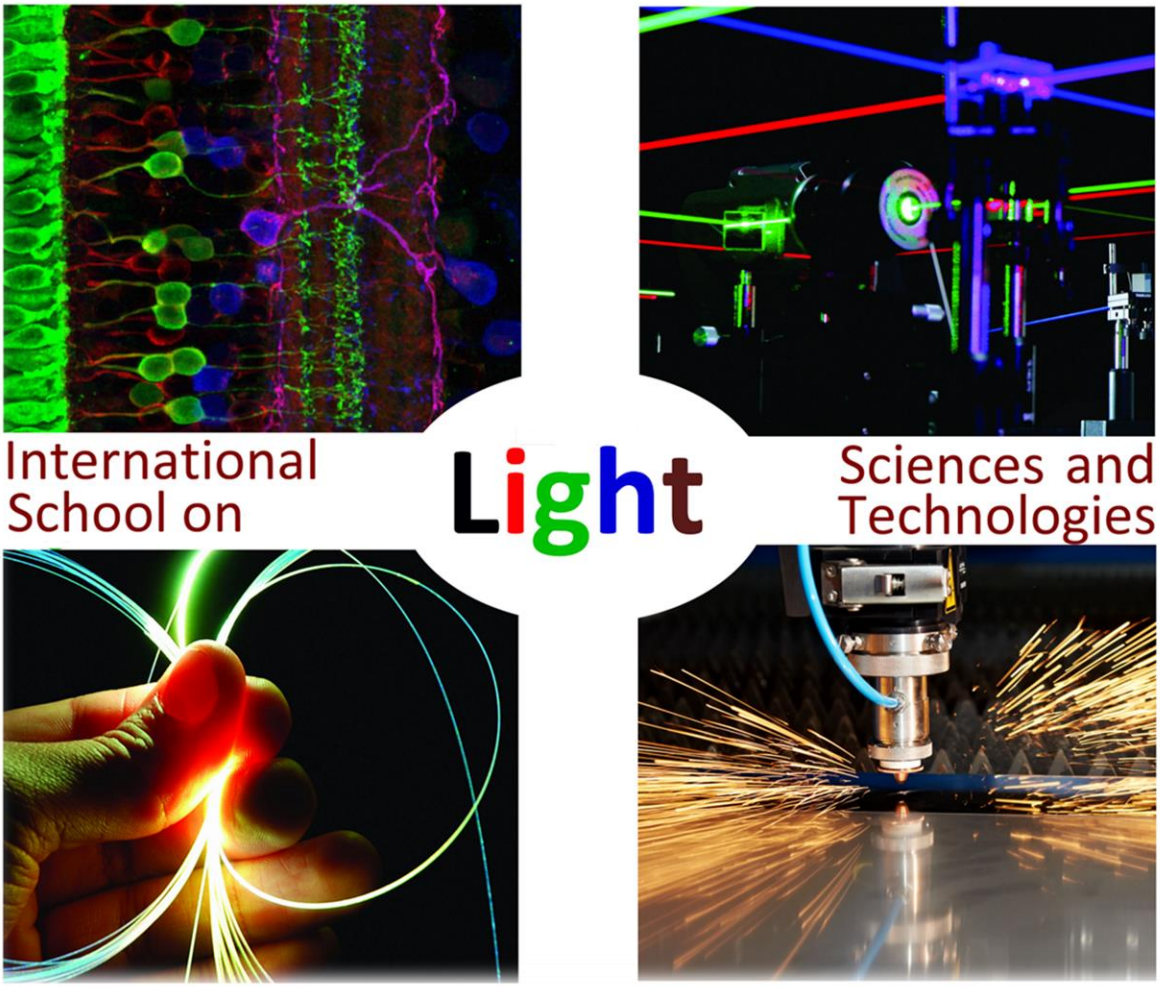
June 24 /11:00 h

Light manipulation and control techniques in industrial processes with pulsed lasers

Based on the insights of the previous talk adapted strategies to achieve high throughput are demanded. Beside fast scanning also energy splitting, either in time i.e. with pulse bursts or in space with multi spots can be applied. Direct beam forming with either a diffractive optical element or a spatial light modulator offer the possibility to work with higher pulse energies and therefore reduced laser repetition rates. Efficient processes like optical stamping or multi pulse drilling on the fly can be realized by combining this kind of beam forming with synchronized scanning. By expanding the synchronization to additional mechanical axes this technique can e.g. be used to machine embossing rollers or tubes.

Prof. Beat Neuenschwander studied physics at the University of Bern and realized 1996 his PhD at the Institute of Applied Physics in the field of diode pumped solid state lasers. From 1997 to 2002 he joined the company Numerical Modelling and since 2000 he is also at the Bern University of Applied Sciences BUAS where he lectures physics and applied laser technology. There he built up the laboratory for laser micro machining and laser surface engineering, became full professor in 2005 and is actually heading the institute for applied laser, photonics and surface technologies ALPS. His main research topic is laser micromachining with ultra-short pulses and its industrial application. He was chair of the LASE Symposium 2018-2021 and is founder member of the national thematic network NTN swissphotonics, which he headed from 2008 – 2011 as managing director. Actually, he is also serving as expert for the Swiss founding agency innosuisse.

ISLiST / UIMP
Universidad Internacional Menéndez Pelayo



NOTEBOOK

June 20 / 11:00 h / **Prof. Bressler**

Extremely intense X-ray Free Electron Laser looking for new Science and Technology Opportunities

NOTES:

June 20 / 12:10h / **Prof. López-Higuera**

Light in Energy and Advanced Fabrication

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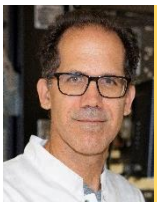


June 20 / 15:30 h / **Prof. Del Cañizo**

Photovoltaics for highly efficient energy conversion and storage

NOTES:

June 20 / 16:40 h / **Prof. Gómez-Expósito**

Solar Energy in the Electrical Systems: The Spanish case for 2050

NOTES:

June21 / 9:30 h / **Prof. Sattler**

Solar Fuels and Electricity by using Sunlight concentrating Systems

NOTES

June 21 / 11:00 h / **Mr. Bengoa**

Laser technology in Advanced Batteries fabrication

NOTES:

June 21/ 12:10 h / **Prof. Martorell**

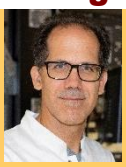
Nano-photonics in energy conversion and solar fuel production

NOTES:

June 21/15:30 h / **Round Table I:**

Light on Energy: Challenges to face





NOTES:

June 22 / 9:30h / **Prof. Molpeceres**

Laser Technology in Photovoltaics

NOTES:

June 22 / 11:00 h / **Prof. Campbell**

Laser driven fusion energy: status, challenges and the future

NOTES:

June 22/ 12:10 h / **Prof. Javier Solis**

Direct writing of photonic structures and element redistribution processes with Femtosecond laser light

NOTES:

June 22 / 15:30 h / **Prof. Wegener**

3D and 4D Nanoprinting

NOTES:

June 22 / 16:40 h / **Dr. Guillemot**

Towards a 4D Bioprinting Industry in the fourth industrial revolution

NOTES:

June 23 /9:30 h / **Dr. Habil. César Jauregui Misas**

Fiber Optic Ultrafast lasers for advanced fabrication: currents and trends

NOTES:

June 23 / 11:00 h / **Prof. Molpeceres**

Microaditive Manufacturing using Laser Direct Write

NOTES:

June 23 / 12:10 h / **Prof. Maite Flores**

Intense light, potential tool to be applied in medical imaging

NOTES:

June 23/15:30 h / **Round Table II:**

Light on Advanced Fabrication and on creation of New Photonic Companies: Challenges to face




NOTES:

June 24 /9:30 h / **Prof. Neuenschwander**

High Throughput and high quality laser ablation and texturing techniques with pulsed lasers

NOTES:

June 24 / 11:00 h / **Prof. Neueschwander**

Light manipulation and control techniques in industrial processes with pulsed lasers

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