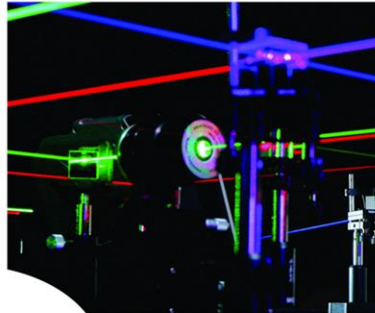
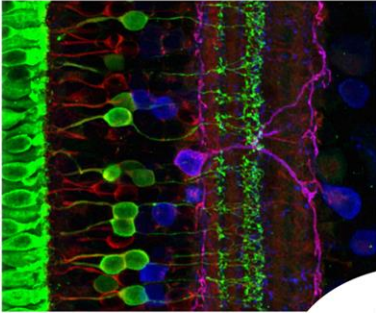


ISLIST / UIMP

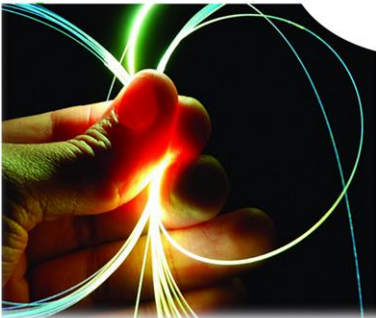
Universidad Internacional
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International
School on

Light

Sciences and
Technologies



Core: Light in Health and Medicine

Santander 19-23 de junio de 2023
(Sala Riancho, Palacio de la Magdalena, Santander)

PROGRAM

 (provisional)

DIRECTOR:
José Miguel López Higuera
*Professor in Electronics and Photonics
Head of the Photonics Engineering Group
University of Cantabria
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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 International 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 in Health and medicine** is the core of this 2023 edition: VI-ISLIST.

It must be noticed that by changing the consecutive core, students and professional have the opportunity to receive and share knowledge, technique, visions, experience etc. several times from about 40 different top international lecturers, along their career. It is envisioned as a key value of ISLIST and it was, certainly, corroborated objectively from answers, of the previous edition attendee’s surveys as you can observe on the final reports. <https://www.teisa.unican.es/ISLIST/index.php/final-report>

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.

Nobel laureates such **Andre Geim, Sujhi Nakamura, Donna Strickland** have participated in the previous editions. Top worldwide Scientists such as Philip Russel, Miles Padgett, X. C. Zhang, Bruce J. Tromberg, José Capmany, Maria Yzuel, Maria Luisa Calvo, JA Martín Pereda, Luis Roso, Aydogan Ozcan, Brian Pogue, Susana Marcos, Jürgen Pop, Vasilis Ntziachristos, Luis Bañares, Antonio Luque, Eli Yablonovitch, Eric Mazur, David Payne, Pablo Artal, John Pendry, Miguel Gonzalez, Hugo Thienpont, Rod Taylor, Katarina Svanberg, Laura Lechuga, Kishan Dolakia, Harald Haas, Christian Bressler, Christian Sattler, Michael Campbell, Martin Wegener, and Beat Neuenschwander, among others. Also, most renowned professionals and directors of organizations such as Jam Denneman, Peter Winzer, Peter Andrekson, Nikolaus Schmitt, Jeroni Nadal, Robert Lieberman, Dra. Kutner Mikel Bengoa y Fabien Guillemot have participated in previous editions.

Seventeen (17) **highly renowned** professors and researchers from the most prestigious worldwide institutions and, as well, responsables of most reputed international Photonic Scientific Organizations and some politicians will participate in this meeting.



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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.

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 VI ISLIST edition.

The international grants and other additional costs are covered by the very generous and key contribution of our collaborators: **Gold (SPIE and Prysmian)**, **Silver (Fyla Lasers and Ambar Telecommunications)** and **Bronze (OZ Optics, Semicrol, ERZIA, Lasing, Ayuntamiento de Santander, Colegio de Medicos de Cantabria, CIBER-BBN, hotel Santemar and the Photonics Engineering Group of the University of Cantabria, CIBER-BBN and IDIVAL**. Without these Sponsor and Collaborators, this top-quality school and over 30 Student Grants (already allocated from over 20 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

International School on light Sciences and Technologies (ISLIST), has been conceived as a great opportunity to: i) **review, actualize and improve** the knowledge of **scientists, professionals and technicians**; ii) **contribute** to the education and to **enhance** the motivation of students (specially of **PhD students**); iii) **offer** an ideal frame for **networking** and also to contribute to the education of the **citizens**; iv) **ensure** that **policymakers, entrepreneurs**, and other “key actors” will be aware of the problem-solving potential of Photonics.

Overview

The event will take place from Monday (June 19, 2023) to Friday (June 23, 2023). During the week along seventeen outstanding lectures a wide set of key topics on light and light sciences and technologies useful for both to supervise and maintain the health and also to recover the health will be presented and discussed. How light affect the mood and the cognitive behaviours, technique to supervise, to enable more accurate diagnosis or to do treatments or to do tools for regenerative medicine including to print tissues or to review the possibility to generate protons for proton-therapy using very intense lasers will be presented. In the format of two round tables challenges to face concerning light technologies on diagnosis and monitoring task will be commented and discussed along the first one (Monday afternoon); Along the second one, (Thursday afternoon), challenges to face on light-based treatments and tools to maintain or/and to recover the health will be presented and discussed.

General Schedule

Time	Monday 19 th	Tuesday 20 th	Wednesday 21 st	Thursday 22 nd	Friday 23 rd
9:30		Prof. Vasilis Ntziachristos Director, Institute for Biological and Medical Imaging at the Helmholtz Zentrum München, Munich, Germany Listening to Light: Advances in Optoacoustic Imaging	Prof. Laura Lechuga Head, Nanobiosensors and Bioanalytical Applications Group, ICN2, CSIC, CIBER-BBN and BIST, Barcelona, Spain Bio-Photonic Sensors after the COVID-19 pandemic	Dr. Alexis Méndez President, MCH Engineering, Alameda, CA, USA Optical Fiber Technology on Biomedical Applications	Prof. Carlos Molpeceres Director, Laser Center, Polytechnic University of Madrid, Spain Laser fabrication technologies helping the regenerative medicine
10:15	Opening Remarks				
10:40	Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00	Prof. Aydogan Ozcan / Opening talk Director, Bio&Nano-Photonics Laboratory, University of California, Los Angeles, USA Deep- learning enabled computational microscopy and diffractive imaging	Prof. Mariana G. Figueiro Director, Light and Health Research Center (LHRC), Icahn School of Medicine, Mount Sinai, NY, USA Light's effects on human health, well-being, and behaviour	Prof. Paola Taroni Head, Photonics for health, Food and Cultural Heritage, Politecnico di Milano Milano, Italy Optical Diffuse Systems for effective Management of breast cancer	Prof. Rox Anderson / TBConfirmed Harvard Medical School and MIT, Wellman Center for Photomedicine, Boston, USA The Yin and Yang of the PDT and PTT in skin diseases	Closing Talk / TBre-Confirmed Prof. E. Michael Campbell Director, Laboratory for laser Energetics (LLE), University of Rochester, NY, USA Intense high-energy proton beams from petawatt-laser irradiation of solids
12:10	Prof. JM López-Higuera Head, Photonic Engineering Group, University of Cantabria, Ciber-BBN and IDIVAL, Spain Light in Health and Medicine: an introduction	Prof. Michael Schmitt Institute of Photonic Technology Jena, Germany Raman based Spectroscopic techniques for Biomedical diagnosis life Sciences	Prof. Kishan Dholakia Director, Centre of Light for life and School of Biological Sciences, University of Adelaide, Australia Optical tweezers: Trapping and Manipulation for biomedical applications	Dr. Alessandro Corsi Director, Simple Vulnology Unit at the IRCCS, San Raffaele Hospital, Milano, Italy Photo-biomodulation for effective treatment of skin lesions	12:30 Closing Remarks, ISLIST-2024 Announcement and Diploma Delivery
13:30-15:0	Lunch	Lunch	Lunch	Lunch	
15:30	Round Table I / Challenges to face on light in diagnostics Aydogan Ozcan , Challenges to face wearable devices based on Smartphone platforms Vasilis Ntziachristos , Challenges to face on Optoacoustic Imaging in Pharmacology Marina G. Figueiro , Challenges on lighting to improve the way of older adults Pablo Artal , light-based techniques to reach very effective, efficient and socialized diagnosis of humans' vision Moderator: JM López-Higuera	Prof. Pablo Artal Director, Laboratorio de Óptica, University of Murcia, Murcia, Spain Light based techniques to evaluate vision	Dr. Valentina Emiliani Director of Photonics Department, Head of WFEMO, CNRS Vision Institute, Paris, France All-optical control of neuronal circuits by wave front shaping and optogenetics	Round Table II /Challenges on light based treatments and tools Susana Marcos , techniques to maintain the quality of humans' vision Carlos Molpeceres , lasers technology in regenerative medicine Valentina Emiliani , rights for humans' brain ROx. Anderson , on PDT translation to Clinic E.Michael Campbell , real proton generating by light Moderator: JM López-Higuera	
16:40		Prof. Susana Marcos D. R. W. Director, Center for Visual Science, The Institute of Optics, University of Rochester, NY, USA Optics and Photonics to improve vision.	Prof. Turgut Durduran Head, Medical Optics Group, Instituto de Ciencias Fotónicas, ICFO, Barcelona, Spain. Shining light on the brain to understand how it works		
17:55			Family Photo Santander City Council Reception		



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PROGRAM

Monday, 19

Morning

10:15 h

Opening Ceremony

10:40 h / **Break**

11:00 h Opening Lecture

Deep-learning enabled computational microscopy and diffractive imaging

Prof. Aydogan Ozcan

Director, Bio&Nano-Photonics Laboratory, University of California, Los Angeles, USA.

12:10 h / Introductory Lecture

Light in Health and Medicine: a general overview

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

15:30 h- 17:35 / **Round Table I**

Light in diagnostics: Challenges to face on

Prof. Aydogan Ozcan, University of California, Los Angeles, USA:

wearables devices based on Smartphone platforms

Prof. Vasilis Ntziarchristos, Helmholtz Zentrum München, Germany:

Optoacoustic Imaging in Pharmacology

Prof. Marina G. Figueiro, Mount Sinai Hospital, NY, USA:

lighting to improve the way of older adults

Prof. Pablo Artal, University of Murcia, Spain:

light-based techniques to reach very effective, efficient and socialized diagnosis of humans' vision

Prof. JM López-Higuera, Director ISLiST, Moderator



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Tuesday, 20

Morning: Light in Diagnostics and Mood

9:30 h / Invited keynote

Listening to Light: Advances in Optoacoustic Imaging

Prof. Vasilis Ntziarchristos

Director, Institute for Biological and Medical Imaging at the Helmholtz Zentrum München, Munich, Germany

10:40 h / Break

11:00 h / Invited Lecture

Light's effects on human health, well-being, and behaviour

Prof. Mariana G. Figueiro

Director, Light and Research Center, (LHRC), Icahn School of Medicine, Mount Sinai, NY, USA

12:10 h / Invited Lecture

Raman based Spectroscopic techniques for Biomedical diagnosis Life Sciences

Prof. Michael Schmitt

Group Leader, Institute of Photonic Technology, Jena, Germany

13:30-15:00 h / Lunch Time

Afternoon: Light technologies in human visual system

15:30-16:30 / Invited Lecture

Light based techniques to evaluate vision

Prof. Pablo Artal

Director, Laboratorio de Óptica, University of Murcia, Murcia, Spain

16:40h / Invited Lecture

Optics and Photonics to improve vision

Prof. Susana Marcos

D. R. W. Director, Center for Visual Science, The Institute of Optics, University of Rochester, NY, USA



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Wednesday, 21

Morning: **Light in Diagnostic/Sensing and Treatment**

9:30 h / Invited Talk

Bio-Photonic Sensors after the COVID-19 pandemic

Prof. Laura Lechuga

Head, Nanosensors and Bioanalytical Applications Group, ICN2, CSIC, CIBER-BBN and BIST, Barcelona, Spain

10:40h / Break

11:00h / Invited Talk

Optical Diffuse Systems for effective Management of breast cancer

Prof. Paola Taroni

Head, Photonics for health, Food and Cultural Heritage, Politecnico di Milano, Italy

12:10h / Invited Talk

Optical Tweezers: trapping and manipulation for biomedical applications

Prof. Kishan Dholakia

Director, Centre of Light for life and School of Biological Sciences, University of Adelaide, Australia

13:30 -15:00h / Lunch Time

Afternoon: **Light in the human's Brain**

15:30-16:30 / Invited Talk

All-optical control of neuronal circuits by wave front shaping and optogenetics

Dr. Valentina Emiliani

Director of Photonics Department, Head of WFEMO, CNRS Vision Institute, Paris, France

16:40h / Invited Talk

Shining light on the brain to understand how it works

Prof. Turgut Durduran

Head, Medical Optics Group, Instituto de Ciencias Fotónicas, ICFO, Barcelona, Spain.

17:55 h VI 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.



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Thursday, 22

Morning: **Light in Supervision, Sensing and Treatment**

9:30h / Invited Lecture

Optical Fiber technology on Biomedical Applications

Dr. Alexis Méndez

President, MCH Engineering LLC, Alameda, California, USA

10:40h / Break

11:00h / Invited Lecture / To Be Confirmed

The Yin and Yang of PDT and PTT in skin diseases

Prof. Rox Andersosn

Director, Harvard Medical School and MIT, Wellman Center for Photomedicine, Boston, USA

12:10h / Invited talk

Photobiomodulation for effective treatment of skin lesions

Dr. Alessandro Corsi

Director, Simple Vulnology Unit at the IRCCS, San Raffaele Hospital, Milan, Italy

13:30 -15:00h / Lunch Time

Afternoon

15:30h- 17:35h / Round Table II

Treatments and tools using light-based technologies

Challenges to face on

Susan Marcos, University of Rochester, NY, USA:

[techniques to maintain the quality of humans' vision](#)

Carlos Molpeceres, Laser Center, Polytechnic University of Madrid, Spain:

[Laser based technology for regenerative medicine](#)

Valentina Emiliani, Photonics Department, CNRS Vision Institute, Paris, France:

[Optogenetic for light control of biological Systems](#)

Rox. Anderson, Harvard Medical School and MIT, Wellman Center for Photomedicine, Boston, US:

[PDT translation to Clinic](#)

E.Michael Campbell, University of Rochester, NY, USA:

[real proton generating by light](#)

Prof. JM López-Higuera, Director ISLIST, Moderator



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Friday, 24

Morning

Laser light in regenerative and protons generation

9:30-10:40h / invited Lecture

Laser fabrication technologies helping the regenerative medicine

Prof. Carlos Molpeceres

Director, Director, Laser Institute, Polytechnic University of Madrid, Spain

10:40h / Break

11:00-12:10h / Invited Lecture / To Be Re-confirmed

Intense high-energy proton beams from petawatt-laser irradiation of solids

Prof. E. Michael Campbell

Former Director, Laboratory for laser Energetics (LLE), University of Rochester, USA

12:15 h



Closing Remarks, Announcement of ISLIST 2024 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 health and Medicine. Key trends and challenges will be identified in several areas of paramount importance.

Invited Speaker	Talk&Abstract	Biography
 <p>Prof. Aydogan Ozcan</p> <p>Director Bio&Nano-Photonics Laboratory, Chancellor's Professor University of California, Los Angeles, USA</p> <p>Opening Invited Talk Monday, June 19 11:00 hours</p> <p>Round table I Monday, June 19 15:30 hours</p>	<p>Deep-learning enabled computational microscopy and diffractive imaging</p> <p>I will discuss diffractive optical networks designed by deep learning to all-optically implement various complex functions as the input light diffracts through spatially-engineered surfaces. These diffractive processors designed by deep learning have various applications, e.g., all-optical image analysis, feature detection, object classification, computational imaging and seeing through diffusers, also enabling task-specific camera designs and new optical components for spatial, spectral and temporal beam shaping and spatially-controlled wavelength division multiplexing. These deep learning-designed diffractive systems can broadly impact (1) all-optical statistical inference engines, (2) computational camera and microscope designs and (3) inverse design of optical systems that are task-specific. In this talk, I will give examples of each group, enabling transformative capabilities for various applications of interest in e.g., autonomous systems, defense/security, telecommunications as well as biomedical imaging and sensing.</p>	<p>Prof. Ozcan Dr. Aydogan Ozcan is the Chancellor's Professor and the Volgenau Chair for Engineering Innovation at UCLA and an HHMI Professor with the Howard Hughes Medical Institute. He is also the Associate Director of the California NanoSystems Institute. Dr. Ozcan is elected Fellow of the National Academy of Inventors (NAI) and holds >60 issued/granted patents in microscopy, holography, computational imaging, sensing, mobile diagnostics, nonlinear optics and fiber-optics, and is also the author of one book and the co-author of >1000 peer-reviewed publications in leading scientific journals/conferences. Dr. Ozcan received major awards, including the Presidential Early Career Award for Scientists and Engineers (PECASE), International Commission for Optics ICO Prize, Dennis Gabor Award (SPIE), Joseph Fraunhofer Award & Robert M. Burley Prize (Optical), SPIE Biophotonics Technology Innovator Award, Rahmi Koc Science Medal, SPIE Early Career Achievement Award, Army Young Investigator Award, NSF CAREER Award, NIH Director's New Innovator Award, Navy Young Investigator Award, IEEE Photonics Society Young Investigator Award and Distinguished Lecturer Award, National Geographic Emerging Explorer Award, National Academy of Engineering The Grainger Foundation Frontiers of Engineering Award and MIT's TR35 Award for his seminal contributions to computational imaging, sensing and diagnostics. Dr. Ozcan is elected Fellow of Optica, AAAS, SPIE, IEEE, AIMBE, RSC, APS and the Guggenheim Foundation, and is a Lifetime Fellow Member of Optica, NAI, AAAS, and SPIE.</p>
 <p>Prof. José Miguel López-Higuera</p> <p>Head</p>	<p>Light in Health and Medicine: a general overview</p> <p>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.</p>	<p>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 850 research publications and 25 patents and also directed 20 PhD theses. He has worked as an editor and co-</p>

Comentado [LHJM1]:



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

Talk
June 19 / 12:10 h

Round Tables I & II
moderator

In this talk, after a brief mention of what should be understood as the Photonics Field we will go into key characteristics of the interaction light-human tissues. Then, a wide set of significant cases of the application of light, light-based technologies and tools in health and medicine will be presented and very briefly 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 VI ISLIST edition.

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.

15:30 h- 17:35 / Round Table I

Light in diagnostics: Challenges to face

Prof. Aydogan Ozcan, University of California, Los Angeles, USA: [on wearables devices based on Smartphone platforms](#)

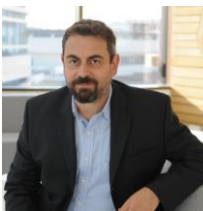
Prof. Vasilis Ntziarchristos, Helmholtz Zentrum München, Germany: [on Optoacoustic Imaging in Pharmacology](#)

Prof. Marina G. Figueiro, Mount Sinai Hospital, NY, USA: [on lighting to improve the way of older adults](#)

Prof. Pablo Artal, University of Murcia, Spain: [on light-based techniques to reach very effective, efficient and social diagnosis of humans' vision](#)

Prof. JM López-Higuera, Director ISLIST, Moderator

MONDAY END



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Prof. Vasilis Ntziarchristos

Director,
Institute of Biological and
Medical Imaging,
Helmholtz Zentrum
München
Professor and Chair of
Biological Imaging,
Technische Universität
München
Munich, Germany

Invited keynote
Tuesday 20/9:30h
Round table I
June 19 /15:30 h

Listening to Light: Advances in Optoacoustic Imaging

Biological discovery is a driving force of biomedical progress. With rapidly advancing technology to collect and analyze information from cells and tissues, we generate biomedical knowledge at rates never before attainable to science. Nevertheless, conversion of this knowledge to patient benefits remains a slow process. To accelerate the process of reaching solutions for healthcare, it would be important to complement this culture of discovery with a culture of problem-solving. In this talk, we focus on advances in optical and optoacoustic technologies from the perspective of problem solving, in particular in the areas of early disease detection and monitoring. We show how new classes of imaging systems and sensors can play a critical role in the frequent assessment of biochemical and pathophysiological parameters of systemic diseases, complement knowledge from – omic analytics and drive integrated solutions for improving healthcare.

Professor **Vasilis Ntziarchristos** studied electrical engineering at Aristotle University in Thessaloniki. Following his M.Sc. and Ph.D. in the Department of Bioengineering at the University of Pennsylvania, he was then appointed Assistant Professor and Director of the Laboratory for Bio-Optics and Molecular Imaging at Harvard University and Massachusetts General Hospital. Since 2007, he has served as Professor of Medicine and Electrical Engineering and the Chair of Biological Imaging at the Technical University of Munich and Director of the Institute of Biological and Medical Imaging at Helmholtz Munich. Prof. Ntziarchristos is also currently Director of Bioengineering at the Helmholtz Pioneer Campus and the Head of the Bioengineering Department at Helmholtz Munich. His research focuses on the development of new methods and devices for optoacoustic and fluorescence imaging with the aim of achieving sustained improvements in the non-invasive investigation of physiological and molecular processes in tissues towards the development of cost-effective and minimally invasive methods for diagnosing and treating life-threatening diseases.



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Prof. Mariana Figueiro

Director

Light and Health Research
Centre, Mount Sinai, USA

Invited Talk
Tuesday 20/11:00 h

Round table I
June 19 / 15:30 h

**Light's effects on human health,
well-being, and behaviour**

Almost every living thing experiences internal biological cycles that repeat daily. Known as circadian rhythms, in humans these cycles regulate all metabolic, physiological, psychological, and behavioural processes (e.g., sleeping and waking, hormone production, body temperature). Research shows that the daily pattern of light and dark incident on the retinas sets the timing for many circadian rhythms, synchronizing our master biological clock with the 24-hour solar cycle at our place and time on Earth. Asynchrony between our circadian rhythms and local time, however, as might occur between our preferred sleep patterns and work schedules or air travel across several time zones, can lead to social, behavioural, and metabolic health problems such as diabetes, obesity, cardiovascular disease, and cancer. Laboratory and field studies have demonstrated that lighting interventions can help to remedy circadian disruption and reduce health risks. Light also has an acute alerting effect on humans, like a cup of coffee.

Mariana G. Figueiro, Ph.D., is Director of the Light and Health Research Center (LHRC) at Mount Sinai and Professor of Population Health Science and Policy at the Icahn School of Medicine at Mount Sinai. She was Director of the Lighting Research Center (LRC) and Professor of Architecture at Rensselaer Polytechnic Institute. She has also served as Light and Health Program Director at the LRC since 1999. Figueiro is the recipient of the 2007 NYSTAR James D. Watson Award, the 2008 Office of Naval Research Young Investigator Award, and the 2010 Rensselaer James M. Tien '66 Early Career Award. In 2013 she was elected Fellow of the Illuminating Engineering Society. Prof. Figueiro is well known for her research on the effects of light on human health, circadian photobiology, and lighting for older adults. In 2013, she was elected Fellow of the Illuminating Engineering Society. She is the author of more than 150 scientific articles in her field of research, and her research is regularly featured in national media, including a TEDMED talk. Her research is regularly featured in national media including *The New York Times*, *The Wall Street Journal*, and *Scientific American*.



Prof. Dr. Michael Schmitt

Group Leader

Institute of Physical
Chemistry, Friedrich-
Schiller University Jena,
Germany, Helmholtzweg
4, D-07743 Jena

Invited Talk
Tuesday, June 20 / 12:10 h

Round table I
Mo June 19 / 15:30 h

**Raman-based Spectroscopic
techniques for biomedical
diagnosis and life sciences**

Raman based technologies have shown its great impact on life sciences and biomedical research and complement established analytical approaches like fluorescence. While the advantages of Raman spectroscopy are its unprecedented high molecular specificity and its versatility it suffers from its poor sensitivity. This disadvantage can be overcome by utilizing special Raman signal enhancing techniques like e.g., resonance Raman spectroscopy or coherent anti-Stokes Raman scattering (CARS). Within this contribution we highlight the great potential of linear and nonlinear Raman approaches for biological and biomedical analysis. It will be shown that Raman spectroscopy allows for a label-free characterization of a broad variety of different biological samples ranging from prokaryotic and eukaryotic cells, fungi, biofilms via tissue sections towards whole organs. The application focus of the presented examples lies on (I) microbial analysis, (II) intraoperative tumor characterization or (III) the Raman spectroscopic visualization of metabolic, defense or chemical communication processes.

Prof. Schmitt received his Ph.D. in chemistry from the University of Würzburg in 1998. From 1999 to 2000 he went for postgraduate studies to the Steacie Institute for Molecular Sciences at the National Research Council of Canada. He subsequently returned to the University of Würzburg, where he finished his habilitation in 2004. Since March 2004 he has been a research associate in the group of Prof. Dr. J. Popp at the Institute of Physical Chemistry at the Friedrich-Schiller-Universität Jena. In 2010 he was promoted to the rank of an associate Professor at the Friedrich-Schiller University Jena. His main research interests are focused on Raman spectroscopy, non-linear spectroscopy and non-linear multimodal imaging for biomedical, life sciences and material research. He has published more than 270 publications in peer reviewed journals. He is assistant editor of *Journal of Biophotonics*. In 2018 he received the Kaiser-Friedrich-Forschungspreis.



International School on Light
Sciences and Technologies ISLIST
June 19-23, 2023, Santander, Spain



Prof. Pablo Artal

Director

Optical Laboratory,
Optical and Nanophysics
Research Centre
Universidad de Murcia,
Spain

Invited Talk
Tuesday, afternoon,
June 20 / 15:30 h

Round table I
June 19 / 15:30 h

Light-based technologies to evaluate vision

A better understanding of the optical properties of the human eye allows to develop new light-based technologies to evaluate and then improve vision. I will revise different experiments we developed based in the use of adaptive optics to evaluate how different type of optical corrections affect vision. In addition, I will present novel approaches to evaluate the effect of scattering in the eye and the use of pulsed invisible infrared lasers to produce vision by means of 2-photon absorption processes.

Prof. Artal studied Physics at the University of Zaragoza. He was a pre-doctoral fellow at the Madrid-CSIC "Instituto de Optica" under the supervision of Javier Santamaría, a post-doctoral research fellow, first at Cambridge University (UK) and later at the Institut d'Optique in Orsay, France. After returning to Spain, he obtained a permanent researcher position at the Instituto de Optica. In 1994, he became the first full Professor of Optics at the University of Murcia, Spain founding the "Laboratorio de Optica". He spent sabbatical years in Rochester (USA) and Sydney (Australia). He is currently a distinguished visiting professor at the Central South University in Changsha, China. His research interests are centered on the optics of eye and the retina and the development of optical and electronic imaging techniques to be applied in Vision, Ophthalmology and Biomedicine.

He has published more than 300 reviewed papers that received more than 24000 citations (h-index of 80) in Google Scholar, presented more than 200 invited talks in international meetings and around 150 seminars in research institutions around the world. He was elected fellow member of the Optical Society of America (OSA) in 1999, fellow of the Association for research in Vision and Ophthalmology (ARVO) in 2009 and 2013 (gold class), fellow of the European Optical Society (EOS) in 2014 and fellow of the SPIE in 2016. In 2013, he received the "Edwin H. Land Medal", in 2014, he was awarded with an Advanced Research grant of the European Research Council. In 2015, he received the "King Jaime I" award in New Technologies. In 2018, he was awarded the Spanish National Research award "Juan de la Cierva" and in 2019 the "Edgar D. Tillyer" award of the Optical Society of America. In 2021, he was awarded the medal of the Spanish Royal Physics Society. He is a co-inventor of 30 international patents in the fields of Optics and Ophthalmology and the co-founder of four spin-off companies.



**Prof. Susana
Marcos**

Optics and Photonics to improve vision

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Prof. Marcos is a Professor of Research at the Institute of Optics (CSIC) where she leads the Visual Optics and Biophotonics Laboratory. She is Director-at-Large of the Optical Society of America (OSA), and editor of the OSA journal Optica. She is the recipient of the Adolph Lomb Medal (OSA), European Young Investigator Award ICO Prize (International Commission for Optics), Doctor Honoris Causa by the Ukrainian Academy of Science and Technology, Physics, Technology and Innovation Award (Royal Society of Physics-Fundacion BBVA), and the ARI Award (Alcon Research



International School on Light Sciences and Technologies ISLIST
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D. R. W. Director,
Center for Visual Science,
The Institute of Optics,
University of Rochester, NY,
USA

Invited Talk
June 20 / 16:40 hours

Round table II
Thursday, June 22
15:30 hours

Institute), among others. She is also an European Research Council Advanced Grantee. She is an elected Fellow of the European Optical Society, Optical Society of America and Association for Vision in Research and Ophthalmology. She is an author of >150 publications, inventor in 15 patents, partner of spin-off Plenoptika Inc and co-founder of 2Eyes Vision

TUESDAY END



BioPhotonic Sensors after the COVID-19 pandemic

COVID-19 pandemics has evidenced the urgent need of having portable diagnostic tools that enable rapid testing and screening of the population with sensitivity and specificity levels comparable to lab techniques. Biosensor technology is one of the best prepared to tackle the challenging goal of offering fast and user-friendly diagnostics tests than can be employed at the point-of-need. In particular, photonic biosensors can provide sensitive, reliable and selective analysis, while reducing test and therapeutic turnaround times, decreasing and/or eliminating sample transport, and using low sample volume.

We have demonstrated cutting-edge nanophotonic biosensors based on Nanoplasmonics and in Silicon photonics technologies that enable ultrasensitive analysis of body fluids in few minutes. By custom tailoring the biochemistry of the sensor biochips, our POC nanophotonic biosensor technology can perform direct detection of proteins, genetic biomarkers or pathogens within <15 min, with high sensitivity and selectivity.

Prof. Lechuga is a world reference in the Photonic Biosensor area, making key contributions and opening new horizons in this field. Her research focusses in novel nanobiosensor devices based on nanoplasmonics and silicon-based photonics principles for point-of-care diagnostics. Her activities encompass from fundamental research to the technological operation of complete sensing platforms, including the technological transfer into products of social applicability. She has published over 300 publications (articles, book chapters and proceedings), has 8 families of patents and 4 trade secrets, and has presented her work in more than 430 invited talks. She has co-founded two spin-off companies.

The quality of her research has been recognised by prestigious prizes and awards, as the Spanish National Research Prize in 2020, the King Jaime I award in New Technologies in 2020, the Ada Byron 2020 Prize, the Physics, Innovation and Technology Prize from the Spanish Royal Physics Society (RSEF) and BBVA Foundation (2016), the XVIII Burdinola Research award in 2021, the 2021 Medal of the International Foundation Olof Palme and the Doctor Honoris Causa awarded by the University of Cádiz, among others.

Prof. Laura M. Lechuga

Head
Nanobiosensors and Bioanalytical Applications Group
Catalan Institute of Nanoscience and Nanotechnology (ICN2).
CSIC, CIBER-BBN and BIST
Barcelona, Spain

Invited Talk
Wednesday, June 21
9:30 h



Diffuse optics Systems for effective Management of Breast Cancer

The physical principles of diffuse optics will be introduced, with special attention to its time domain implementation for the highest informative content.

Prof. Paola Taroni is Full Professor of Physics at Politecnico di Milano (Milan, Italy) since 2011. Co-author of more than 140 scientific papers on international peer-reviewed journals (Scopus H-index: 46). Her research activity concerns mainly the development of photonics systems for time-resolved spectroscopy and imaging, and their diagnostic applications in biology and



International School on Light
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June 19-23, 2023, Santander, Spain

Prof. Paola Taroni

Head
Research group on Photonics for Health, Food and Cultural Heritage,
Physics Department,
Politecnico di Milano,
Milan, Italy

Invited Talk
June 21 / 11:00 h

Diffuse optics can be used for the non-invasive in-depth optical characterization of highly diffusive media, such as biological tissues. Then, diffuse optical spectroscopy allows the non-invasive estimate of tissue composition (water, lipid, and collagen content) and functional blood parameters. It also provides information on the microscopic tissue structure. The potential of the technique will be highlighted describing its implementation and use for the management of breast cancer: non-invasive diagnosis, monitoring and prediction of neoadjuvant chemotherapy, and estimate of cancer risk due to breast density.

medicine, including time domain diffuse optical spectroscopy, with special attention to breast imaging and spectroscopy, and time-resolved fluorescence spectroscopy and fluorescence lifetime imaging for medical diagnostics and microscopy.



Prof. Kishan Dholakia

Director
Centre of Light for life and School of Biological Sciences,
University of Adelaide, 5005,
Australia
University of St Andrews,
Scotland, UK

Invited Talk
June 21 / 12:10h

Optical Tweezers: trapping and manipulation for biomedical applications

Light is incredible. In addition to its exquisite use in areas such as imaging and sensing, light can exert minuscule forces in the form of optical tweezers. This area was recognised by the Nobel Prize Committee in 2018, awarding half of the prize for that year to Arthur Ashkin. Such optical tweezers are ideal for probing and measuring at the cellular or molecular level. In this talk I will describe the background to this area and the importance of advanced photonics such as beam shaping and near field effects to the field. Examples will be presented showing how optical tweezers can be used for both in vitro and in vivo studies in the areas of single molecule biophysics, micro-rheology and intact behaving animals.

Kishan Dholakia is Professor at the University of Adelaide, Australia and St Andrews, Scotland. He is an honorary adjunct Professor at the Centre for Optical Sciences at the University of Arizona, USA, Chiba University, Japan and IIT Madras, India. He works on advanced beam shaping for optical manipulation and imaging. He has published over 350 journal papers and has in excess of 38,000 citations. His work is cited in the Guinness book of Records 2015. He is a Fellow of the Royal Society of Edinburgh, Optica and SPIE. In 2016 he won the R.W. Wood Prize of the Optical Society, in 2017 he won the IOP Thomas Young Medal and Prize and is the 2018 recipient of the SPIE Dennis Gabor Award. In 2021 he won an Australian Research Council Laureate Fellowship and is Director of the newly launched Centre of Light for Life at the University of Adelaide.



Prof. Valentina Emiliani

Director
Photonics Department
Head of Wavefront-engineering microscopy group

All-optical control of neuronal circuits by wave front shaping and optogenetics

Genetic targeting of neuronal cells with activity reporters (calcium or voltage indicators) and actuators has initiated the paradigmatic transition whereby photons have replaced electrons for reading and manipulating neuronal activity of genetically identified cell populations. These progresses have in turn stimulated the development of sophisticated optical methods to enable "all optical" in depth brain circuits interrogation with high spatial and temporal resolution on large volumes. Here, we will review the most significant breakthroughs of the past years, which enable

Prof. Emiliani's lab has pioneered the use of wave-front shaping for neuroscience. Precisely, they have proposed several approaches such as computer-generated holography, generalized phase contrast and temporal focusing to sculpt the excitation volume with a shape perfectly tailored on the selected target. Combined with optogenetics, wave front shaping enables the control of neuronal activity with unprecedented spatiotemporal precision. Their findings paved the way to optogenetic manipulation of brain circuits with single cell resolution: an essential methodology to perturb and activate neural circuits for interrogating brain function. Today, her research focuses on the use of these approaches for the study of the neural circuits involved in vision using mice and zebrafish models. She is a recipient of the Prix "Coups d'élan pour la recherche



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CNRS, Sorbonne
 University, INSERM
 Vision Institute, Paris,
 France

Invited Talk
 June 21 / 15:30 h

Round table II
 Thursday, June 22
 15:30 h

reading and writing neuronal activity at the relevant spatiotemporal scale for brain circuits manipulation, with particular emphasis on the most recent advances in what we named *circuit optogenetics*: a combination of wave front shaping approaches, including holographic light illumination and temporal focusing, with opsins engineering and laser development enabling the control of single or multiple targets independently in space and time with single-neuron and single-spike precision, at large depths. Finally, we will show examples where *circuits optogenetics* has been applied for the interrogation of mice retina and cortical circuits.

française" from the Bettencourt-Shueller foundation, the Axa Chair *Investigation of Visual Circuits by Optical Wavefront Shaping*, the ERC advanced grant, *HOLOVIS*, the "Silver Medal" from the CNRS, the *Maxime Dahan Prize for Innovation in Methods and Instrumentation at the Interface of Physics, Biology & Medicine* and the *Michael S. Feld Biophotonics Award*.



Shining Light on the Brain to understand How it works

Prof. Durduran XXXXXX

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Prof. Turgut Durduran

Head

Medical Group, ICFO,
 Barcelona, Spain

TENTATIVE

Invited Talk
 Wednesday, Afternoon,
 June 21

17:55 h VI 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.

WEDNESDAY END



International School on Light
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Dr. Alexis Méndez

President

MCH Engineering LLC, CA,
USA

Invited Talk
Thursday, June 21
9:30 h

Optical Fiber Technology on Biomedical Applications

Given their EM immunity, intrinsic safety, small size & light weight, autoclave compatibility and capability to perform multi-point and multi-parameter sensing remotely, optical fibers and fiberoptic-based sensors are seeing increased acceptance and new uses for a variety of bio-medical applications—from laser delivery systems, to disposable blood gas sensors, to intra-aortic pressure probes, to digital X-rays to name a few. This talk will provide a broad overview on how optical fibers are being utilized for illumination, imaging, digital X-rays, sensing, laser delivery in the biomedical arena, highlighting their intrinsic characteristics, advantages and limitations. Key industry trends, technology challenges and future commercial outlook will also be discussed.

Dr. Méndez received a PhD. degree in Electrical Engineering from Brown University, USA in 1992. He is president of MCH Engineering LLC—a consulting firm specializing in optical fiber sensing technology. Dr. Mendez was the former Group Leader of the Fiber Optic Sensors Lab within ABB Corporate Research (USA) where he led R&D activities for the development of fiber sensors for use in industrial plant, oil & gas, and high voltage electric power applications. He was also Director of Engineering Sensing Solutions at Micron Optics. He has written 70 technical publications, taught several short courses on fiber sensors, holds 5 US patents and is recipient of an R&D100 award.

Dr. Méndez is a Fellow of SPIE and was past Chairman of the 2006 International Optical Fiber Sensors Conference (OFS-18), past Technical Chair of the 2nd Workshop on Specialty Optical Fibers and their Applications (WSOF-2). He is also VP of the IEEE Fiber Sensors Standards Committee, and co-editor of the *"Specialty Optical Fibers Handbook"*, and co-author of SPIE's *"Fiber Optical Sensors Book"*.

Alex Andersson



**Dr. Alessandro
Corsi**

Director

Wound Care Unit
San Raffaele Hospital,
Milan, Italy

Invited Talk
Thursday, June 22
12:10 hours

Photobiomodulation for effective treatment of skin lesions

The application of light in the treatment of skin lesions, acute and chronic, has been used for years to reactivate the tissue repair process in order to allow complete and rapid healing of lesions by skin regeneration (and not by scarring).

The use of monochromatic or fluorescence light has now become part of the normal activity of Wound Care centers.

In this presentation, we analyze in detail the interference of light at different stages of the healing process, what are the outcomes, functional and aesthetic, and the economic impact of the use of this technology.

Dr. Alessandro Corsi: Degree in Medicine and Surgery at the University of Florence (Italy) in 1994.

Specialization in General Surgery at the University of Florence (Italy) in 2000. Master in Wound Care at the University Di Torino (Italy) in 2009.

Diploma of Expert In Wound Care at the Italian Academy of Wound Care (IAWC) in 2013.

Since 2017 Consultant at the Wound Care Unit of the Hospital "San Raffaele" in Milan (Italy), of which he became Director since October 2020.

Adjunct Professor at the University view Health of the Hospital "San Raffaele" in Milan (Italy), he is author and co-author of numerous articles on General Surgery and Wound Care.

He has participated as a speaker in numerous national and international Courses and Congresses.



International School on Light
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Afternoon
15:30- 17:45 h
Round Table II

Treatments and tools using light-based-based technologies

Challenges to face on

Susana Marcos, University of Rochester, NY, USA:

techniques to maintain the quality of humans' vision

Carlos Molpeceres, Laser Center, Polytechnic University of Madrid, Spain:

Laser based technology for regenerative medicine

Valentina Emiliani, Photonics Department, CNRS Vision Institute, Paris, France:

Optogenetic for light control of biological Systems

Rox Anderson, Harvard Medical School and MIT, Wellman Center for Photomedicine, Boston, US:

PDT translation to Clinic

E.Michael Campbell, University of Rochester, NY, USA:

real proton generating by light

Prof. JM López-Higuera, Director ISLIST, Moderator

THURSDAY END



Prof. Carlos Molpeceres

Director

Centro Láser, Universidad Politécnica de Madrid, Spain

Invited Talk
June 23 /9:30 h

Round Table II
June 22 /15:30h

Laser Fabrication Technologies helping the Regenerative Medicine

Since their invention, lasers have been a fundamental tool for the processing of inert materials, being to date a disruptive technology in manufacturing processes in practically any industrial sector. The medical field has also benefited from the unique characteristics of this tool since its inception, presenting itself today as a technology of enormous impact in diagnosis and treatment of diseases. Currently, the use of lasers is beginning to appear as an absolutely differential option in the field of tissue engineering, a multidisciplinary field of enormous growth and where laser based additive manufacturing and laser bioprinting techniques are gaining interest for their unique characteristics. This presentation explores the fundamentals of laser based additive manufacturing techniques and bioprinting processes in tissue engineering, highlighting the differential characteristics of these techniques in comparison with competitive technologies, and presenting some of the applications currently under development in this field of regenerative medicine.

Prof. Carlos Molpeceres is 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, ICALCO, 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.



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**Intense high-energy proton
beams from petawatt-laser
irradiation of solids**

Recorded talk

**Prof. Michael
Campbell**

Former Director
Laboratory for Laser
Energetics (LLE),
University of Rochester,
USA

Closing Invited talk
June 23 / 11:00 h
June 21 / 15:30
Round Table II

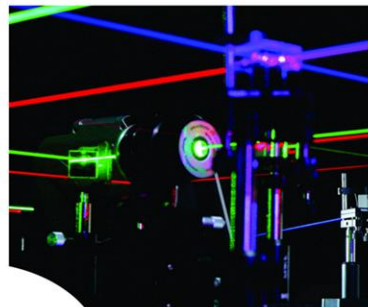
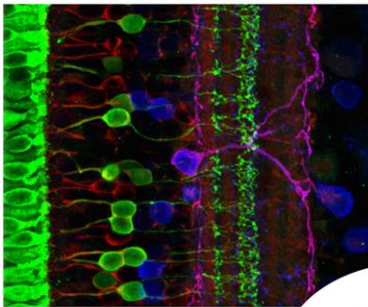
Prof. Campbell is an internationally known expert in inertial fusion, high-energy-density physics, high-power lasers and their applications, and advanced energy technologies including Generation IV nuclear fission reactors and biofuels. He has won numerous awards including the Department of Energy's 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.



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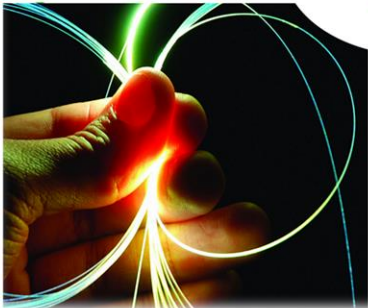
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NOTEBOOK



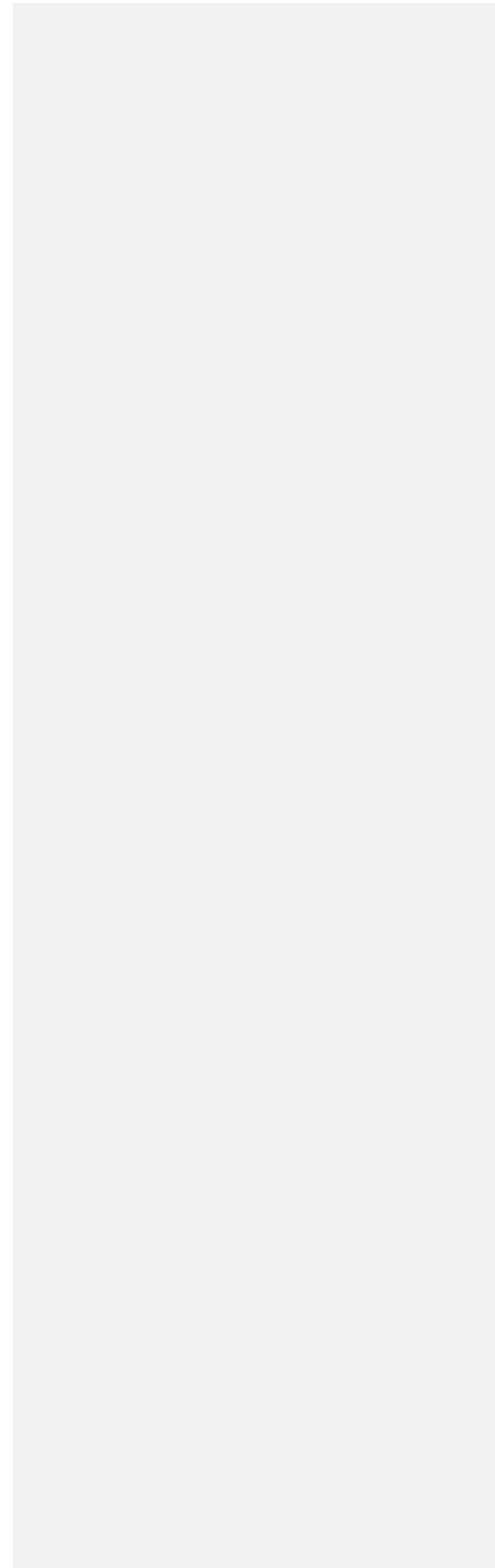
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June 19 / 11:00 h / **Prof. Ozcan**

Deep-learning enabled computational microscopy and diffractive imaging

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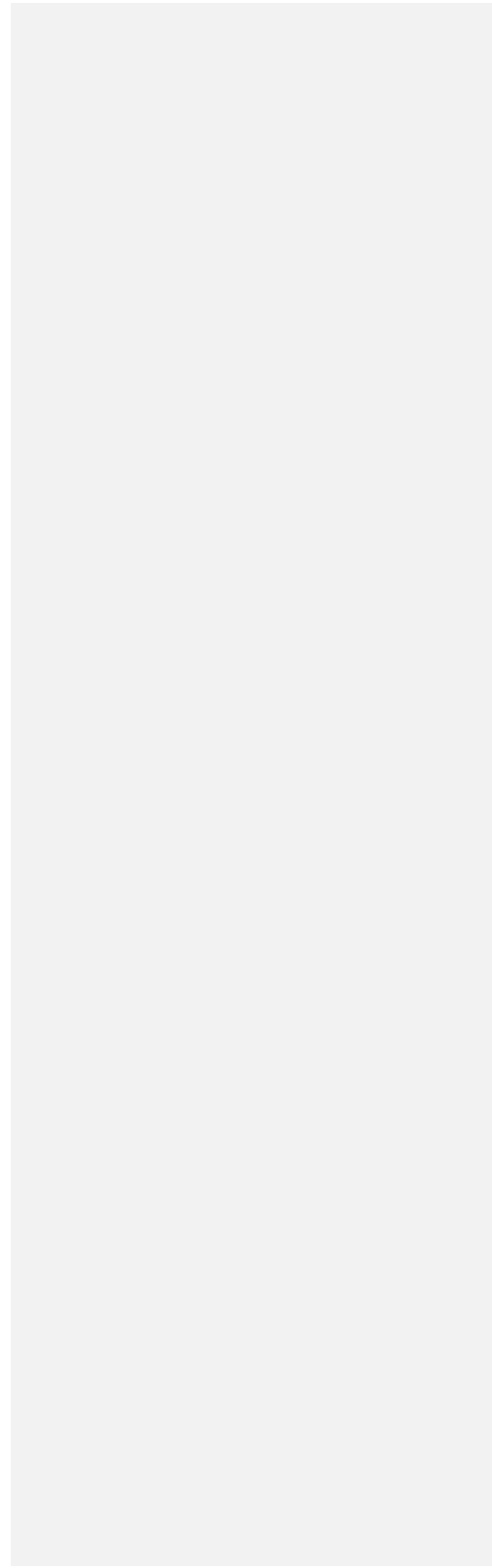
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June 19 / 12:10h / **Prof. López-Higuera**

Light in Health and Medicine: a general overview

NOTES:





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June 19/15:30 h / **Round Table I:**

Challenges to face on supervision sensing and diagnosis



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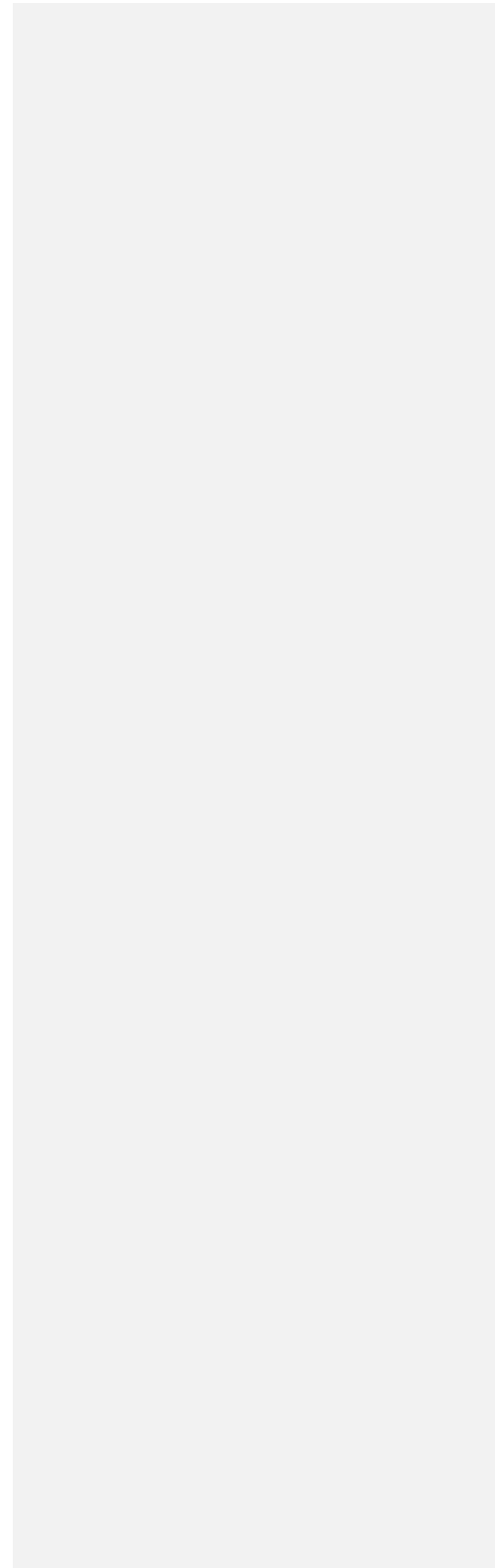
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June 20 / 9:30 h / **Prof. Ntziachristos**

Listening to Light: Advances in Optoacoustic Imaging

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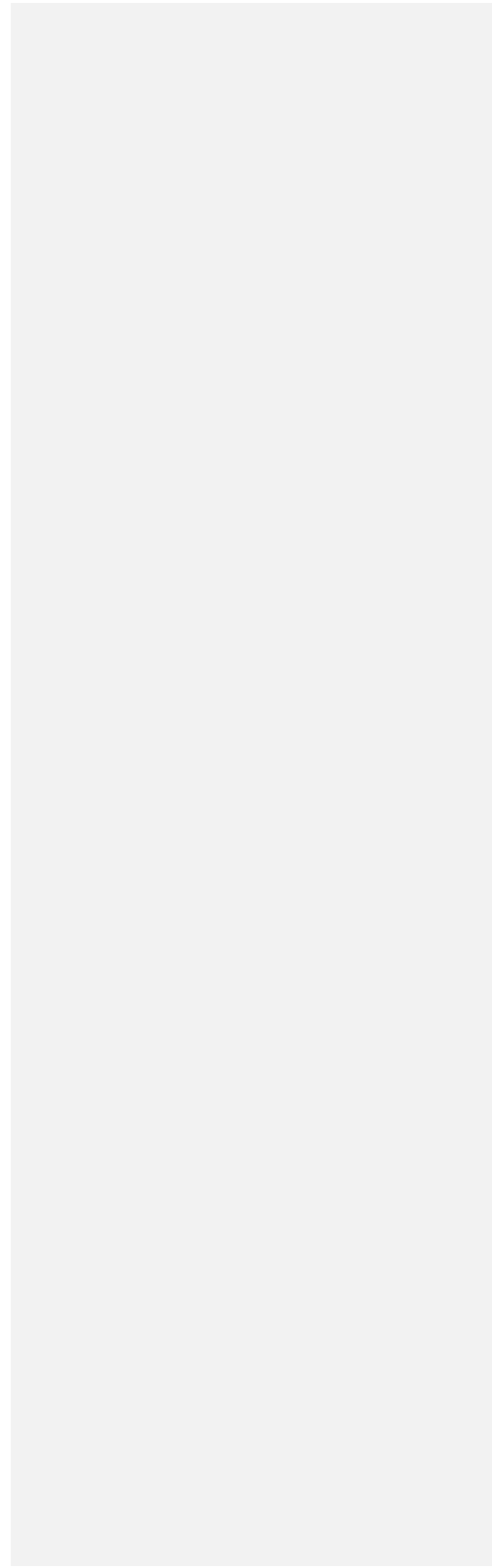
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June 20 / 11:00 h / **Prof. Figueiro**

Light's effects on human health, well-being, and behaviour

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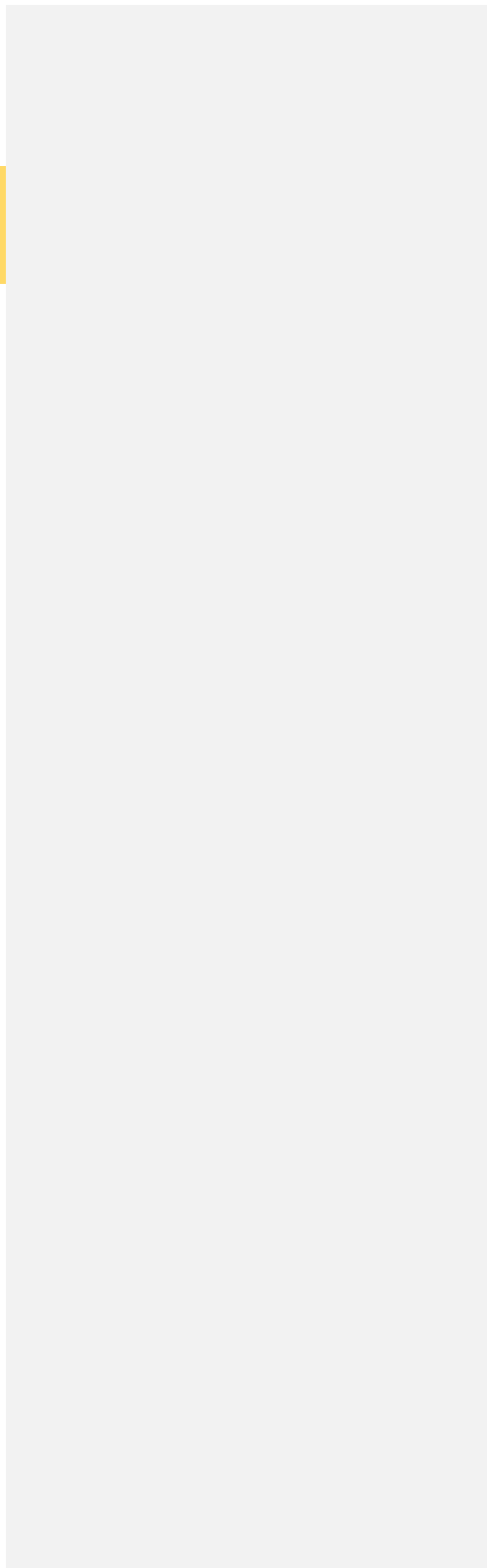
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June21 / 12:10 h / **Prof. Schmitt**

Raman based Spectroscopic techniques for biomedical diagnosis and life sciences

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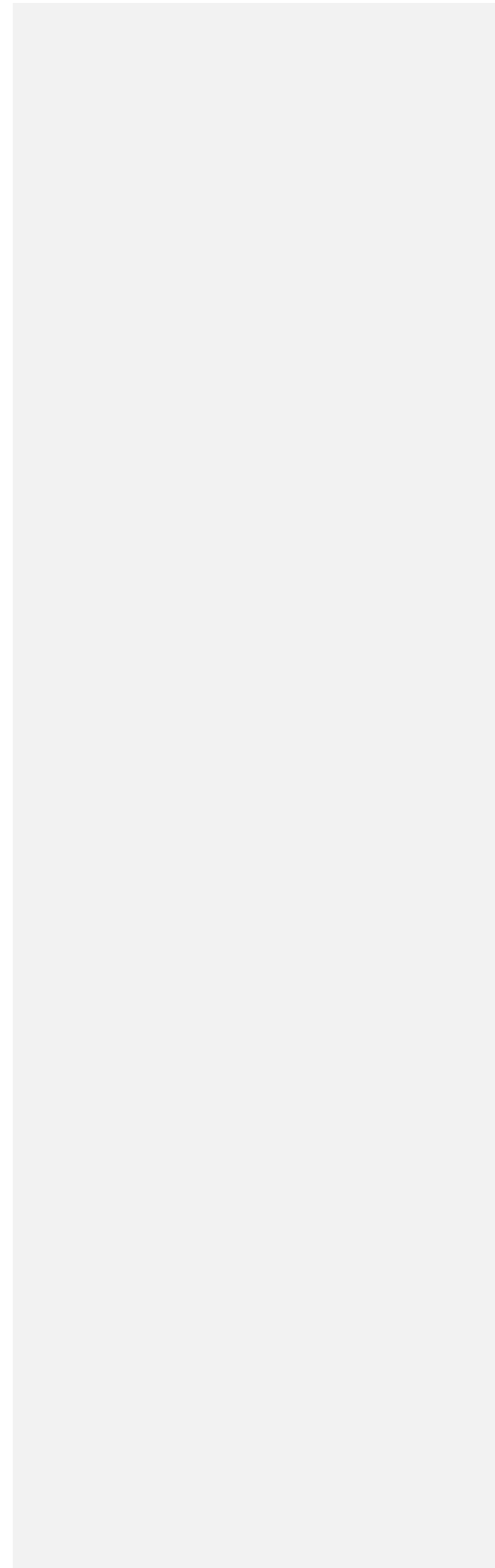
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June 21 / 15:30 h / **Prof. Artal**

Light-based technologies to evaluate vision

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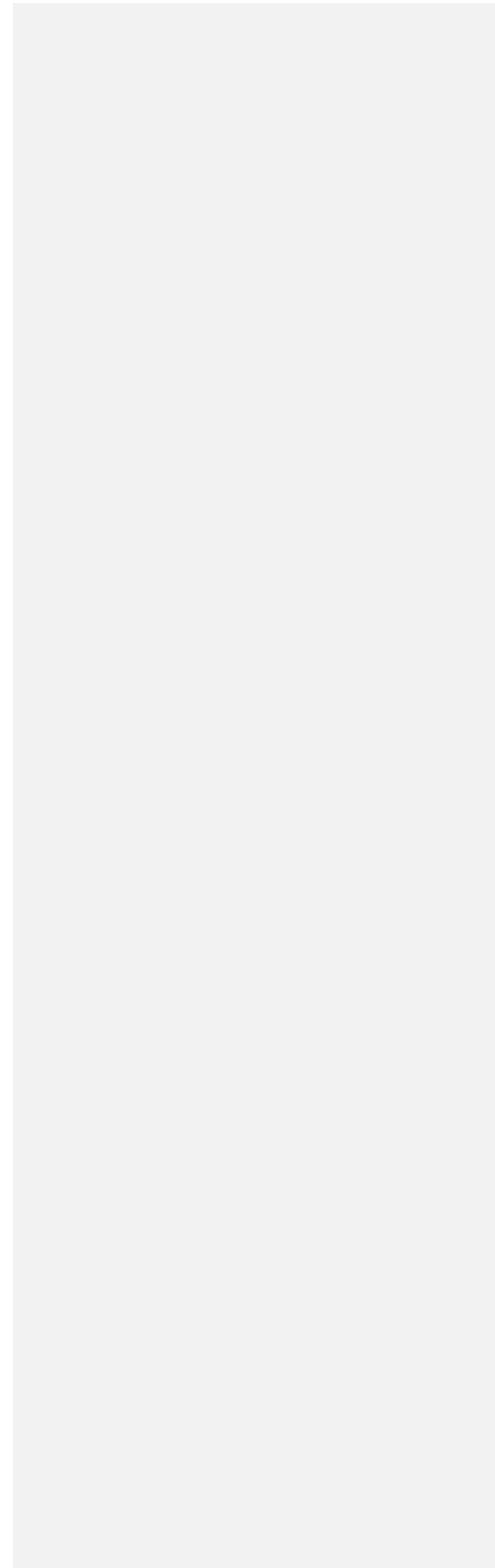
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June 21/ 16:40 h / **Prof. Marco**

Optics and Photonics to improve Vision

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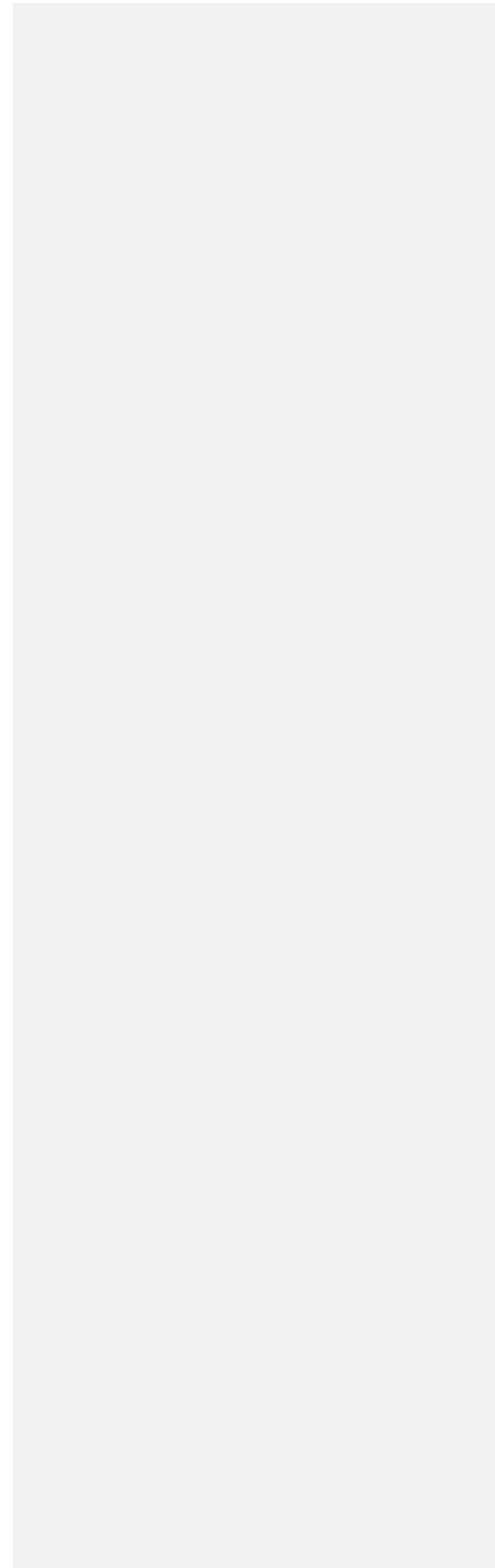
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June 22 / 9:30h / **Prof. Lechuga**

BioPhotonic Sensors after the COVID-19 pandemic

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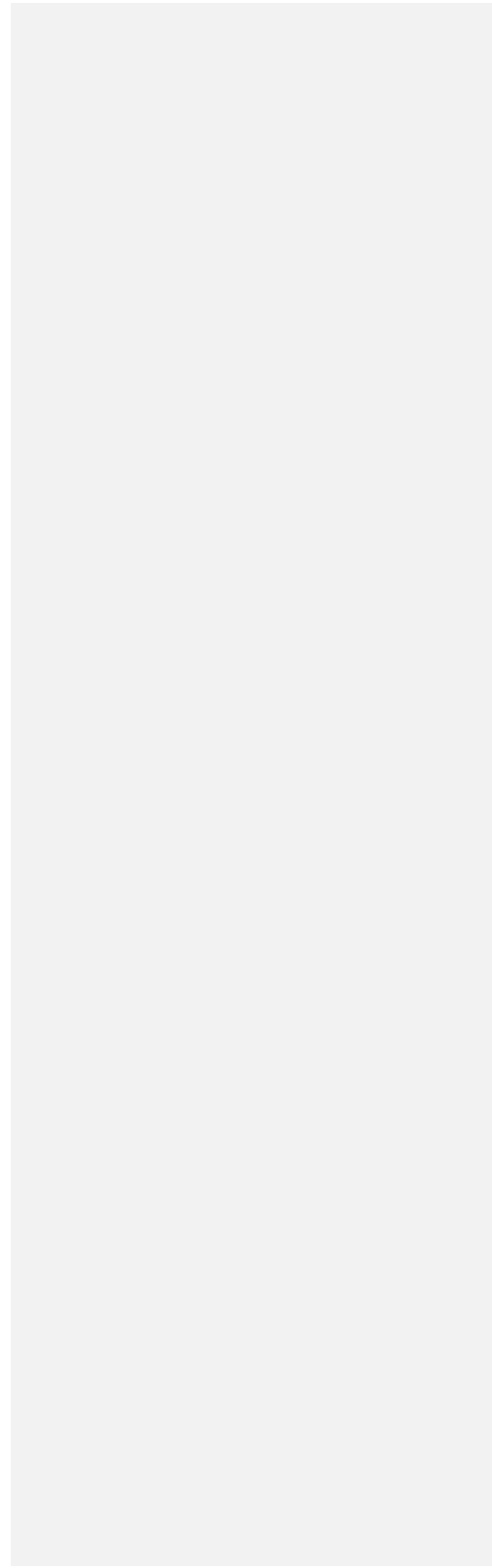
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June 22 / 11:00 h / **Prof. Taroni**

Diffuse optics Systems for effective Management of Breast Cancer

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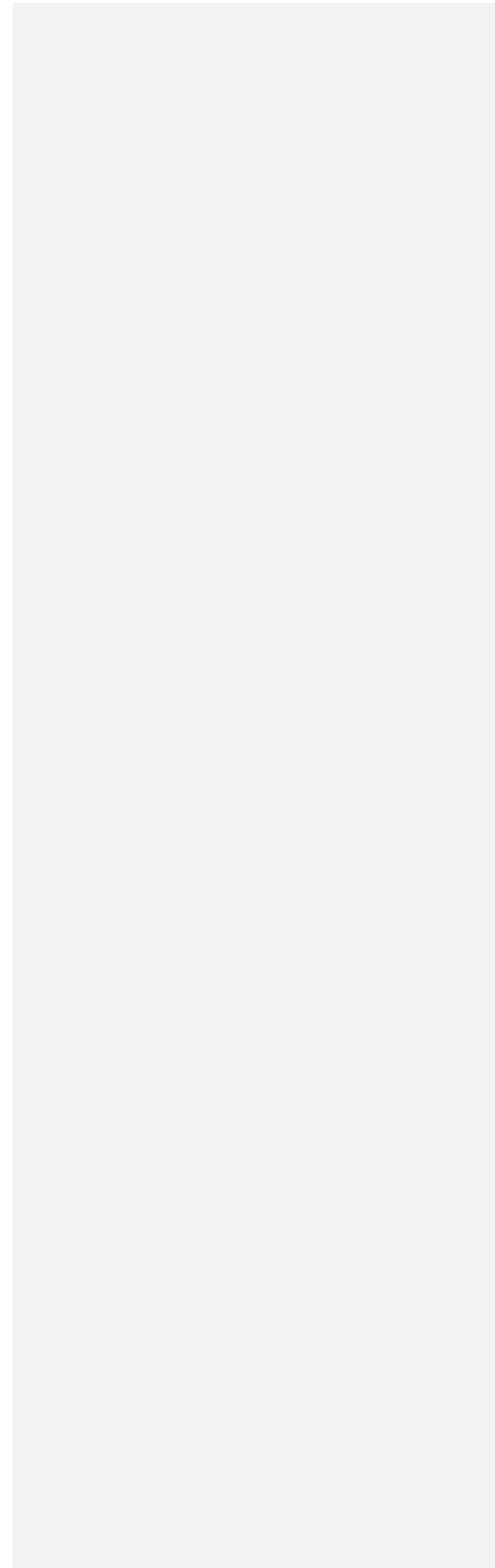
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June 22/ 12:10 h / **Prof. Dolakia**

Optical Tweezers: trapping and manipulation for biomedical applications

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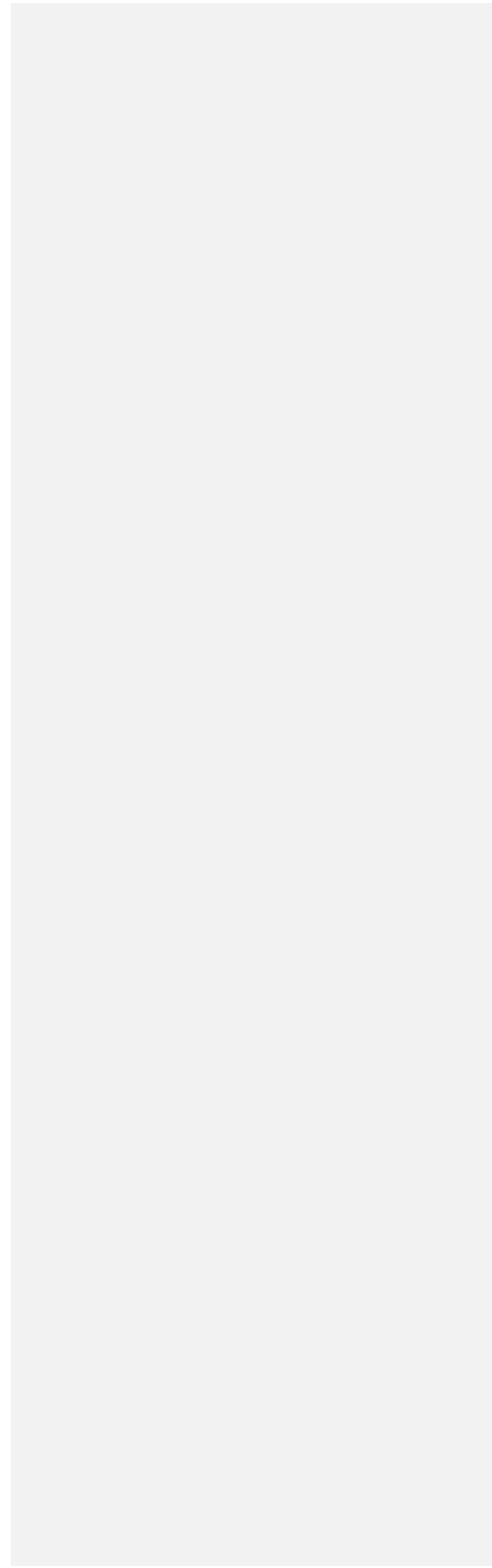
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June 22 / 15:30 h / **Prof. Emiliani**

All-optical control of neuronal circuits by wave front shaping and optogenetics

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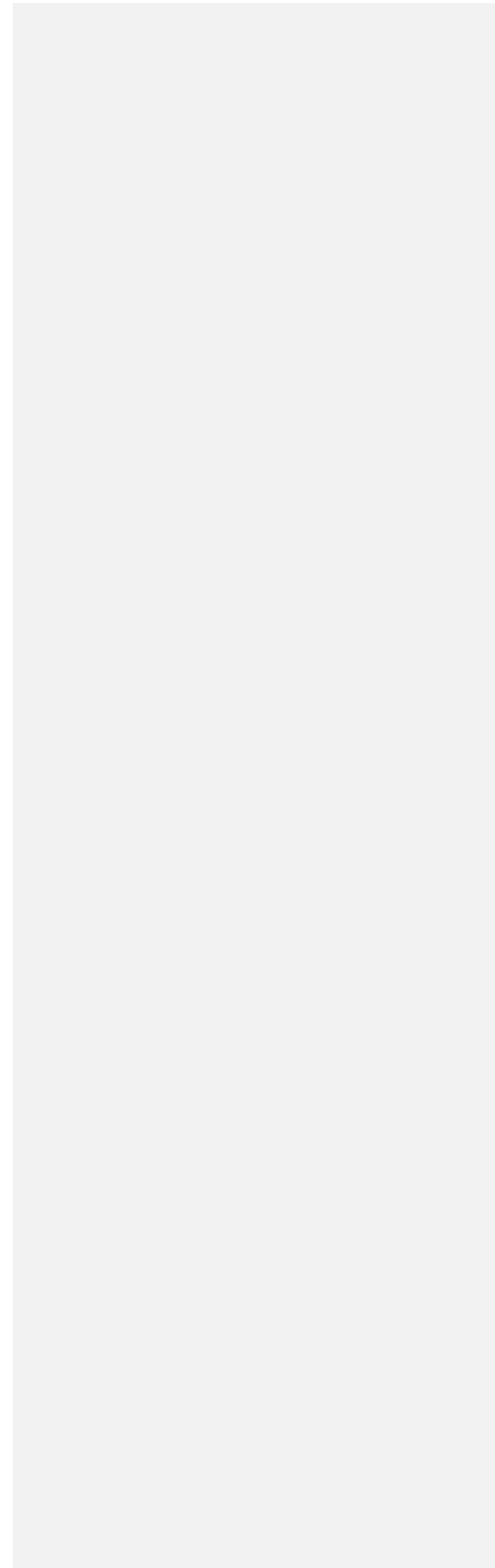
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June 21 / 16:40 h / **Prof. Durduran**

Shining Light on the Brain to understand How it works

NOTES:





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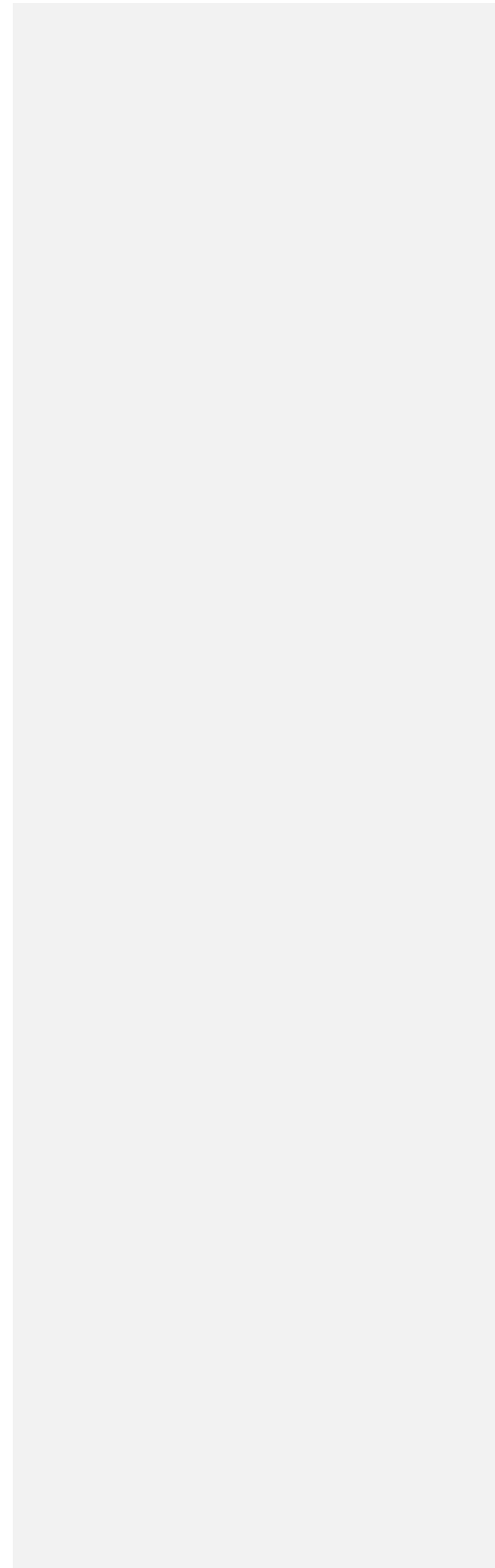
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June 23 /9:30 h / **Dr. Mendez**

Optical Fiber Technology on Biomedical Applications

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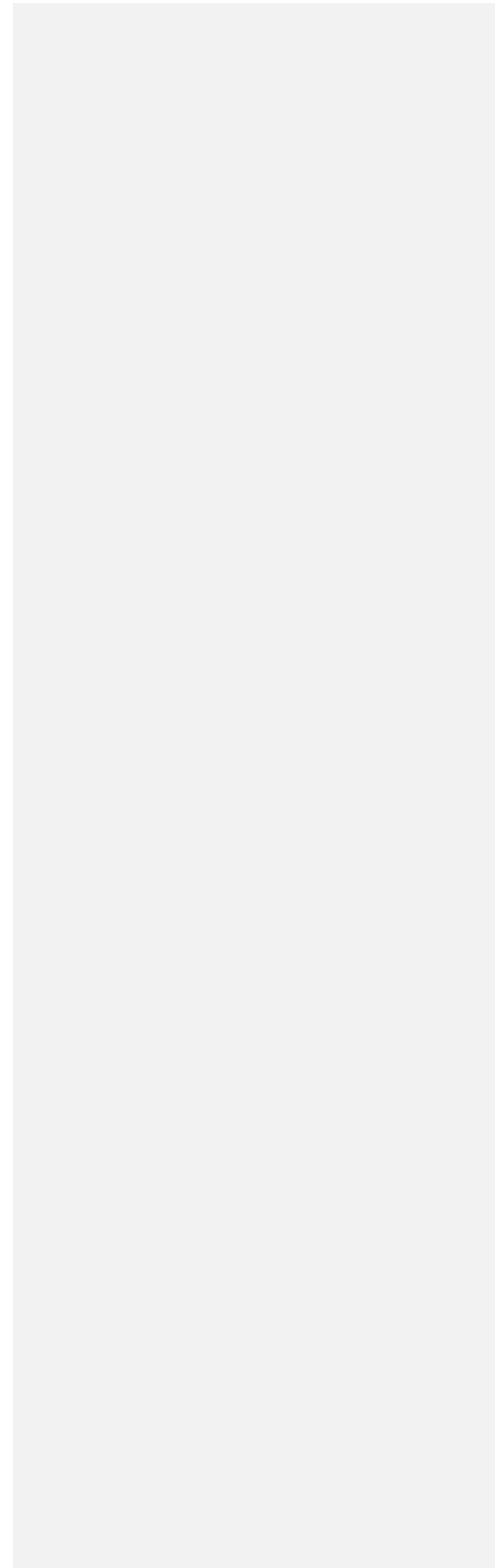
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June 23 / 11:00 h / **Prof. Rox Anderson**

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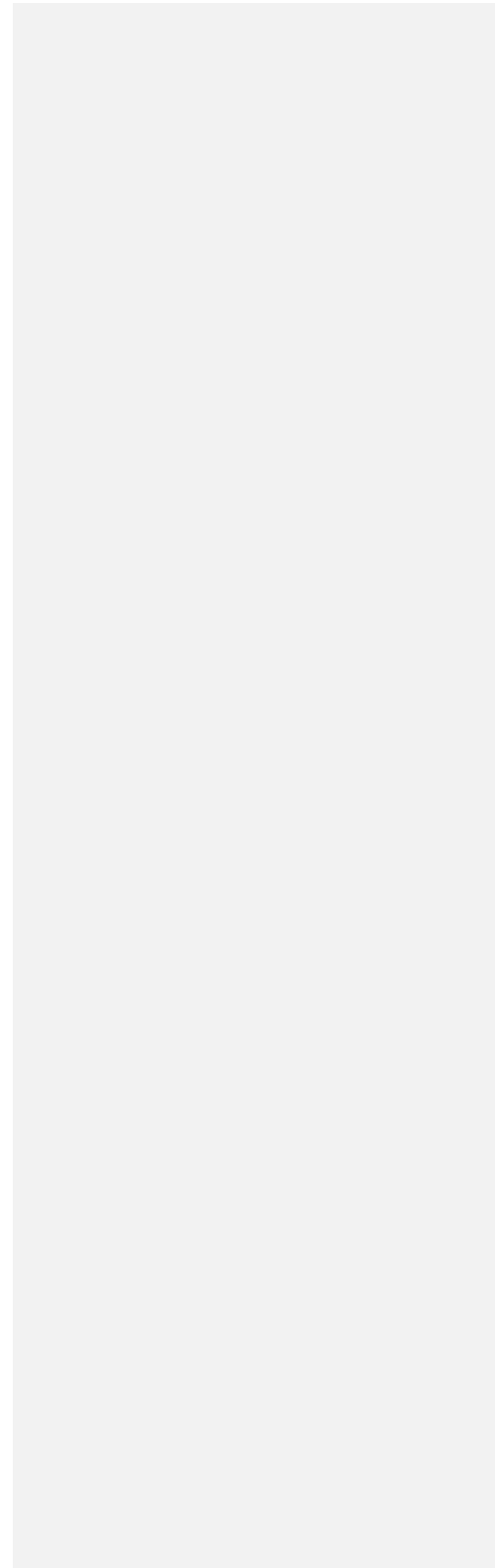
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June 19-23, 2023, Santander, Spain



June 23 / 12:10 h / **Dr. Corsi**

Photobiomodulation for effective treatment of skin lesions

NOTES:

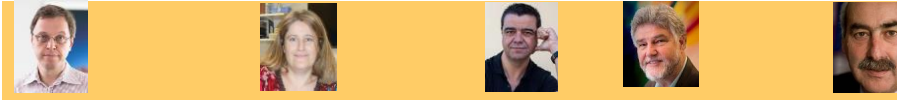




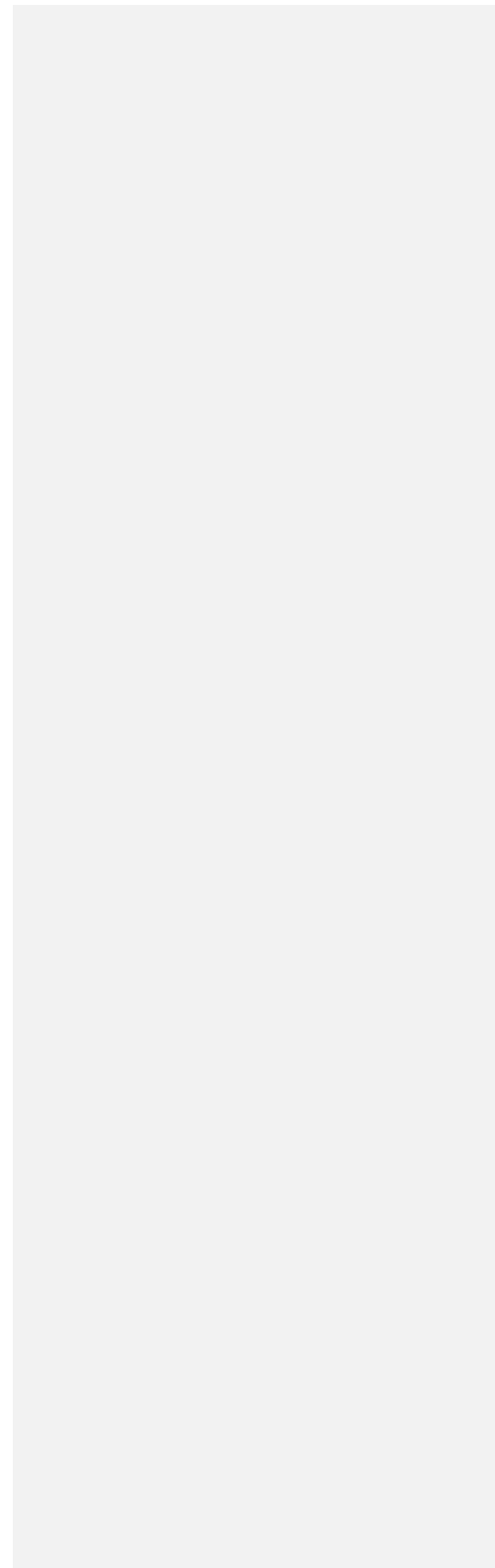
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Sciences and Technologies **ISLiST**
June 19-23, 2023, Santander, Spain

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

Light on treatments and tools: Challenges to face



NOTES:





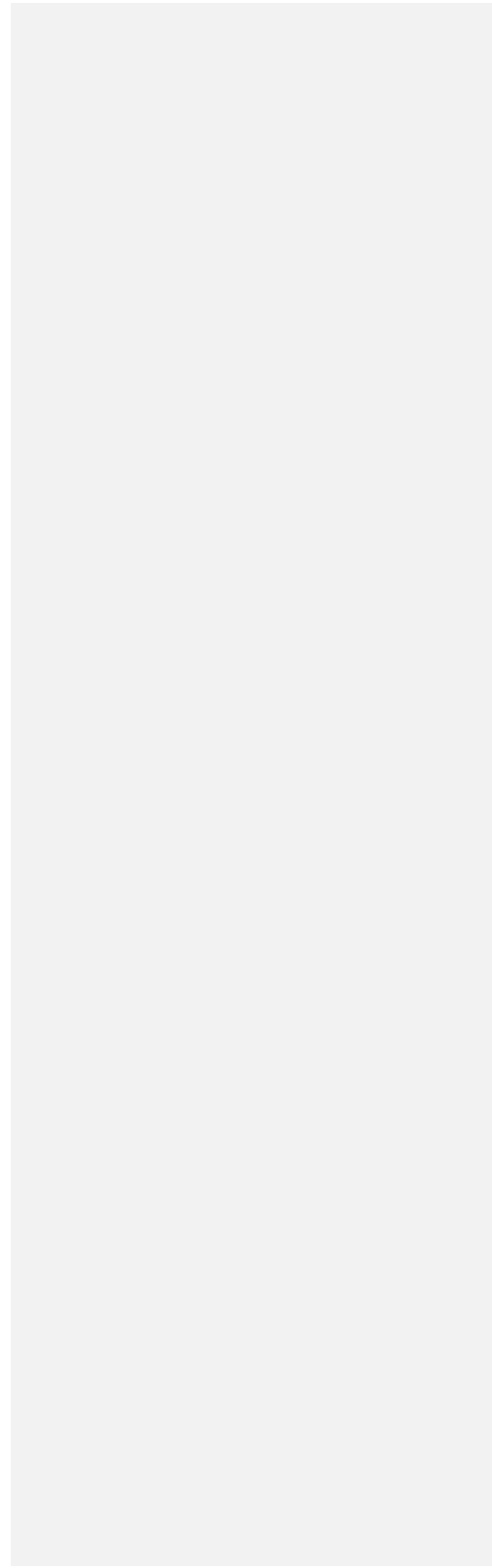
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June 23 / 9:30h / **Prof. Molpeceres**

Laser Fabrication Technologies helping the Regenerative Medicine

NOTES:





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

Intense high-energy proton beams from petawatt-laser irradiation of solids

NOTES:

