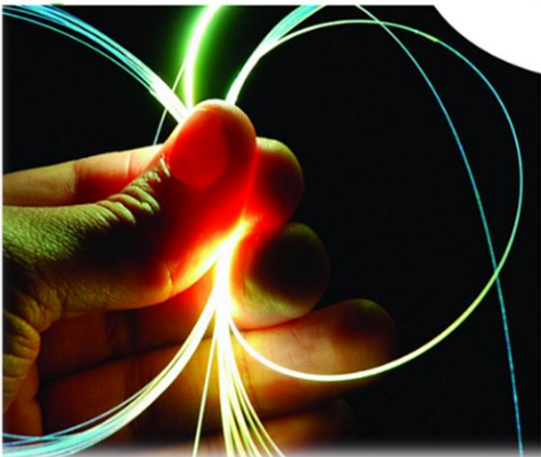


International
School on

Light

Sciences and
Technologies



2022 Core: Light in Energy and Advanced Fabrication

FINAL REPORT



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International School on Light Sciences and Technologies (ISLiST)

June 20-24, 2022, Santander, Spain

Core: *Light in Energy and Advanced Fabrication*

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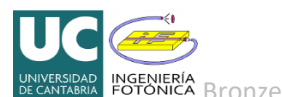
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1. EXECUTIVE SUMMARY

This International School 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 common citizens. It is also a great opportunity to ensure that legislators, entrepreneurs, and other key “actors” will be aware of the problem-solving potential of Photonics.

ISLiST is envisioned to be a worldwide top International forum on *Light Sciences and Technologies* in the framework of a “special university” that is recognized as the “university of universities”. It runs (the third or fourth week of June of every year) 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 Energy and Advanced Fabrication* was the core of this 2022 edition.

More than 69 attendees from 14 nationalities and from more than 23 different institutions gathered during the week of June 20 to 24, 2022, in Santander, Spain to receive the knowledge and experience from 15 of the most reputable professors and professionals of the academic and research institutions and companies of 5 different nationalities.



Figure 1.- General View of the Royal Palace of the Magdalena, venue of ISLiST.



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The ISLiST participants (60% PhD students, 11% Master students, 16% Posdocs) had the privilege of receiving the teachings and experience of researchers of the stature of professors, Christian Bressler, Carlos del Cañizo, Antonio Gómez, Christian Sattler, Jordi Martorel, Carlos Molpeceres, Michael Campbell, Javier Solis, Martin Wegener, Fabien Guillemot, César Jauregui, Maite Flores, Beat Neuenschwander and JM López-Higuera. They also received the expertise of reputable professionals such as Mikel Bengoa (General Director of Coherent Rofin, Spain). Unfortunately just in the last minute due to an unexpected health problem, we were unable to receive the valuable knowledge and experience of Nobel Laureate Prof. Gerard Mourou. Very hot topics in the use of light sciences and technologies in Energy and Advanced Fabrication were presented and discussed for the 17 one-hour lectures and two round tables that focused on the search for challenges pending both in light Energy (round table I) and in the use of Light in the Advanced Fabrication sectors (round table II).

Sponsored by the Santander Council (Ayuntamiento de Santander), the ISLiST attendees enjoyed the Santander Council Reception, a great opportunity to share experiences and an optimum occasion for networking.

During the International School of Sciences and Technologies of Light, SEDOPTICA (The Spanish Optics Society) delivered the Justiniano Casas Awards to the best works on Image decided by the Image Committee.

In order to achieve this 2022 ambitious program, the Government of Cantabria has sponsored this International School of UIMP. ISLiST was also supported by Collaborators such as Fyla Lasers (Gold), Prysmian (Gold), Aragón Photonics (Silver), Ambar Telecommunication (Silver) and Lasing, Santander City Council and Photonics Engineering Group of UC, CIBER-BBN Nad IDIVAL (the last three Bronze). Without these Sponsor and collaborators, this top quality school and the grants for international students would not have been possible. The UIMP, the direction of this event and the scientific community using Light are grateful for the generosity of all these Organizations and all the Invited Speakers. **Thank you so much!**

At the end of the closing ceremony, the next edition of this international school was announced. The fifth edition of ISLiST (June 19-23, 2023) will have the core on **Light Health and Medicine**.

Santander, October 26, 2022.



Prof. José Miguel López-Higuera
Director ISLiST at UIMP



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2.- ISLIST-2019: A SUCCESSFUL AND TRULY INTERNATIONAL SCHOOL

ISLIST at UIMP has been acknowledged as a high standard international meeting both by the invited scientists and professionals and by the attendees. It has been considered as an edition with an excellent organization, where high quality services were offered, where cutting-edge ideas and technologies were presented and discussed and where networking and interchange of experiences were also successfully carried out (see satisfaction-survey).

+The participants of this edition of the ISLIST at UIMP in Santander, Spain, enjoyed the Sixteen (17) invited talks and two round tables by highly renowned professors and researchers from the most prestigious worldwide institutions of Europe and USA. The hot topic of *Light in Energy and Advanced Fabrication* was the core of this 2022 edition.



Figure 2. Family photo of the ISLIST-2022 participants. It was taken just before the Santander Council reception. Around, Invited Speakers and organizers.



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2.1 ISLIST 2022: Some data

Sixty-nine (69) attendees from 14 different nationalities (from over 23 different institutions) participated in this meeting. As shown in the geographical breakdown in Figure 3 the participants came from: Spain (more than 45), Italy, Morocco, UK, India, Nigeria, Russia, France, Cuba, Lithuania, Mexico, Ukraine, Ecuador and Romania.

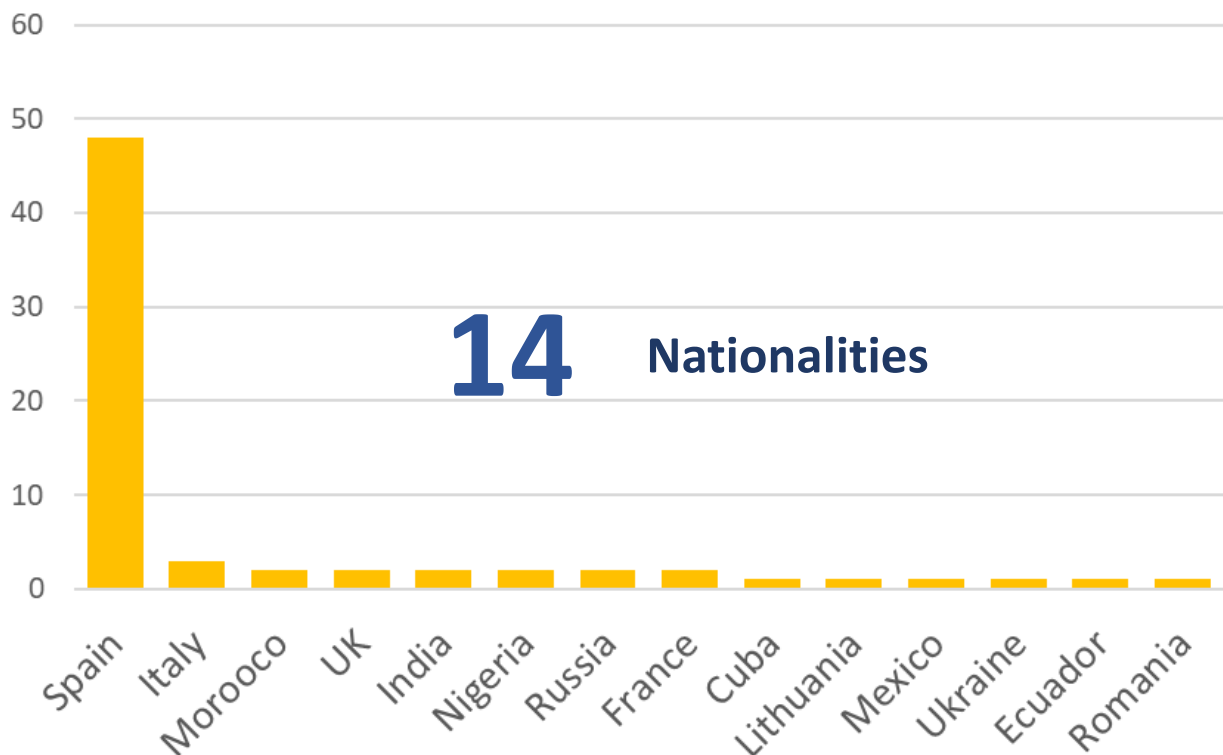


Figure 3.- ISLIST attendees by countries from Europe, Asia, America and Africa.

Eighty-two per cent (82%), twelve (12%) and six (6%) of participants were from education institutions (Universities), R&D centers and companies, respectively.



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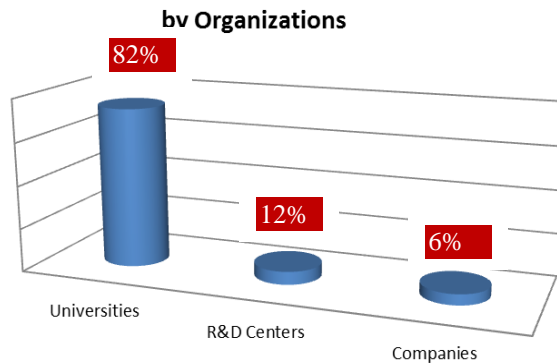


Figure 4.-Attendees by Organizations.

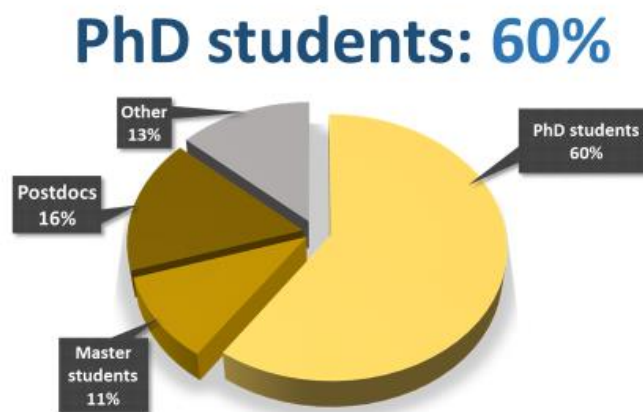


Figure 5.-ISLiST attendees by education

Regarding the previously mentioned students: 60% were PhD students, 16% were PhD (Dr), 11% were Master Students (figure 5).

In terms of the participants age: 65% of the attendees were in the range from 20 to 30 years, which is in correlation with the fact of the education period working towards PhD degrees and also in Post-docs. This fact suggests the very good acceptance of this top quality school and its positive potential impact on the education of very good researchers and professionals in the early stages of their careers. This fact will be key issue for the near future of our globalized world in which this key technology (Photonics) will play as relevant roll as Electronics played in the last XX Century. 22% of the attendees were in the range from 31 to 35 and 22% were attendees of more than 41 years old respectively.



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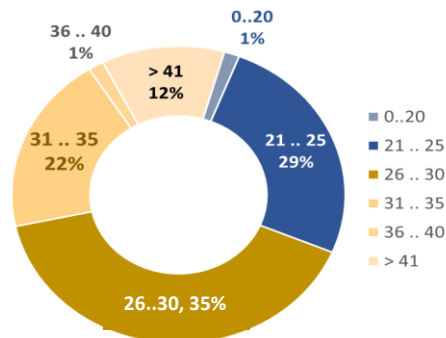


Figure 6.-ISLiST attendees by age.

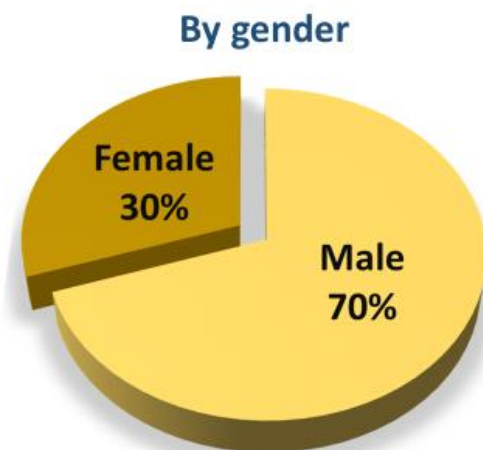


Figure 7.- ISLiST attendees by gender

Analyzing the gender distribution, 70% of the attendees were men and 30% women, that in correlation with the 2019 edition and in comparison with the gender distribution of the previous ISLiST editions [2017 (74% attendees were men and 26% women) and ISLiST 2018 (67% attendees were men and 33% women)] represents a little decrease of the gender gap. This also correlates with the real situation in many countries in technical and scientific jobs. Taking in consideration the number of women as students in grade levels of the current education institutions, these numbers will be progressively change towards a more homogeneous distribution without the need of any specific policy, N just fighting against any kind of discrimination. In any case, what really will help to decrease this gap are policies facilitating the familiar real conciliation lives of the families with very special emphasis on the youngest.

For Spanish Students or Students of any nationality but working/studying in Spanish institutions, UIMP offers grants with funds provided by the Spanish State. However, UIMP is not able to offer grants for any other international Students. Thanks to the sponsors and collaborators,



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ISLiST was able to offer grants 38 grants of which 15 were for **international** students from non-Spanish institutions. <http://www.teisa.unican.es/ISLiST/index.php/grants>

A call for applications was opened for two kinds of student grants: i) Registration Grants or ii) Full Grants that cover course registration, accommodation and living expenses.

A total of 62 grants were allocated (24 funded by the Spanish state and 38 with funds from the collaborators). 33 were complete or full grants (35 for international students) and 29 covered the school registration fee.

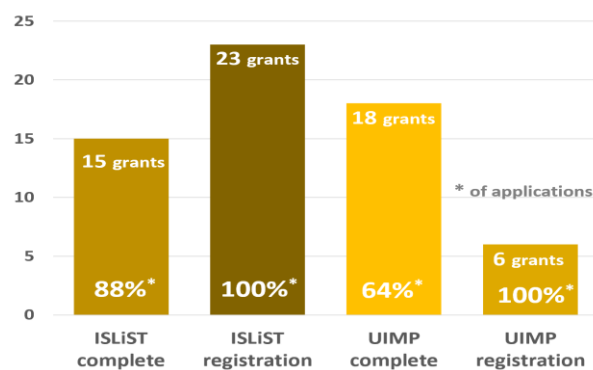


Figure 8.-ISLiST Student Grants distribution

The International School on Light Sciences and Technologies (ISLiST) at the Menéndez Pelayo International University (UIMP), Spain, has consolidated as an international reference at the highest scientific and technical level.

It is confirmed on the fact of the highest quality of the lectures of the best experts of the most renowned institutions and organizations in the world in the use of Light Sciences and Technologies in Sources, in Health and Medicine, together with the numerous and high qualification of international participants. In this regards, as it happened in the previous editions of ISLiST, the offer of scholarships to international students (from any institution around the world) has significantly contributed to the achievement of the recognition of ISLiST as a top international forum, what is "inscribed in the genes" of this very special **University of Universities** (the International University Menendez Pelayo, UIMP).

3.- PROGRAM AND ITS DEVELOPMENT

The School Programme was designed and published in the meeting web site. The program and notebook were included in the bag of all the ISLiST participants:

<https://www.teisa.unican.es/ISLiST/images/2022/Programa%20completo%20ISLiST-2022-UIMP-14junio.pdf>

The **general Schedule of ISLiST-2022** was programmed and developed as shown in figure 9.



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General Schedule

Time	Monday 20 th	Tuesday 21 st	Wednesday 22 nd	Thursday 23 rd	Friday 24 th
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 Bern, 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 (LEE), University of Rochester, USA Laser driven fusion energy: status, challenges and the future (RTalk)	Prof. Carlos Molpeceres Director, Laser Institute, UPM, Spain Microadditive Manufacturing using Laser Direct Write	Prof. Beat Neuenschwander Lead Scientist, laser processing Expert University of Bern, 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, ICIQ, 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 de 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 Dr. Fabien Guillemot CEO, POETIS, France Towards a 4D Bioprinting Industry in the fourth industrial revolution	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				
17:55	Justiniano Casas AWARD Ceremony (SEDOPTICA)		Family Photo Santander City Council Reception		

Figure 9.-ISLIST-2022 General Schedule

The ISLIST-2022 Speakers are also, shown in the figure 10.



Figure 10.-ISLIST-2022 Speakers (by apparition order).



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3.1 Invited Talks and Round Tables in the frame of ISLiST-2022

After the Opening Ceremony, from June 20 to June 24, 2022, 17 invited talks and two Round Tables were developed.



Figure 11. Prof. Bressler during his invited opening talk.

Prof. Christian Bressler (Lead Scientist and Group Leader, Max Planck Institute for the Structure and dynamics of matter, European XFEL, Hamburg, Germany), after an introduction to the European XFEL as a highly brilliant femtosecond x-ray source able to carry out structural dynamics experiments at atomic-scale and spatial and femtosecond temporal resolution, spoke about the arsenal of scientific tools available at European XFEL and provided few case examples including the early dynamics in potential functional molecular systems for photovoltaic and molecular switching applications, and also in fundamental studies of many-body interactions in disordered media. Brilliant and very instructive was the part of the talk that he devoted to his creation of the *Virtual Lab* to enable the fully simulation of femtosecond x-ray experiments at one of the available beamlines of the facility.



Figure 12. Prof. Lopez-Higuera (University of Cantabria, Spain) during his lecture.

Prof. López-Higuera, spoke about what should be under-stood as Light Sciences and Technologies (Photonics) and, very briefly, summarized some key properties of Light and reviewed some key doctrinal conceptions to understand the use of light approached in health and medicine. Then, he demonstrated the fundamental theory concerning the emission of the light on the sun and they trip and correlated effects that the flux of photons (light) experiment to arrive to the hearth. He also spoke about the facts behind the climatic change and the



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necessity to develop efficient and effective new technologies based on light approaches to contribute to fight the adverse climatic change effects. Then, Prof. López-Higuera justified the key role placed by the light based technologies in Energy and Advanced Manufacturing in a wide set of their processes. He concluded his talk with an illustrative review of significant cases.

Prof. **Del Cañizo** (Director of Solar Energy Institute, University Politechnique of Madrid, Spain) showed to the attendees the reasons for what the Photovoltaic Solar Energy (PV) was becoming and, in the currents, is really a keystone of a decarbonized energy system, making the dream of using directly the sun radiation to produce electricity come true. Along the lecture, the fundamentals of photovoltaic conversion were revisited for a better understanding of the technology improvements that have succeeded in making PV a scalable, cost-competitive and reliable power source. He continued describing how the efficiencies reached by current PV devices are being approaching the theoretical limiting ones, bringing to light the challenges ahead to keep the technology progress up.



Figure 14. The moderator during the questions' time.

Then, in the last part of the talk, he presented a proposal to address the need of storage coming from the intermittent nature of the solar resource. In this case, the energy stored at ultrahigh temperature is being converted back into electricity by thermophotovoltaic devices, he concluded.



Figure 13. Prof. Del Cañizo (Solar Energy Institute, UPM, Spain) during his invited presentation.

Prof. **Gómez Expósito** (Lead Scientist expert in energy systems at the University of Seville, Spain), spoke about Solar Energy in the Electrical Systems and focused on the Spanish case for 2050.

In his lecture, after a review and analysis of the evolution of solar energy in the world, the potential of Photovoltaic (PV) energy in Spain was analysed for what he focused, especially, on self-consumption. Then, taking as a starting point the National Integrated Energy and Climate Plan 2021-2030 (PNIEC) scenario for 2030, he analysed a hypothetical scenario for the 2050 horizon. In this Spanish scenario, the gap left by the substitution of the nuclear and combined cycle power plants by solar energy, and he estimate the costs and storage needs made to meet current demand plus that of a fully electrified light vehicle fleet, he summarised.



Figure 15. Prof. Gómez Expósito (University of Seville, Spain) during his lecture.



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Professor Sattler (Director of DLR's Institute of Future Fuels, German Aerospace Center (DLR), and professor for solar fuel production at the Technical University of Dresden, Germany), developed a lecture concerning the Solar Fuels and Electricity by using Sunlight concentrating Systems. During his brilliant presentation, Prof. Sattler offered an excellent overview of the concentrating solar fuel production processes. He offered insights in how to design the required heliostat fields, secondary optics, and control systems including the integration of artificial intelligence (AI).

He also, stated that the production of electricity and fuels by concentrated solar radiation is, really, an option for efficient large-scale processes. He argued that the radiation could, 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 CO₂ splitting into hydrogen, oxygen and CO. He added that, 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 expected to be set-up until 2024. He also mentioned that the concentrator systems, mainly heliostat fields, are similar to installations for power production, but 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, he concluded.

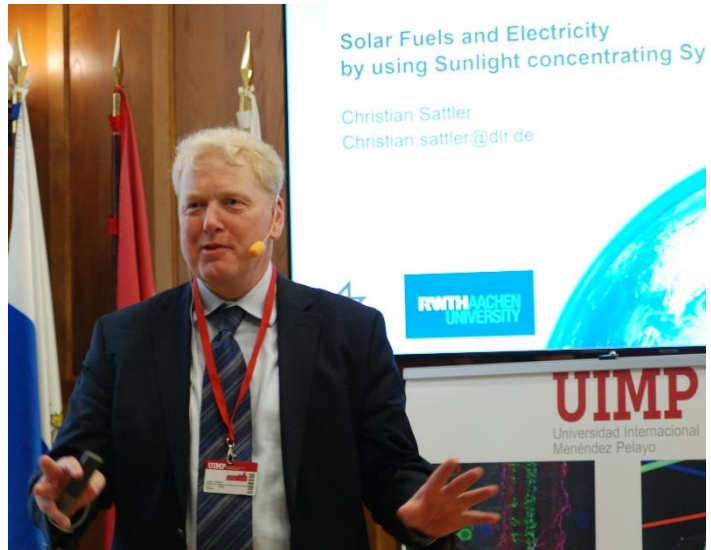


Figure 16. Prof. **Sattler** (DLR's Institute of Future Fuels, German Aerospace Center (DLR), Germany) during his Invited lecture.



Figure 17. Mr. **Bengoa** (Coherent Rofin in Spain, Spain) during his lecture.

Mr. Bengoa (General Director of Coherent Rofin in Spain, Pamplona) spoke about Laser technology in Advanced Batteries fabrication. During his very comprehensive invited presentation, he introduced the new demands created by the e-Mobility transformation and, in particular, in battery fabrication, and the strategies that are being, currently, followed to overcome those challenges from a laser design perspective. He stated that 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.



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Figure 18. Prof. Martorell (Institute of Photonic Sciences, ICFO, Barcelona, Spain) during his lecture.

Nano-photonics in energy conversion and solar fuel production were the subject addressed by **Professor Martorell (Group Leader of Organic Nano-structured Photovoltaics at ICFO, Barcelona, Spain)**. During his invited talk, he reviewed the reasons for what the implementation of nano-phonic structures are key to achieve high performance organic solar cells, paying special attention on semi-transparent devices. Then, he introduced novel photonic structures with potential to be used in combination with wide bandgap perovskite photovoltaic cells for stray light recycling in a system emitting broadband polarized light. Prof. Martorell also discussed the photon recycling and antireflection dielectric multilayers for achieving ultimate efficiencies in a planar

geometry perovskite solar cells. He also discussed the role of nano-photonics in photo-electrochemical cells for an optimal hydrogen generation or CO₂ reduction for the production of solar fuels, he concluded.

During the Round Table I on Challenges to face on Light in Energy, both the attendees and the invitees enjoyed a very interesting round table with very active participations from both sides. After the moderator's presentation each of the invited panellists presented their brief statement



Figure 19.- Round Table I; Challenges on Light in Energy. From left to right hand: Antonio Gómez, Christian Sattler, Carlos del Cañizo, and JM López-Higuera. Online from San Diego, USA, Michael Campbell. Courtesy of Photonics Engineering Group.



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on their previously allocated topics. Due to unexpected and important commitments, Prof. **E.M. Campbell** participated online from San Diego, USA. The topics on Challenges to face to: *reach profitable green energy systems based on Solar Fuels (Christian Sattler)*, *reach profitable laser driven fusion energy (E.M. Campbell)*, *improve the efficiency of Photovoltaic solar cells (Carlos del Cañizo)* and *to reach efficient and sustainable Solar energy systems by Antonio Gómez-Expósito* were, importunately and deeply discusses by the participants.

Then, each member of the panel took the opportunity to debate different aspects among the panelists. After that, attendees asked different questions, in an open and fully-freedom-environment, and a very interesting debate took place inside the room. Numerous interactions were carried out among the panelists and from the attendees and discussions from both sides also took place.

.After two and half hours, the round table concluded with several open questions and also with very interesting and useful insights and conclusions.



Figure 20. Panellists' moments during the round table I development



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Figure 21. Prof. Molpeceres (Universidad Politécnica de Madrid, Spain) during his Invited talk.

Professor Molpeceres (Director of Laser Centre of Polytechnic University of Madrid, Spain) reviewed and discussed ongoing works concerning the Laser Technology in Photovoltaics.

In his presentation, he discussed the current 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, he discussed the impact of laser technology in the present and future development of Building Integrated Photovoltaics (BIPV), an area in which lasers offer outstanding solutions for product customization.

Prof. Molpeceres also, spoke about the impact that laser-based advanced manufacturing techniques, and in particular those based on ultrafast laser processing techniques, are having in the research of cutting edge concepts that will define the photovoltaics of the future.

Lasers are being 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, he concluded.

Professor Michael Campbell (Director of the Laboratory for laser Energetics (LLE), University of Rochester, NY, USA) reviewed and discussed the current state of the art, trends and challenges to

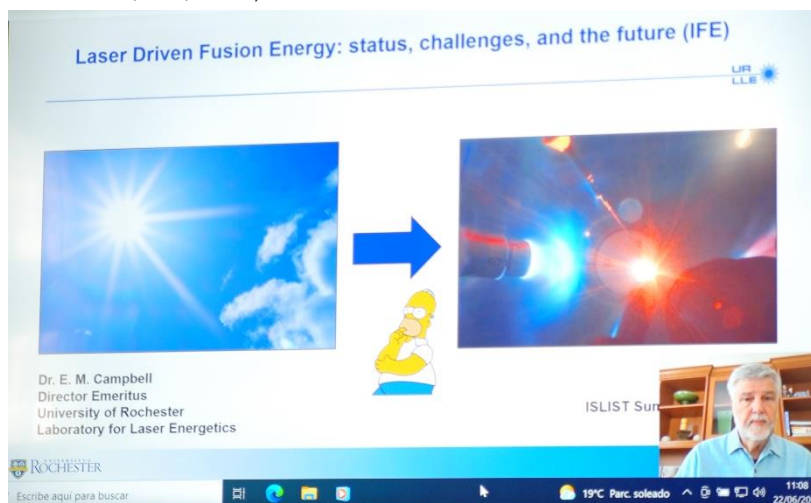


Figure 22. Prof. M. Campbell (University of Rochester, NY, USA) during his brilliant online presentation from San Diego, USA.

be faced concerning the generation of huge accounts of energy by fusion of elements as consequence of being illuminated by extremely intense laser lights. After his description of the key parts required and the basic physics involved in the process, he identified bottlenecks in what is required much more effort to reach a mature technology able to be used on real exploitation field.



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Professor Solis, (Director of Ultrafast, Nonlinear and Nanoscale Photonics Department of the Institute of Optics at National Research Council (CSIC), Madrid, Spain) reviewed and discussed the



Figure 23. Prof. Solis (CSIC, Spain) during his Invited talk. It was delivered sitting due his transitory reduced Mobility, at that moment.

state of the art related to *direct writing of photonic structures and element redistribution processes with femtosecond laser light*. 1996. He mentioned that in the last decades, several different research groups 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. He recalled 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.

Prof. Solis described the fundamentals of the direct writing technique, its main advantages and limitations, as well as a number of relevant application examples. He also described 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, he concluded.



Figure 24. Prof. Wegener (Institute of Nanotechnology at KIT, Karlsruhe, Germany) during

Professor Wegener (Director of the Institute of Nanotechnology at KIT, Karlsruhe, Co-founder Nanoscribe, Germany) spoke about the *3D and 4D Nanoprinting technology*. He, introduced the ISLiST's attendees into the field of 3D laser micro-and nanoprinting based on two-photon absorption and briefly, reviewed the current state-of-the art, recent progress experimented in his institute that 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 their work on replacing two-photon absorption by two-step absorption. Unlike two-photon absorption, which requires mode-locked femtosecond lasers, two-step

absorption can be induced by compact low-power continuous-wave semiconductor laser diodes, he concluded.



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Figure 25. A sample of the interesting and, sometimes, deep discussions occurred after the invited presentations. Questions and discussions among the invitee lecturers and, also, with the attendees, in a fully freedom university environment but, always, observing the due courtesy, as common way of behave on ISLiST at UIMP.

Dr. Guillemot (CEO and Co-founder of Poietis, Aquitanie, France) developed his lecture on *4D Bioprinting Industry in the fourth industrial revolution*. He mentioned the challenges for the manufacturing of tissue engineered advanced therapy medicinal products (ATMPs) relate to the standardization of manufacturing processes and the improvement of tissue functionality, and cost-effectiveness and profitability of related treatments. He argued that the production of advanced therapy medicinal products remains a cumbersome process with costs, reproducibility and scalability issues.

He commented that his company (Poietis) are developing biomanufacturing solutions based on Next-Generation Bioprinting (NGB). He added that based on Laser-Assisted Bioprinting, this new platform integrates automation and robotics technologies, coupled with online sensors – including cell microscopy. NGB is a paradigm shift since it's 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 are discussing how next-gen bioprinting technology should make it possible to overcome current tissue manufacturing bottlenecks and, also, provide new therapeutic opportunities, he concluded.



Figure 26. Dr. Guillemot (Poietis, Aquitanie, France) during his



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Prof. Habil. Jauregui-Misas (Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Jena, Germany) presented and discussed the currents and trends on *Fiber Optic Ultrafast*



Figure 27. Prof. Dr. Habil. Jauregui (Institute of Applied Physics, Jena, Germany) during his Invited talk.

lasers for advanced fabrication. He provided the audience with a general overview on high-power, high energy ultrafast fiber lasers and some of their applications. In particular, he focussed on the current state-of-the-art of ultrafast, high-power fiber lasers for advanced fabrication processes and light-matter interaction experiments. He continued with the identification of the main challenges that fiber laser

technology has been facing and the most practical solutions that have been proposed. With an incursion in the future of high-power lasers, including their architecture and predicted performance for the coming decades, he concluded his both top didactic and deep scientific technical content, invited lecture.

Professor Molpeceres (Director of the Laser Centre, University Polytechnic of Madrid, Spain) reviewed and discussed the work towards *Microadditive Manufacturing using Laser Direct Write* technology.



Figure 28. Prof. Molpeceres (UPM, Madrid, Spain) during his second Invited tlecture.



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He mentioned that 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. Prof. Molpeceres described their development from its origins to the present in which they are becoming a promising tool for the development of 2D and 3D micro-additive processes. He, discussed 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. To give an idea of the huge potential of these technologies in completely different strategic technological fields, he conclude his very comprehensive lecture with important details on particular examples, developed at Laser Center UPM such as the metallization of photovoltaic and flex electronics devices and, single cell isolation and cell sorting for biomedical applications.



Figure 29. Prof. Cobo (Secretary of ISLiST) during his presentation of the next invited lecturer.

Prof. Flores (Group Leader at the Department of Applied Physics at the University of Santiago de Compostela) discussed the advances in *Intense light, as a potential tool to be applied in medical*

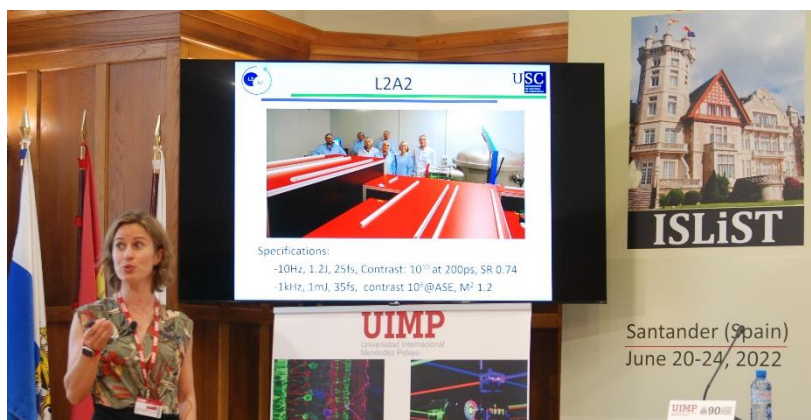


Figure 30.- Prof. Flores (Universidad de Santiago de Compostela, Spain) during her Invited talk.

imaging. She stated that high power laser is overcoming as a new technology for the production of short half-life PET (positron-emission tomography) radioisotopes (^{11}C , ^{13}N ,...) that are produced by a self-shielded laser accelerators. She also argued that the advantages of using some radioisotopes as the ^{11}C -based as radiotracers are offset by the difficulties of ites. She added that the possibility



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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, avoiding the problem of distribution, and thereby expanding the range of radiotracers and their applications. Laser accelerators could generate different types of beams (gamma, protons, deuterons, ions) that can be use, to produce different radioisotopes of interest in diagnostic imaging and therapy, she concluded.

During the Round Table II on Challenges to face Creation of New Photonic Companies and also, in Advanced Fabrication, the participants experienced a very interesting round table with very actives participations from both sides. After the presentation by the moderator, each of the invited panellists (Prof. **Martin Wegener**, Dr. **Fabien Guillemot**, and Prof. **Carlos Molpeceres**) presented their brief statement on their previously allocated topic.

Then, each member of the panel took the opportunity to debate different aspects among the panelists. After that, attendees asked a very significant number of different questions, in an open and fully-freedom-environment, and a very interesting debate took place inside the room. Numerous interactions were carried out among the panelists and from the attendees and also discussions were established from both sides. After two and half hours, the round table concluded with several open questions and also with very interesting and useful thoughts and conclusions.



Figure 31. The panelists during the round table on Challenges on creation of new photonic Companies and on Advanced Fabrication: Dr. Guillemot, Prof. Wegener, Prof. Molpeceres and Prof. López-Higuera (coordinator).



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Figure 32. The panelists and coordinator during moments of their interventions.

Prof. Beat Neuenschwander (Head of the Institute for Applied Laser, Photonics and Surface Technologies ALPS, Switzerland) in his first invited presentation spoke about the *High Throughput and high quality laser ablation and texturing techniques with pulsed lasers*. He mentioned that



Figure 33. Prof. Beat Neuenschwander (Photonics and Surface Technologies ALPS, Switzerland) during his first Invited talk.

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. He also argued that the about mentioned 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. He stated that 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. With a discussion on the requirements and limits of an efficient scale up process to high throughput, he concluded his didactic and useful invited lecture.



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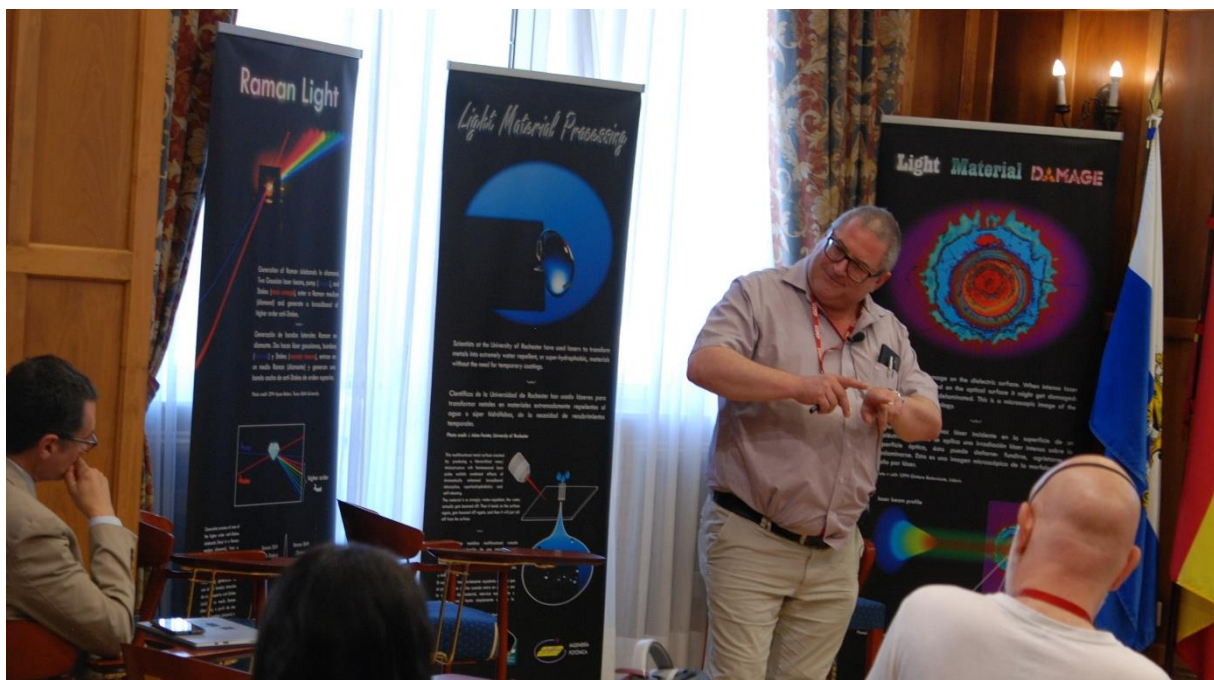


Figure 34. Prof. Beat Neuenschwander (Photonics and Surface Technologies ALPS, Switzerland) answering one of the attendees questions after his second Invited talk.

In addition, Prof. **Beat Neuenschwander** delivered a second invited lecture on *Light manipulation and control techniques in industrial processes with pulsed lasers* for, what, he used the insights of the previous talk adding that adapted strategies to achieve high throughput are very demanded. He, also mentioned that beside fast scanning also energy splitting, either in time i.e. with pulse bursts or in space with multi spots can be applied. He added that 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. He continued mentioned that 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. He concluded his very useful presentation by stating that by expanding the synchronization to additional mechanical axes this technique can e.g. be used to machine embossing rollers or tubes.



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3.2 Some moments during the talks and free times



Figure 35-44. Several moments along the week.



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Figure 35-44. Several moments along the week.



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Figure 45-48. Several moments along the week.



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Figure 49-54. Several moments along the week.



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Figure 55. Several moments along the week.



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4 Special Events

Within the frame of ISLiST, two special events took place: The Santander Council Reception, and the Justiniano Casas Award.

4.1 Santander Council (Ayuntamiento de Santander) Reception

The Santander Council was very pleased to offer to ISLiST attendees a special Reception. It was a great opportunity to chat, to do networking and to share experiences, enjoying with snacks and drinks inside an incredible nice environment in the Royal Hall at Magdalena Palace.



Figure 56-58. Welcome words from, the chancellor of Santander Council Mss. Gema Igual welcoming the ISLiST participants, from Prof. López-Higuera (Director of ISLiST) and also, from the Rector of UIMP Prof. Andradás addressing the acknowledging to the Santander Council for their collaboration to reach the objectives of this International School.



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Figure 59-63.-
 ISLiST 2019
 Family Photo
 including
 university and
 Santander
 Council
 Authorities



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Figure 64.- ISLiST participants on the Royal Hall terrace at the Magdalena Palace enjoying moments of socialization and networking during the Santander City Council Reception.



Figure 65. Opening of the session on Thursday's morning.



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4.2. Justiniano Casas Award on Optical imaging

The Imaging Techniques Committee of the Spanish Optical Society (SEDOPTICA) with the sponsorship of LASING S.A. presented the prizes of the 8th edition of the **Justiniano Casas Award** for Research in Optical Imaging.



Before the delivery of the awards brief words were addressed from José Miguel López Higuera, Director of the ISLiST, from Luis Plaja Rustein, SEDOPTICA Vice President about SEDOPTICA and the context of the Justiniano Casas Award for Optical Imaging Research and finally by Olga M Conde, Secretary of the SEDOPTICA Imaging Techniques Committee who did the Reading of the Resolution of the Justiniano Casas Award, 8th.



Figure 66-67. The Secretary of the Jury (Prof. Conde Portilla), The CEO of the Lasing (Sponsors of the Award), The Vicepresident of SEDOPTICA Luis Plaja and the Director of V ISLiST during the presentation of the Ceremony.



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Figure 68. The Secretary, Prof. Conde Portilla, reading the act of the Jury.

Then the Award certificates were delivered for **winners and directors**, by Luis Plaja Rustein, Vice President SEDOPTICA (Diploma to the author); Valentín Guadaño Martínez, CEO of LASING, S. A. – Cash prize; Luis Plaja, Valentín Guadaño, José Miguel López Higuera (Supervisor plates)

The **awards' winners** were:

Dr José Ángel Picazo Bueno, for the work related to his doctoral thesis entitled "Spatially multiplexed interferometric microscopy: from basic principles to advanced arrangements", supervised by Dr. Vicente Micó Serrano at the University of Valencia.

Dr. Ouafa Sijilmassi, doctoral thesis entitled "Embryonic ocular alterations due to maternal dietary folic acid deficiency: image analysis, optical and biological characterization", supervised by Drs. María del Carmen Barrio Asensio and Aurora del Río Sevilla and Dr. José Manuel López Alonso at the Complutense University of Madrid.

The ceremony concluded with some words from the LSEDOPTICA Vice President.



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Figure 69- 74. Several Moments during the Justiniano Casas Award Ceremony.



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5. Opening, Closing remarks and Diploma Delivery

The opening ceremony was presided by the Vice-Chancellor of the International University Menendez Pelayo D. Francisco Matorras Weinig, who welcomed all participants to the event and stated that ISLIST international School is envisioned to be a worldwide top International forum (**every three or fourth week of June**) on *Light Sciences and Technologies* in Santander, Spain. She also spoke about the general vision and mission of UIMP.

The IV ISLIST Director, Prof. López Higuera spoke on the relevant role of Light Sciences and Technologies (Photonics) in the XXI century. Then he justified the creation of ISLIST in the frame of UIMP that runs the third or fourth week of June of every year with different core. Then he presented the panel of top level international invited speakers for the V ISLIST edition with the core Light on Energy and Advanced Fabrication. Then he introduced the schedule of activities planned to develop ISLIST 2022.

He also added that ISLIST has been conceived as a great opportunity to review and actualize knowledge in this Key or Essential science and technology for the development of nations. It offers a great opportunity to contribute to the education of citizens and to ensure also that policymakers are made aware of the problem-solving potential of Photonics.

The ISLIST director explained how the School was planned to be developed along the week including the special and exceptional events included in the programme. He presented also the statistics concerning the participants on the school and concluded with acknowledgement words for the Sponsors and Collaborators with special thanks to all the Invited Speakers selected among the world-wide leader authorities in their respective matters. He added special mentions to the secretary of the course Adolfo Cobo and to his secretary Maria Ruiz, both at University of Cantabria.



Figure 75. UIMP Vice-Chancellor and ISLIST Director during the Opening Ceremony.



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During the **Closing Ceremony** the ISLIST director offered an overview of the development of this fifth ISLIST edition. He remarked that it was an honor to this 2022 season of the UIMP Advanced Courses in Santander that were inaugurated (in person) by the king of Spain D. Felipe VI who has the detail to chat some minutes with group ISLIST attendees after the inauguration ceremony.



Figure 76-77. The Secretary (Prof. Cobo) and the School Director during the Concluding Remark and announcement of the ISLIST 2020.



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Prof. López-Higuera announced that the sixth International School on Light Sciences and Technologies next year 2023 (VI ISLiST) will have the Main Core on **Light Health and Medicine**. It will be developed during the week of June 19-23, 2023.

Finally, the Vice-Chancellor of the International University Menendez Pelayo D. Francisco Matorras Weinig, after a brief dissertation declared closed V ISLiST.



Figure 78.-The Secretary (Prof. Cobo), the vice-Chancellor of the International University Menendez Pelayo D. Francisco Matorras and the ISLiST Director during the Concluding Remark and announcement of the ISLiST 2023.

Official Diploma delivery ceremony

In the previous ISLiST editions, after the closing Ceremony (as a part of the It), were delivered the personalized Official Diploma to the participants that attended the school. Unfortunately, in this edition it was not possible for some unexpected inconveniences happen in the last minute. We hope to recover this ceremony in the VI ISLiST edition.



Figure 79. Sample of ISLiST-2019 attendees receiving the diploma from four ISLiST professors.



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6. QUALITY: SATISFACTION SURVEY

To have an objective index of quality, after closing the ISLiST international School a brief and anonymous survey was carried out online by the participants. The questions asked were:

Q1-Please indicate your overall opinion regarding the quality of the invited speakers

- | | |
|---------------|----------------|
| 0 - Very Poor | 3 - Good |
| 1 - Poor | 4 - Very good |
| 2 - Average | 5 - Excellent! |

Q2-Please indicate your overall opinion regarding the topics of the talks

- | | |
|-----------------------------|------------------------------------|
| 0 - Extremely uninteresting | 3 - Interesting |
| 1 - Not very interesting | 4 - Very Interesting |
| 2 - Average | 5 - Really what I was looking for! |

Q3-Please indicate your overall opinion regarding the ORGANIZATION of the school

- | | |
|---------------|----------------|
| 0 - Very Poor | 3 - Good |
| 1 - Poor | 4 - Very good |
| 2 - Average | 5 - Excellent! |

Q4-Please indicate your overall opinion regarding the INFORMATION that you received before attending the school

- | | |
|---------------|----------------|
| 0 - Very Poor | 3 - Good |
| 1 - Poor | 4 - Very good |
| 2 - Average | 5 - Excellent! |

Q5-Would you attend future editions if possible?

- | | |
|---------------------|--|
| 0 - Not at all | 3 - If the main core suits me |
| 1 - Not very likely | 4 - Probably |
| 2 - Maybe | 5 - I would love to come again to Santander and attend ISLiST-XX |

Q6-Would you recommend ISLiST to other colleagues?

- | | |
|---------------------|------------------------------------|
| 0 - Not at all | 3 - If the main core suits him/her |
| 1 - Not very likely | 4 - Probably |
| 2 - Maybe | 5 - Absolutely! |

Q7-Finally, did the school meet your expectations?

- | | |
|--|---|
| 0 - No, it was a complete disappointment | 3- Yes, but it might have been better |
| 1 - Not really | 4 - Yes, absolutely |
| 2 - Only partially | 5 - It was even better than I expected! |

Q8-Please, tell us about the best things of the school (what we should go on considering in future editions)

Q9-Please, tell us about the worst things of the school (what we should NOT consider in future editions)

Q10-Do you have any suggestions, comments ...?

After receiving the responses, the overall results of the survey are graphically summarized as follows:



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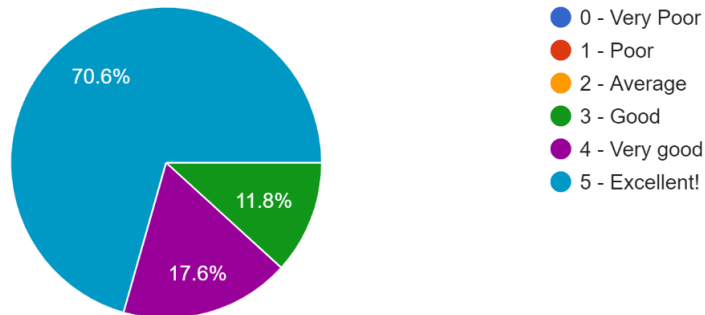


Figure 71.-Regarding the **quality of the invited speakers** (Q1), the **70,6 %**, the **17,6 %** of the participants considered that they were **excellent**, and **very good** respectively. There were no answers qualified as average, poor or very poor.

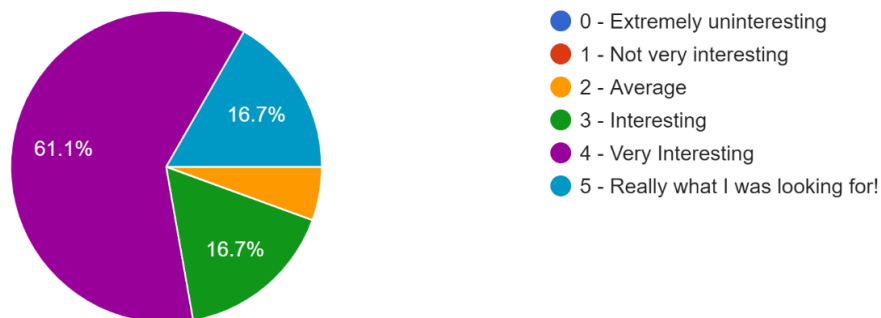


Figure 72.- Regarding the **topics of the talks** (Q2), the **16,7%**, the **61,1%** and the **16,7%** of the participants considered that they were **Really it was what I was looking for**, **very interesting** and **interesting** respectively.

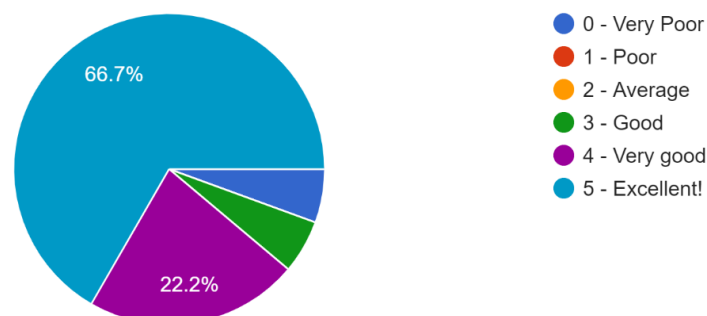


Figure 73.-Regarding the **organization of the School** (Q3), the **66,7 %**, the **22,2 %** and the **4.5 %** of the participants considered that they were **excellent**, **very good** and **good** respectively. There were no answers qualified as average, poor or very poor.



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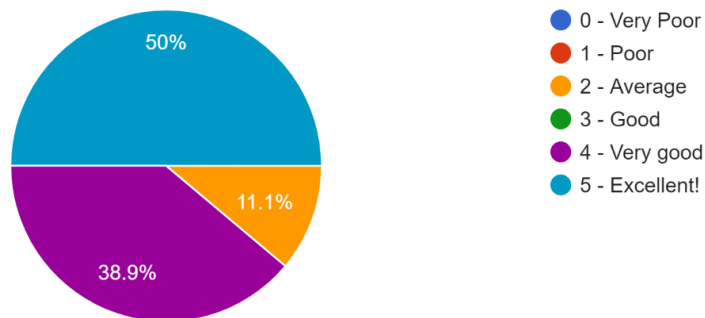


Figure 74.- Regarding the **information received before attending the School (Q4)**, the **50 %**, the **38,9 %** and the **11,1%** of the participants considered that they were **excellent**, **very good** and **average** respectively.

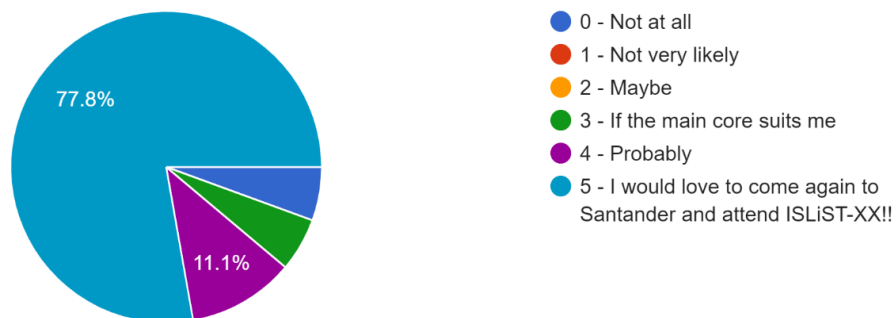


Figure 75.-Regarding the **possibility of attending the next edition of the School (Q5)**, the **77,8 %**, the **11.1%** and the **5 %** of the participants considered that they were **that they would love to come again**, **If the main core suit they**, **probably**, respectively.

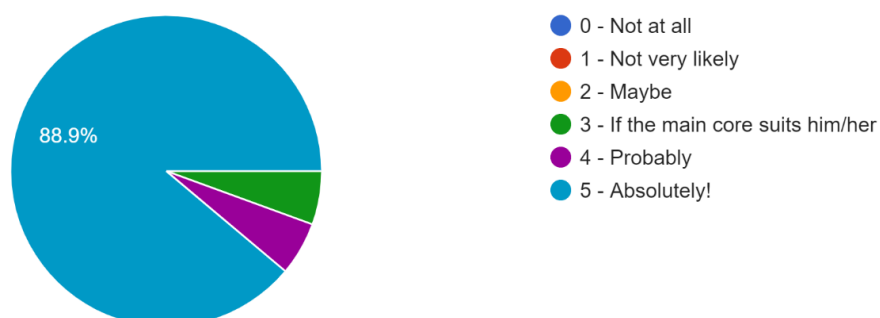


Figure 76.-Concerning **if they would recommend ISLiST to other colleagues (Q6)**, the **88,9%** will recommend the school to other colleagues, without any debt.



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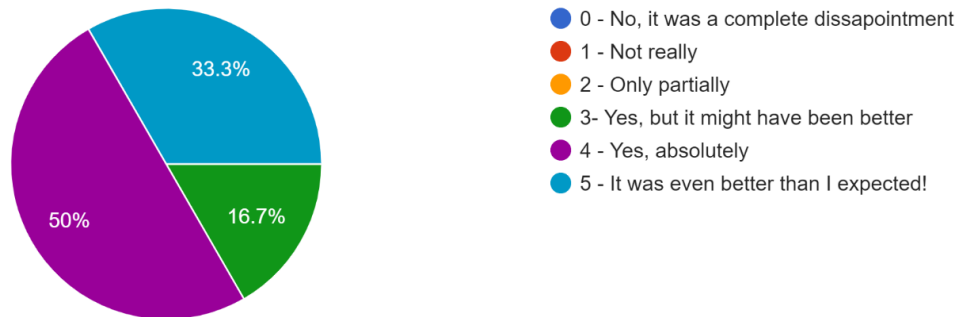


Figure 77.-Concerning **if the ISLiST meet your expectations** (Q7), the **50%**, the **33%**, and the **16,7%** of the participants considered that: **yes absolutely**, **it was even better than they expected** and **yes, but it might have been better** respectively the school meet their expectations.

Concerning the three additional questions (Q8, Q9 and Q10), we have received the following (they are as they have been received):

Q8-Please, tell us about the best things of the school (what we should go on considering in future editions):

- The best thing was the hospitality of the organizers, special thanks from Adolfo and López-Higuera, interesting topics, wonderful location
- The organization, environment and the food was very good.
- I would like to express my high appreciation to organization committee for such a nice summer school with extremely interesting talks which took place in one of the most beautiful place in the world. Especially, I wish to thank Adolfo Cobo for a help with getting opportunity to get a grant for this school.
- The organization of the timetable was perfect because it left the time to discuss and get to know other colleagues.
- I really liked the daily schedule (i.e., timetable, duration of the lectures, etc..). The speaker were expert in their field and you could tell that they knew very well the topic they were presenting. I really appreciated the internationality of the speakers. The room was suitable for the presentation, and the screen positioned in several location helped following the talks. I really enjoyed the talks with a lot of very well done figures to explain concepts rather than text. The location was amazing. I really enjoyed the moderator introductions and final report. The buffet we had was very useful to get in touch with other people. The detailed program delivered at the beginning with a space for the notes was very useful.
- The advise given to us on how to move our ideas into the business world was amazing
- The diversity of topics based on photonics
- The topics chosen were interesting and related to our field of research. Contrary to other Congress or Schools where I have been since I started the PhD, this school was punctual and followed the



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schedule, which allowed us to plan in advance. Furthermore, the location of the course at the Palacio de la Magdalena was unbeatable.

- The service of the staff at the facilities was excellent.
- The quality of the presentations in terms of novelty and knowledge is very relevant.

Please, tell us about the worst things of the school (what we should improve in future editions)

Q9-Please, tell us about the worst things of the school (what we should NOT consider in future editions)

- Honestly, nothing
- bad weather
- Info and program sent too late
- The internet connection was not satisfactory within the hall of lecture and the residence.
- Definitely the organization, among other things the constant malfunctioning of the microphones made some talks hard to follow.
- It is difficult to find something bad, because there were not bad things. But maybe it would be nice also to organize some student activities for evenings after lectures. (For example organized hiking around or smth else) As a member of Optica student chapter in our University we, students, usually organized some activities for conference's participants and Optica provided us some funding for this.
- I think there might be some improvements possible with the audio system, we had some issues with the mics. I would recommend the speakers to place large enough figures and fewer text on their slides for the oral talk. If the slides are then make available to the attendees, maybe they could provided an extended version or references in the last slide. As a rule of thumb I would say that less is more, i.e., it is not useful to put too many things on a slide if the speaker is not able to say everything.
- The wifi connection was bad.
- The chairs are hugely uncomfortable
- More accommodation places should be available to those students that did not obtain the grant. In my case, I had to be in the waiting list for the residence of the university, and it was only when there were cancellations that I could get a place. Also, the round tables should be improved or suppressed; some anecdotes told by the speakers at them could be interesting, but the rest was not very relevant in my opinion.
- There were not enough recreational cultural activities to encourage attendees to interact with the attendees even more.
- In my opinion, the talks are a bit long, causing you to lose the thread if you are not an expert.



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Q10-Do you have any suggestions, comments ...?

Coffee break with coffee ☺, the bigger screens instead of those big monitors
maybe a short city tour with all the participants

The 2 hour gap for lunch might be too big. Some days if the lecture would finish early we'd have 3 hour
lunch stop. I think it could be narrower and in exchange have the course end earlier each day.

keep it up!

Maybe it could be useful to deliver a survey to select the topics that the school is going to talk about before
to decide the speakers for the next school. Thank you for the amazing work you did.

I would value the option of replacing the chairs

Please send us the certificates as soon as possible, my university will pay me back the trip expenses but they
need the certificate. Kind regards.

I believe that there should be more participation of women scientists as invited speakers.

No

7.- Summing-up

The International School on Light Sciences and Technologies (ISLiST) at the Menéndez Pelayo International University (UIMP), Spain, has consolidated as an international reference at the highest scientific and technical level. It is confirmed on the fact of the highest quality of the lectures of the best experts (including **Nobel Prizes such as Andre Geim, Sujhi Nakamura and Donna Strickland**) of the most renowned institutions and organizations in the world in the use of Light Sciences and Technologies together with the numerous and high qualification of international participants. ISLiST was founded and is, since then, directed by José Miguel López-Higuera that has been assisted in this edition by Adolfo Cobo García, both of the Photonics Engineering Group of the University of Cantabria, CIBER-BBN and IDIVAL.

In its V ISLiST edition, it had more than 69 attendees from 14 nationalities and from more than 25 different institutions gathered in the week of June 20 to 24, 2022, in Santander, Spain to receive the knowledge and experience of 15 from the most reputable professors and professionals of the most reputable academic and research institutions and companies of 5 different nationalities. They also enjoyed the Santander Council Reception, where they took advantage of the great opportunities to do networking on matters of their interest.

The ISLiST participants (60% PhD students and 30% female) had the privilege to receive the teachings and experience of researchers of the stature professors, Christian Bressler, Carlos del Cañizo, Antonio Gómez, Christian Sattler, Jordi Martorel, Carlos Molpeceres, Michael Campbell, Javier Solis, Martin Wegener, Fabien Guillemot, César Jauregui, Maite Flores Beat Neuenschwander and JM López-Higuera. They also received the experience of reputable professionals such Mikel Bengoa (General Director of Coherent Rofin, Spain). Unfortunately just in the last minute because of an unexpected health trouble, we were unable to receive the invaluable knowledge and experience



International School on Light Sciences and Technologies (ISLiST)

June 20-24, 2022, Santander, Spain

Core: *Light in Energy and Advanced Fabrication*

from Nobel Laureate Prof. Gerard Mourou. Very hot topics in the use of light sciences and technologies in Energy and Advanced Fabrication were presented and discussed along of the 17 one-hour lectures and two round tables that focused on the search for challenges pending both in light Energy (round table I) and in the use of Light in the Advanced Fabrication sectors (round table II). <https://www.teisa.unican.es/ISLiST/index.php/program>

Unforgettable were also the fresh and enthusiastic questions and discussions among the participants and the panellists of the two round tables.

Thanks to the Santander Council Reception, the attendees and the invited speakers had the opportunity to share thoughts, experience and to do networking inside an unparalleled place, the Royal Palace of Magdalena, and having snacks and drinks. Thank you for that opportunity to Ayuntamiento de Santander.

According to the post-ISLiST survey, the quality of the program, of the speakers, of the complementary events, of the facilities offered, can be considered at the top level worldwide. ISLiST has met their expectations. As numeric indicators it can be considered that 70.6% of the attendees agreed with the excellence of the invited speakers, the 88.9% of the attendees very happy to recommend ISLiST to other colleagues and the 77.8% indicating their interest in participating again in next editions of the ISLiST School.

More details: <https://www.teisa.unican.es/ISLiST/>



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ANEX

ISLIST-2022 PROGRAMME

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



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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



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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 Guillemot

CEO and Co-founder of, Poietis, Aquitaine, 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.



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Core: *Light in Energy and Advanced Fabrication*

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

Microadditive 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 Optoscribe, 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



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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.