

# Photoniques

N°101

LIGHT AND APPLICATIONS ■ EOS & SFO JOINT ISSUE

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& scientific highlights

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Gustav Mie:  
the man, the theory

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- THz spectroscopy using quantum-cascade lasers
- THz spectroscopy for fundamental science and applications
- Bi-dimensional materials for THz frequency nanodevices



All-dielectric photoconductive  
THz metasurfaces



THz sensing in biology and medicine

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# Editorial



NICOLAS BONOD

Editor-in-Chief

## Focus on THz technologies: Covid-19 & Photonics

The Terahertz spectral domain is a fertile wavelength range for spectroscopy because THz radiations stimulate the vibrational modes of biomolecules. For this reason, THz technologies have attracted a keen interest to develop devices capable of probing and sensing viruses, proteins, and antibodies. This choice of focus, decided long before the Covid-19 epidemic hit the headlines, sounds very timely today. Along with THz technologies, the entire photonics research and industry will have a key role to play in the fight against epidemics, not only in understanding them and preventing them, but also in diagnosing and curing diseases.

This pandemic stresses further the crucial role of research, innovation and scientific expertise. Europe has developed an ambitious research policy with very effective funding programs, but with severe economic constraints expected in the near future and major choices to be made in terms of budgetary policies, this crisis should convince decision-makers of the necessity to maintain Europe's scientific excellence and prioritize the funds allocated to research and innovation.

The biographical section of this issue is dedicated to the German physicist Gustav Mie and discusses how an outstanding physicist, passionate about teaching experimental physics,

ensured his place in the history of science with an outstanding theoretical work. Motivated by the understanding of the structural colours of gold colloids, Mie developed a complete electromagnetic theory that truly reached prosperity decades after its initial publication. This article could have been called "The Brilliance of a Hidden Gem" since Gustav Mie himself did not foresee the importance of this major work and was far from anticipating the huge impact that his theory would have several decades after its publication.

The Buyer's Guide is devoted to Spatial Light Modulators (SLMs). The article introduces the basics of this optical component which is nowadays widely used to tailor the properties of light beams, explains its operating principles and main categories (transmission, reflection) and provides a list of suppliers. Beam-shaping is at the core of many classical and quantum technologies and the range of applications of this optical component is steadily growing.

The success of previous annual issues has motivated the edition of two international issues this year. The publication of two such issues per year would not be possible without the strong support of EOS, SFO and EDP Sciences, whom I warmly thank for their partnership and support in the edition and distribution of this issue.

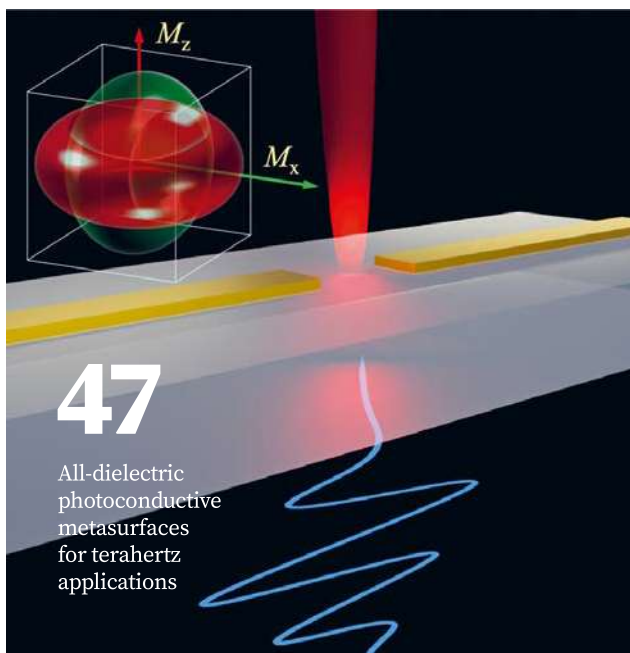


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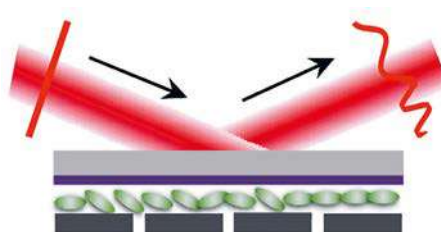
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# EOS/SFO forewords

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**PHILIPPE ADAM**

President of the French Optical Society

**T**he PHOTONIKUES magazine is an opened window on the activities of the French optical community: it reflects its dynamism and vitality. The French Optical Society (SFO) also wishes to ensure the spreading towards other communities and to strengthen the influence of this community in a broader framework than the simple national scale. These are the goals of that publication, with a half-year period, for the special international issue of PHOTONICS.

The European Optical Society entrusted to France the organization of EOSAM (EOS Annual Meeting) for 2021 (EOSAM 2020 will take place in Porto / Portugal). It is a great responsibility to be assigned the organization of this event; it is also a great sign of trust and we will do all our best to ensure the success of this congress, one of the flagship meetings of our community in Europe.

Still in the direction of promoting our scientific activities in the field of R&D, is our involvement in the operations of EOS: the SFO takes care to propose French candidates for each Fellows campaign; it has already provided a substantial number of these EOS-Fellows and of course wishes to continue to contribute to this important committee with annually renewed proposals.

Finally, in this somewhat destabilizing period, it is clear that the usual links and friendliness are put to the test: many events will be cancelled or postponed, and activities delayed or the necessary times for many of our activities considerably lengthened. On the other hand, we can clearly realize that research is a key activity, nationally and as well as internationally. This unprecedented crisis could help us to refocus, because of the pressure of events, on what makes our strengths and weaknesses, in order to better contribute in the current needs and to participate more efficiently in the construction of the future.

Despite the current situation, which could be also time consuming, I hope we could find some little times to read about Physics and Optics. The main topic of PHOTONIKUES about THz is a nice opportunity. Have a pleasant and interesting time while reading this special issue of PHOTONIKUES.



**HUMBERTO MICHINEL**

President of the European Optical Society

**A**s president of the European Optical Society (EOS), I am pleased to write once more an editorial for a new European special issue of "Photoniques", a journal which is a beautiful example of the strength of SFO, the French branch of EOS. This European special issue is devoted to a very promising optical technology, such as THz photonics, which has attracted a great deal of interest from the optical community in the last years, mainly due to its potential use in many hot fields, from biomedical applications and security to communications and nanotechnology, among many others. This fast growing field gathers a multidisciplinary community, joining physicists, engineers and electronics experts, in a technological melting point that will generate many exciting applications in the years to come.

In line with this, I would like to emphasize in these days of uncertainty because of the global crisis due to the spread of the coronavirus pandemic, that the commitment to excellent research, such as that represented by the French optical community, is without a doubt the best weapon that humanity has in the face of threats like the one that currently plagues us. It is evident that Optics and Photonics, in combination with other technologies, have a lot of potential as efficient tools in the fight against the virus, either by contributing to the development of faster and more reliable tests, or by improving the precision and quality of other existing techniques. I hope that once the crisis has passed, decision makers in Europe will not forget that it is essential to maintain support for researchers who contribute to the development European technology and science. From here I finally want to congratulate the entire French optical community, represented by SFO, for their excellent contribution and encourage them to persevere in their continuous search for excellence in photonics research, which is an example for all of us. Their vitality, not only in the field of THz technologies, but in all Optics and Photonics disciplines, is periodically reviewed in each issue of "Photoniques", a nice window to the progress in French Optics.

## NEW MEMBERS

PHOTONICS FRANCE NOW HAS 157 MEMBERS! WELCOME TO :

- AERODIODE
- CEDRAT TECHNOLOGIES
- CMP
- DISTRAME
- IRIDESCENCE
- JENOPTEC
- OBS FIBER
- SATT SAYENS,
- TERATONICS
- PHASELAB INSTRUMENT
- ENSSAT
- MBTEC
- VISIONAIRY

## AGENDA

■ **France Pavilion**  
May 12-14, CLEO,  
San Jose (US)

■ **General Assembly /  
Photonics France Congress**  
June 4, BPiFrance  
Le Hub, Paris

■ **France Pavilion, SPIE  
Astronomical Telescopes +  
Instrumentation 2020**  
June 14-19, Yokohama (JP)

■ **Photonics Pavilion,  
Global Industrie,**  
June 24-26, Villepinte, Paris

■ **French Photonics Days:  
Special optical fibres and  
future applications,**  
Sept. 17-18, Perros-Guirec

■ **France Pavilion, OPTATEC**  
Nov. 17-19, Frankfurt (DE)

■ **3rd Journées Sécurité  
Optique et Laser au  
Travail (JSOL),**  
Dates tbc, Grenoble (FR)

■ **LALS2020 Partnership,**  
Spring 2021, Nancy (FR)

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## SAVE THE DATE

## FRENCH PHOTONICS DAYS

**On 17 & 18 September in Perros-Guirec.  
Do you have the fibre of innovation ?**

Photonics France, SupOptique and Photonics Bretagne are co-organizing the 2nd edition of the French Photonics Days in Perros-Guirec (22) on the theme "Special optical fibers and future applications". This two-day seminar, designed for a technical but non-specialist audience, will include presentations (overview, news on new special fibers, training and needs of the industry), conferences including those of Marko Erman, Scientific Director of Thales and Hervé Lefèvre, Scientific Director of iXblue, as well as a round-table discussion to allow stakeholders to reaffirm the issues at stake and debate the industry's priorities, and presentations by local political figures.

Programme & registration to come. Attention, places are limited to 150!



Free for the members of the organizing entities, except for the evening (participation of 30€ HT/36€ TTC). Non-member rate, including the evening: 130€ HT/156€ TTC.

## RECRUITMENT AND TRAINING

**Photonics France collaborates with the State to attract talent in the technologies of the future!**

**P**hotonics France has initiated a process with the cabinets of the Ministries to strengthen the representation and support of photonics in order to make it recognized as a strategic sector. The federation proposes solutions to certain problems, such as training and the lack of qualified personnel.

Photonics France signed a project (EDEC) on Employment and Skills Development with the Ministry of Labour on November 12, 2019. This project in photonics and electronics with a budget of 521k€ is financed by the State and the UIMM for a period of 3 years. Four axes are developed: the diagnosis and identification of jobs and skills in voltage (March to September 2020), the reinforcement of continuous training and its promotion, the development of work-study programs and the link between the industry and the actors of training, and the implementation of a plan to develop the attractiveness of jobs. Various works are undertaken with the Ministry of National Education, Pôle Emploi and ONISEP.

More information on [www.photonics-france.org](http://www.photonics-france.org)