CHINESE OPTICS LETTERS
Vol. 22, No. 2 | February 2024

Editorial of special issue on the 20th anniversary of Wuhan National Laboratory for Optoelectronics (WNLO)

On the occasion of the 20th anniversary of the founding of *Chinese Optics Letters*, Wuhan National Laboratory for Optoelectronics (WNLO) has also gone through 20 years. WNLO is one of six national research centers approved by the Ministry of Science and Technology of China in 2017. Its predecessor was Wuhan National Laboratory for Optoelectronics (preparatory), one of five national laboratories approved for preparatory construction by the Ministry of Science and Technology of China in November 2003. WNLO was jointly built by the Ministry of Science and Technology of China, Ministry of Education of China, Hubei Provincial Government, and Wuhan Municipal Government. It is supported by Huazhong University of Science and Technology, and there are three other joint organizations, namely Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, China Information and Communication Technology Group Co., Ltd., and Huazhong Institute of Electro-Optics. WNLO strives to become an academic innovation center, discipline leading center, talent cultivation center, scientific knowledge dissemination and achievement transfer center with important international influence in the field of optoelectronic science. As an interdisciplinary research center, WNLO focuses on fundamental scientific and technological issues in the fields of information optoelectronics, energy optoelectronics, and life optoelectronics. After 20 years of development, it has achieved fruitful results in many fields including brain imaging, solar cells, ultra-fast lasers, laser manufacturing, structured light, multi-dimensional optical communications, optoelectronic devices and integration, data storage, etc. The 20th anniversary of WNLO is one important milestone and also a new beginning. In the future, WNLO will continue to strive for the independent and controllable development of optoelectronic devices and equipment, as well as self-reliance and self-improvement in the field of optoelectronic science and technology in our country.

Here, we thank Chinese Laser Press for celebrating the 20th anniversary of the establishment of WNLO with us in the form of a special issue. We organize relevant experts to summarize the latest scientific research achievements and look forward to future trends in the field of optoelectronics for information, energy, and life science in this special issue. The successful publication of this special issue is not only for the 20th anniversary of WNLO, but it will also help expand our communication and collaboration with colleagues, experts, and scholars from all over the world to better serve the optoelectronics community.

This special issue includes 9 invited reviews and original research papers, discussing on-chip stimulated Brillouin scattering (SBS)[1], electric field sensors based on the thin-film lithium niobate on insulator (LNOI) material platform[2], complementary metal oxide semiconductor (CMOS) silicon photomultipliers (SiPMs) for scintillator-based radiation detectors toward all-digital sensors[3], photonic integrated optical phased arrays (OPAs) and their applications[4], optical vortex array generation and application[5], next-generation optical data storage[6], indoor organic and perovskite photovoltaics[7], the molecular-alignment-based cross-correlation polarization-gating frequency resolved optical gating (M-XFROG) technique and deep learning method for measuring the molecular alignment[8], and tissue optical clearing imaging for structural changes of neuromuscular junctions after mice ischemic stroke[9].

Yu *et al.*[1] introduce the fundamental principle of SBS in integrated photonics and a method for calculating Brillouin gain, and they illustrate the Brillouin effect on different material platforms with diverse applications (microwave synthesizers, microwave photonic filters, light storage and time delay components, optical isolators and non-reciprocal components, optical gyroscopes). A concise conclusion and prospect of the future developments of on-chip SBS are finally discussed.

Li *et al.*[2] propose and demonstrate an electric field sensor based on LNOI. The sensor consists of an asymmetric Mach–Zehnder interferometer (MZI) and a tapered dipole antenna array. The measured fiber-to-fiber loss is less than −6.7 dB, while the MZI structure exhibits an extinction ratio of greater than 20 dB. Moreover, 64-ary quadrature amplitude modulation (64-QAM) signals at 2 GHz are measured, showing an error vector magnitude (EVM) of less than 8%.

D'Ascenzo *et al.*[3] outline the basic concepts of the SiPM working principle and describe the key performance indicators used to benchmark CMOS SiPMs. They report the SiPM requirements for application to scintillator-based radiation detectors, review the achieved performance of CMOS SiPM, and compare them with custom-based available commercial technologies. They exploit the transition to digital SiPM technologies and describe the new concept of multi-threshold SiPM.

Ma *et al.*[4] summarize the typical architectures of the integrated OPAs (1D, 1.5D, 2D OPAs) and their performance. They analyze the key components of OPAs (phase modulators, waveguide grating antennas, optical amplifiers) and evaluate the figure of merit for OPAs. Various applications in light detection and ranging (LiDAR), free-space optical communications (FSO), imaging, biomedical sensing, and specialized beam generation are introduced.

Du *et al.*[5] introduce the fundamental concepts and characteristics of optical vortices and optical vortex arrays. They present three methods for generating optical vortex arrays, including diffractive optical elements, metasurfaces, and integrated optical devices. They explore wide applications of optical vortex arrays in optical trapping, optical communications, imaging, metrology, and quantum applications. Finally, they conclude and provide future perspectives on optical vortex arrays.

Yan *et al.*[6] provide a comprehensive overview of recent advancements in next-generation optical data storage, offering insights into various technological roadmaps. They pay particular attention to multi-dimensional and super-resolution approaches, each of which uniquely addresses the challenge of dense storage. They summarize the immense opportunities of these approaches, while also outlining the formidable challenges they face in the transition to industrial applications.

Liu *et al.*[7] analyze the realistic losses of the efficiency of indoor organic and perovskite photovoltaics. The efficiency limit of indoor photovoltaics is calculated to be 55.33%. The realistic losses of photovoltaic external quantum efficiency, nonradiative recombination, and resistance cause the large efficiency gap between the realistic values and theoretical limit. In reality, it is feasible to reach the efficiency of 47.4% at 1.77 eV for organic and perovskite photovoltaics under indoor light.

Tao *et al.*[8] demonstrate a deep-learning neural network (DNN) method for the measurement of molecular alignment by using the M-XFROG technique. The DNN has the capacity for direct measurement of molecular alignment from the FROG traces. The method is demonstrated in a proof-of-principle experiment in O_2 molecules, and the molecular alignment factor of O_2 impulsively excited by a pump pulse is directly reconstructed.

Xu *et al.*[9] examine 3D distributions and detailed morphology of neuromuscular junctions (NMJs) in entire mouse muscles after unilateral and bilateral strokes induced by photothrombosis. 3D distributions and the number of NMJs do not change after stroke, and severe unilateral stroke causes similar levels of NMJ fragmentation and area enlargement as bilateral stroke. This research provides structural data, deepening the understanding of neuromuscular pathophysiology after stroke.

Finally, we express our sincere gratitude to *Chinese Optics Letters* for providing the opportunity to publish this special issue. Meanwhile, we appreciate all authors spending their precious time and contributing their high-quality papers to this special issue. Last, but not least, we thank the professional and excellent editorial team of *Chinese Optics Letters* for their hard work and outstanding performance.

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DOI: 10.3788/COL202422.020001

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