

Report on OPTICS & PHOTONICS International Congress 2019 (OPIC2019)

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1. Introduction

OPTICS & PHOTONICS International Congress (OPIC) has been held annually since 2012 in Yokohama as an international forum to present and discuss the most updated R & D activities in optics and photonics over the world. The state-of-art technologies and products in optics and photonics are demonstrated at the co-located and jointly organized OPIE (OPTICS & PHOTONICS International Exhibition).

OPIC2019 was held in April 22-26, 2019 at Pacifico Yokohama Congress Center with Congress Co-Chairs: Christopher P. J. Barty (University of California Irvine, USA), Reinhart Poprawe (Fraunhofer Institute for Laser Technology, Germany), Sadao Nakai (Osaka University, Japan), and Ruxin Li (Shanghai Institute of Optics and Fine Mechanics, China) (Fig. 1).



Fig. 1 Congress Co-Chairs of OPIC2019:

Christopher P. J. Barty, Reinhart Poprawe, Sadao Nakai, and Ruxin Li (from left to right)

OPIC2019 was organized by OPTICS and PHOTONICS International Council, with the support of five Ministries of Japanese Government and Japan Business Foundation, and in cooperation with many research institutes and academic societies in Japan and foreign countries, as shown in Table 1.

Table 1. Organization of OPIC2019

OPTICS & PHOTONICS International Congress 2019 (OPIC2019)
Co-located with OPTICS & PHOTONICS International Exhibition 2019 (OPIE2019) Organized by OPTICS & PHOTONICS International Council
Specialized International Conferences were organized by
The Laser Society of Japan / SPIE – The International Society for Optics and Photonics/ Institute for Nano Quantum Information Electronics, The University of Tokyo / The Graduate School for the Creation of New Photonics Industries / The Optical Society of Japan / Akasaki Research Center (ARC), Nagoya University / The Micro Solid-State Photonics Group of The Laser Society of Japan / High Energy Accelerator Research Organization (KEK) / Institute of Laser Engineering, Osaka University / The Executive Committee of Laser Solution for Space and the Earth / SIOM Chinese Academy of Science / Japan Laser Processing Society / RIKEN SPring-8 Center / Research Center for Ultra-Precision Science & Technology, Osaka University
Supporting agencies of OPIC2019
Ministry of Education, Culture, Sports, Science and Technology (MEXT) / Ministry of Economy, Trade and Industry (METI) /Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF) / Ministry of Health, Labour and Welfare (MHLW) / Ministry of Land, Infrastructure, Transport and Tourism (MLIT) / KEIDANREN (Japan Business Federation) / Japan Science and Technology Agency (JST) / Japan Tourism Agency (JTA)
Cooperating agencies of OPIC2019
AESJ - Atomic Energy Society of Japan / AIST - The National Institute of Advanced Industrial Science and Technology / Fraunhofer Institute for Laser Technology ILT (Germany) / ILT - Institute for Laser Technology / JPC - Japan Photonics Council / JSPF - The Japan Society of Plasma Science and Nuclear Fusion Research / NEDO - New Energy and Industrial Technology Development Organization / OITDA - Optoelectronic Industry and Technology Development Association / OSA - The Optical Society (USA) / Photonics Media (USA) / PIDA - The Photonics Industry & Technology Development Association (Taiwan) / QST - National Institutes for Quantum for Quantum and Radiological Science and Technology / RIKEN

OPIC is composed of Specialized International Conferences covering a broad range of topics in optics and photonics. Each Specialized International Conference is planned and operated by the Conference Chair and a consortium of scientists, based on their own initiatives to strengthen and advance the research in each specific field. This approach helps Conference Chairs organize attractive conferences with timely topics and speakers, and also broadens research networks by continuing to hold the conferences over many years.

2. OPIC2019 with 14 Specialized International Conferences

OPIC2019 was composed of 14 Specialized International Conferences, the largest number since the beginning of OPIC, with the addition of two new conferences: Optical Technology and Measurement for Industrial Applications (OPTM2019) and Optical Wireless and Fiber Power Transmission Conference (OWPT2019). These 14 Specialized International Conferences and the Conference Chairs are shown below.

■ ALPS - The 8th Advanced Lasers and Photon Sources

Chairs: **Hitoki Yoneda**, The University of Electro-Communications

Ruxin Li, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Science

- **BISC** - The 5th Biomedical Imaging and Sensing Conference
Chair: Toyohiko Yatagai, Utsunomiya University
- **HEDS** - International Conference on High Energy Density Science 2019
Chair: Tomonao Hosokai, Osaka University
- **ICNN** - International Conference on Nano-photonics and Nano-optoelectronics 2019
Chair: Yasuhiko Arakawa, The University of Tokyo
- **IoT-SNAP** - IoT Enabling Sensing/Network/AI and Photonics Conference 2019
Chairs: Norihiro Hagita, ATR Intelligent Robotics and Communication Laboratories
Ronald Freund, Fraunhofer Heinrich Hertz Institute
- **IP** - Information Photonics 2019
Chair: Yoshio Hayasaki, Utsunomiya University
- **LDC** - Laser Display and Lighting Conference 2019
Chairs: Kazuo Kuroda, Utsunomiya University,
Hiroshi Murata, Mie University
- **LEDIA** - The 7th International Conference on Light-Emitting Devices and Their Industrial Applications
Chair: Hiroshi Amano, Nagoya University
- **LIC** - The 7th Laser Ignition and Giant-microphtonics Conference
Chair: Takunori Taira, RIKEN
- **LSSE** - Laser Solution for Space and the Earth 2019
Chair: Toshikazu Ebisuzaki, RIKEN
- **OMC** - The 6th Optical Manipulation and Structured Materials Conference
Chair: Takashige Omatsu, Chiba University
- **OPTM** - Optical Technology and Measurement for Industrial Applications 2019
Chair: Takeshi Hatsuzawa, Tokyo Institute of Technology
Rainer Tutsch, Technische Universität Braunschweig
Toru Yoshizawa, NPO 3D Associates
- **OWPT** - Optical Wireless and Fiber Power Transmission Conference 2019
Chair: Tomoyuki Miyamoto, Tokyo Institute of Technology
Noriyuki Yokouchi, American Furukawa Inc.
- **XOPT** - International Conference on X-ray Optics and Applications 2019
Chairs: Tetsuya Ishikawa, RIKEN,
Kazuto Yamauchi, Osaka University

The overall schedule of OPIC2019 is shown in Fig. 2. The OPIC Plenary Session, open to the public, was held in the morning of 23 April, Tuesday. The Specialized International Conferences were held in parallel 22-26 April (Monday-Friday), with the exception of Joint Sessions held in the afternoon of 23 April. The Posters were presented at the Exhibition Hall to stimulate interaction between OPIC and OPIE participants. The OPIC Get-Together was held in the evening of 22 April, Monday, and the OPIC Reception in the evening of 24 April.

Statistics of OPIC and Specialized International Conferences during 2012-2019 are summarized in Table 2. Some of the Specialized Conferences have been organized with different titles and some Conferences were held in other countries, as shown in italics in Table 2.

Monday, 22 April	Tuesday, 23 April	Wednesday, 24 April	Thursday, 25 April	Friday, 26 April	
OPTICS & PHOTONICS International Exhibition 2019					
ALPS	OPIC Plenary Session	<i>Joint Session</i> ALPS HEDS XOPT	ALPS		
HEDS			HEDS		
			XOPT		
		<i>Joint Session</i> BISC OMC	OMC		
			BISC	<i>Joint Session</i> BISC IP	BISC
			IP		<i>Joint Session</i> IP LDC
		<i>Joint Session</i> LDC LEDIA	LDC		
			LEDIA		
			ICNN		
			IoT-SNAP		
			LIC		
			LSSE		
			OPTM		
			OWPT		
Workshop Get-Together		Poster Session Reception	Poster Session		

Fig. 2 Overall schedule of OPIC2019.

Table 2 shows that OPIC has been growing steadily as an international conference, as seen from the number of specialized conferences (14), the number of participants (1,218) and the percentage of foreign participants (40%), and the number of countries (45). The top 10 countries, in order of the number of participants (shown in the parentheses), are Japan (731), P. R. China (128), Taiwan (76), Korea (40), Germany (35), USA (30), Russia (22), France (20), India (13) and Italy (7). (Here “country” refers to the place where participant’s affiliation is located.) These statistics show that OPIC is an international forum with broad scientific scope, attended by international communities from Asia, North America, Europe and Russia. The Specialized International Conferences held continuously over many years are now firm footing with attendance of many participants who look forward to discussing the most up-to-date progress in their fields and meeting with friends at OPIC.

The co-located OPIE2019 was held during 24-26 April with participation of 405 companies and organizations (9% increase from 2018), including direct overseas exhibitions by 73 companies from 15 countries. Total number of participants to OPIE 2019 over 3 days was 16,709. Various activities were organized at OPIE including technical exhibitions, product demonstrations, and technical seminars. Also the Award Ceremony of the 2019 Industrial Award by The Laser Society of Japan was held at the Exhibition Hall, and awards were presented to 7 companies in 3 categories.

Table 2 Records of OPIC and Specialized International Conferences during 2012-2019.
(Specialized International Conferences held previously and at other countries are shown in italics.)

Year	OPIC2012	OPIC2013	OPIC2014	OPIC2015	OPIC2016	OPIC2017	OPIC2018	OPIC2019
Date	April 25-27	April 23-26	April 22-25	April 22-24	May 17-20	April 18-21	April 23-27	April 22-26
Congress Chairs	K. Shimoda R. Byer	K. Shimoda R. Byer	K. Iga R. Byer A. Ostendorf	K. Iga C. Barty A. Ostendorf	K. Iga C. Barty A. Ostendorf	C. Barty R. Poprawe S. Nakai	C. Barty R. Poprawe R. Li S. Nakai	C. Barty R. Poprawe R. Li S. Nakai
Number of Specialized Conferences	6	10	9	7	11	12	14	14
Papers presented	296	411	570	478	736	729	837	869
Participants	519	677	782	732	1028	1012	1185	1218
Foreign participants (%)	24%	18%	27%	25%	32%	37%	40%	40%
Participants / Conference	86.5	67.7	86.9	104.6	93.5	84.3	84.6	87.0
Number of Countries	23	23	28	26	31	32	47	45
Specialized International Conference	Conf. Chair	Conf. Chair	Conf. Chair	Conf. Chair	Conf. Chair	Conf. Chair	Conf. Chair	Conf. Chair
ALPS(Advanced Lasers and Photon Sources)	K. Midorikawa	K. Midorikawa	F. Kannari	N. Miyanaga	H. Yoneda	H. Yoneda	H. Yoneda	H. Yoneda, R. Li
<i>SeTBio (Sens. Tech. for Biomater., Food, & Agri.)</i>		N. Kondo						
BISC (Biomedical Imaging & Sensing Conf)			T. Yatagai		T. Yatagai	T. Yatagai	T. Yatagai	T. Yatagai
<i>APBP (Asian & Pacific-Rim Symp. Biophoton)</i>				T. Iwai				
<i>CLSM (Conf. on Laser Surgery and Medicine)</i>	M. Kikuchi	M. Kikuchi						
<i>CIFE (Conf. on Inertial Fusion Energy)</i>	H. Azechi							
<i>LANSAs (Laser & Accler. Neutron Sourc. & Appli.)</i>		H. Azechi						
<i>CLE (Conf. on Laser Energetics)</i>				H. Azechi				
<i>CLES (Conf. on Laser Energy Science)</i>					H. Azechi			
<i>CLES/LASNA (Laser Energy Sci. & Neutron Sources)</i>						H. Nishimura R. Hanayama		
HEDS(Int. Conf on High Energy Density Sci.)	R. Kodama	R. Kodama	R. Kodama	R. Kodama	R. Kodama	R. Kodama	T. Hosokai	T. Hosokai
ICNN (Int. Conf on Nano-photonics & Nano-optoelectronics)						Y. Arakawa	Y. Arakawa	Y. Arakawa
IP (Information Photonics)						Y. Hayasaki		Y. Hayasaki
IoT-SNAP (IoT Enabling Sensing/Network/AI and Photonics Conf)							N. Hagita, R. Freund	N. Hagita, R. Freund
LDC (Laser Display & Lighting Conf)	K. Kuroda	K. Kuroda	<i>(in Taiwan)</i>	K. Kuroda	<i>(in Germany)</i>	K. Kuroda	K. Kuroda H. Murata	K. Kuroda H. Murata
LEDIA (Int. Conf on Light-Emitting Devices and Their Industrial Applications)		H. Amano	H. Amano	H. Amano	H. Amano	H. Amano	H. Amano	H. Amano
LIC (Laser Ignition and Giant-microphtonics Conf)		T. Taira	T. Taira	<i>(in US)</i>	T. Taira		T. Taira	T. Taira
<i>LSC (Laser & Synch. Rad. Combin. Exper.)</i>			H. Azechi				N. Sarukura	
<i>LNPC (Light Driven Nucl.-Particle Phys. & Cosmology)</i>						K. Homma, O. Tesileanu		
<i>LANE (Laser Appl. on Nuclear Engin.)</i>		H. Horiike						
LSSE (Laser Solution for Space & Earth)					T. Ebisuzaki	T. Ebisuzaki	T. Ebisuzaki	T. Ebisuzaki
OMC (Optical Manipulation Conf)			T. Omatsu	T. Omatsu	T. Omatsu	T. Omatsu	T. Omatsu	T. Omatsu
OPTM (Optical Technology and Measurement for Industrial Applications)								T. Hatsuzawa R. Tutsch T. Yoshizawa
OWPT (Optical Wireless and Fiber Power Transmission Conf)								T. Miyamoto N. Yokouchi
<i>PLD (Int. Conf. on Pacific-Rim Laser Damage)</i>			T. Jitsuno	<i>(in China)</i>	T. Jitsuno J. Shao W. Rudolph	<i>(in China)</i>	T. Jitsuno	
<i>LPCC (Laser Proc. for CFRP & Compos. Mater.)</i>	M. Kutsuna	H. Ogata						
<i>SLPC (Smart Laser Process. Conf.)</i>			Y. Okamoto		Y. Okamoto R. Poprawe		M. Tsukamoto R. Poprawe	
XOPT (Int. Conf. X-ray Opt., Det., Sourc. & Appl.)					T. Ishikawa K. Yamauchi	T. Ishikawa K. Yamauchi	T. Ishikawa K. Yamauchi	T. Ishikawa K. Yamauchi

3. OPIC2019 Plenary and Reception

OPIC 2019 Plenary Session was held in the morning of 23 April. The Welcome Address was given by Sadao Nakai (Osaka University), Congress Co-Chair. It was followed by a short speech celebrating the 2018 Nobel Prize for Physics awarded to three researchers in laser science Arthur Ashkin, Gerard Mourou, and Donna Strickland. Takashige Omatsu (Chiba University), Chair of OMC2019, presented Ashkin's work. Ashkin is a pioneer of the laser cooling and optical trapping technology. Optical trapping has been applied to bioscience as an optical tweezer. Subsequently, Christopher Barty, Co-Chair of OPIC2019, introduced the work of Mourou and Strickland. Mourou and Strickland invented the chirped pulse amplification technology which has greatly contributed to the development of high-power laser science.

Four plenary talks were presented on optics and photonics: applications of high-power laser systems, high-brightness X-ray sources, and quantum information systems. (Fig. 3).

Ursula Keller (ETH Zurich), gave the first plenary talk entitled "Recent advances in SESAM-modelocked high-power thin disk lasers". She reported the demonstration of SESAM-modelocked high-power laser system up to 350-W with 940-fs, 40- μ J pulses at the output of an Yb:YAG thin disk oscillator. She installed the laser disk in the vacuum chamber to reduce the thermal lensing effect and to remove the optical nonlinearity of the air. She also demonstrated the cascaded $\chi^{(2)}$ nonlinearity to compensate the self-phase modulation of air. This enabled laser operation in air at 210 W average power output with 780-fs, 19- μ J pulse, the highest output power of SESAM-modelocked laser operated in air.

The second speaker was Ruxin Li (Shanghai Institute of Optics and Fine Mechanics). The title of his talk was "The 10PW and 100PW lasers: paving the way for exploring the next frontier of high field physics". He is investigating the high-power laser systems for progressing fundamental science of high-field physics. He introduced two high-power laser systems in his Laboratory, the working system Shanghai Super intense Ultrafast Laser Facility (SULF)-10PW laser facility and the future facility Station for Extreme Light (SEL) 100 PW laser system. He talked about the recent achievements using SULF facility and future prospects on ultra-high field science such as the vacuum quantum electrodynamics with SEL facility.

Mike Dunne (SLAC National Accelerator Laboratory) presented "A billion times brighter: An overview of the revolution underway in X-ray science". The development of X-ray free electron lasers (XFEL) opened the study on atomic and molecular-scale science of quantum materials, catalytic chemistry, the science of extreme science, and structured biology. Dunne and his group built the facilities that provide ultrashort X-ray pulses with a peak brilliance over 9 orders of magnitude higher than synchrotron sources which enables us to capture atomic level detail on femtosecond timescale using a wide range of coherent imaging and spectroscopy tools. Dunne also showed the dynamics of molecules as a stop motion movie.

The final plenary speaker was Yoshihisa Yamamoto (Stanford University). Title of his talk was "Optical Neural Network Operating at the Quantum Limit -Coherent Ising machines,

XY machines and SAT solvers- ". He discussed the basic concept, operational principle and implementation of a coherent Ising machine, XY machine, and SAT solvers based on degenerate optical parametric oscillators. Quantum bits are series of optical pulses stored in optical fiber. He applied this machine to some optimization problems.

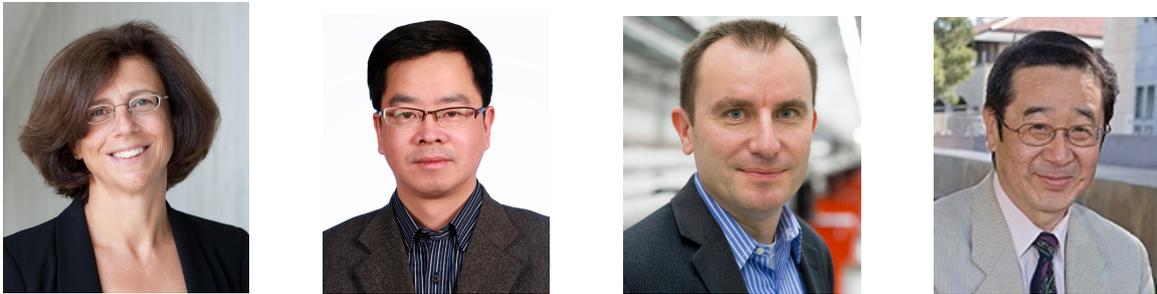


Fig. 3 Plenary speakers of OPIC2019:

Ursula Keller, Ruxin Li, Mike Dunne, Yoshihisa Yamamoto (from left to right)

The OPIC Reception began with a welcome speech given by Kenichi Iga (Tokyo Institute of Technology), Chair of International Advisory Board, followed by Kagami-biraki – the ceremonial opening of a sake barrel (Fig. 4) and a toast given by Kazuo Kuroda (Utsunomiya University), Co-Chair of Organizing Committee. During the reception, participants enjoyed drinks, food, conversation, and a jazz band. Attended by most of the OPIC participants, the reception was an excellent place for socializing and beginning new friendships between various communities.



Fig. 4 OPIC2019 Reception.

Kagami-Biraki by Beth Harrington, Jim Oschmann, Tatsuya Uzuka,

Mike Dunne, Yoshihisa Yamamoto, Sadao Nakai (from left to right).

4. Acknowledgement

We are indebted to Christopher P. J. Barty, Reinhart Poprawe, Sadao Nakai, and Ruxin Li as Congress Co-Chairs, members of the International Advisory Board, members of the Organizing Committee and the Steering Committee, and Chairs of the Specialized International Conferences, for organizing OPIC2019. We would like to thank MEXT, METI, MAFF, MHLW, MLIT and KEIDANREN for supporting OPIC2019.

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