

# **AOMATT 2014**

**The 7<sup>th</sup> SPIE International Symposium on  
Advanced Optical Manufacturing and Testing Technologies**

**26-29 April 2014**

**Harbin International Conference Center  
Harbin China**

**Sponsored by:**

**COS** - The Chinese Optical Society

**IOE** - Institute of Optics and Electronics,  
- Chinese Academy of Sciences

**SPIE** - The International Society for Optics and Photonics  
- (*Technical Co-Sponsor*)

**Supported by:**

Ministry of Science and Technology of China  
Chinese Academy of Sciences (CAS)  
National Natural Science Foundation of China

**Honorary Chair:**

**ZHOU Bingkun**, President of Chinese Optical Society (COS), Academician, CAS

**Symposium General Chair:**

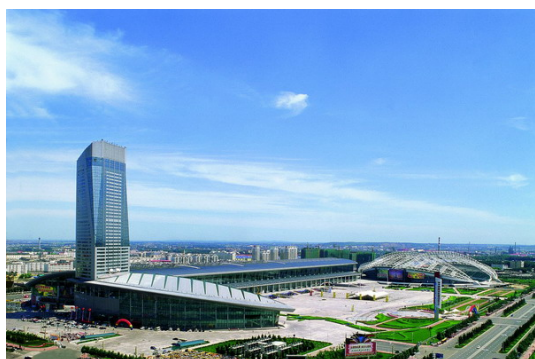
**ZHOU Liwei**, President of Beijing Optical Society, Academician, CAE

**Conferences:**

- 1 Large Mirror and Telescopes
- 2 Advanced Optical Manufacturing Technologies
- 3 Optical Test, Measurement Technology and Equipments
- 4 Design, Manufacturing and Testing of Micro and Nano Optical Devices and Systems
- 5 Opto Electronics Material and Devices
- 6 Smart Structure and Materials in Manufacturing and Testing

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**26-29 April 2014**  
**Harbin China**

## **INVITATION**

### **Dear Authors and Friends!**

The International Symposium of AOMATT has been grew up 14 years since 2000 the first conference. It becomes more and more both popular in domestic and abroad in this field.

On behalf of the Organization Committee of the Symposium, I would like sincerely to invite you to participate in the AOMATT2014 to be held in Harbin, China in April 26-29, 2014. It will be very appreciative that you submit your abstracts and manuscripts to the SPIE proceedings of this conference in time. We believe that the beautiful city-Harbin, China and also the successful symposium of AOMATT2014 will give you a pleasant and impressive memory.

We are looking forward to meeting authors and attendees at the symposium AOMATT2014 in Harbin, China.

Sincerely Yours,



*Prof. ZHANG Yudong*

*Director of the Institute of Optics & Electronics, CAS  
Chairman of the Organization Committee of AOMATT2014  
General Co-Chair of AOMATT2014*

**Organizations & Committees****Sponsored by:**

**COS** - The Chinese Optical Society



**中国光学学会**  
The Chinese Optical Society

**IOE** - Institute of Optics and Electronics, Chinese Academy of Sciences



**中国科学院光电技术研究所**  
THE INSTITUTE OF OPTICS AND ELECTRONICS  
THE CHINESE ACADEMY OF SCIENCES

**SPIE** - The International Society for Optics and Photonics (*Technical Co-Sponsor*)



**SPIE**

**Supported by:**

- Ministry of Science and Technology of China
- Chinese Academy of Sciences (CAS)
- National Natural Science Foundation of China

**Cooperating Organizations:**

- Harbin Institute of Technology, Harbin Engineering University, National University of Defense Technology
- University of Electronic Science and Technology of China, Sichuan University
- Sichuan Optical Society, State Key Laboratory of Optical Technologies on Nano-Fabrication and Micro-Engineering
- Key lab of AO, CAS
- Changchun Institute of Optics, Fine Mechanics and Physics(CIOMP)
- Beijing Institute of Technology, Changchun University of Science and Technology

### *Honorary Chair:*

**ZHOU Bingkun**, President of Chinese Optical Society (COS), Academician, CAS)

### *Symposium General Chair:*

**ZHOU Liwei**, President of Beijing Optical Society, Academician, CAE

### *Symposium General Co-Chairs:*

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**H. Philip Stahl**, SPIE President 2014, USA

**ZHANG Yudong**, Director of the Institute of Optics and Electronics (IOE), Chinese Academy of Sciences

**Larry Stepp**, Telescope Department Head, Thirty Meter Telescope Project, USA

**Liang Yingchun**, assistant to the president, Harbin Engineering University(China)

**Yao Yu**, vice-president, Harbin Institute of Technology(China)

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**Harald Giessen**, Professor, University of Stuttgart(Germany)

**Pan Junhua**, Academician, Chinese Academy of Engineering, Soochow University (China)

**Myung K. Cho**, NOAO (USA)

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**Cao Jinghua**, Deputy Secretary for International Cooperation, CAS (*Co-Chair*)

**Xiang Libin**, Director for Academy of Opto-electronics, CAS (*Co-Chair*)

**JIANG Yadong**, president, School of Optoelectronic Information, University of Electronic Science and technology (*Co-Chair*)

etc.

### *Program Committee:*

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**Yang Hu**, IOE, CAS(China) *Co-Chair*

**Wei Gao**, Tohoku University(Japan) *Co-Chair*

**YU Huadong**, president, Changchun University of Science and Technology(China) *Co-Chair*  
etc.

### *Secretary General of the Symposium:*

**YANG Li**, Committee of Optical Manufacturing Technology, COS

**Jinxue Wang**, SPIE Technical Advisor (USA)

***Honorary Chair:***

**Zhou Bingkun**, President of Chinese Optical Society (COS), Academician, Chinese Academy of Sciences

**Zhou Bingkun** was born in Sichuan, China in 1936. He graduated from Tsinghua University, Beijing, China in 1956. Since 1956 he has been with the Electronic Engineering Department at the same University. From 1960 to 1962 he was a visiting scholar at Leningrad Electrotechnical Institute, Leningrad, former USSR. From 1983 to 1984 he was a visiting scholar and then professor of Applied Physics Department, Stanford University, U.S.A. From 1985, he has been a professor of Electronic Engineering Department at Tsinghua University, Beijing, China.



He was elected as a member of Chinese Academy of Sciences in 1991 and was elected as a member of the Third world Academy of Sciences in 2001. At present he is president of the Chinese Optical Society and vice-chairman of the science and technology committee of Ministry of Education. He was the vice-president of the National Natural Science Foundation of China (1996-2003), director of Information Science Department of CAS (2003-2006), the Chairman of the Steering Committee of Optoelectronic Devices and System Integration Technology, High Technology Research & Development Program of China and the Director of National Research Center for Optoelectronic Technology, Beijing(1987-1996). He is fellow of the Optical Society of America and Chinese Institute of Electronics.

He has been engaged in laser and optoelectronics research and teaching for a long time. In 1984, He made key contributions to development of diode pumped, narrow linewidth and frequency stable Solid State Lasers. He with his research group has made scientific research achievements in the area of "Single Mode, Narrow Linewidth, Frequency-Stable and Tunable External Cavity Semiconductor Lasers"; "semiconductor laser pumped solid state laser"; "fiber ring cavity and their application"; "doped fiber amplifiers and lasers" and "DWDM optical fiber transmission technology". He has won 11 national and ministry-level prizes. He is the author or co-authors of about 100 papers, presentations, patents and one book : " Laser Principle" , which was awarded the state excellent prize.

***Symposium General Chair:***

**ZHOU Liwei**, President of Beijing Optical Society, Academician, CAE

**Zhou Liwei**, Professor, Ph.D, Member of Chinese Academy of Engineering, was born in Shanghai in 1932. He was graduated from Beijing Institute of Technology (BIT) in 1958 and received the USSR Candidate Degree (Ph.D) of physics-mathematical science in 1966. In 1984 he was titled " Outstanding Expert at the State Level" for developing a school of his own in the electron optics study, and in the same year he was promoted to the rank of full professor. He used to be the Chairman of Academic Committee, BIT, the vice president of Chinese Optical Society and Chairman of Association of Science and Technology, BIT. Now he is the Chair-Expert of BIT, Honorary



Director of School of Basic Education of BIT and president of Beijing Optical Society.

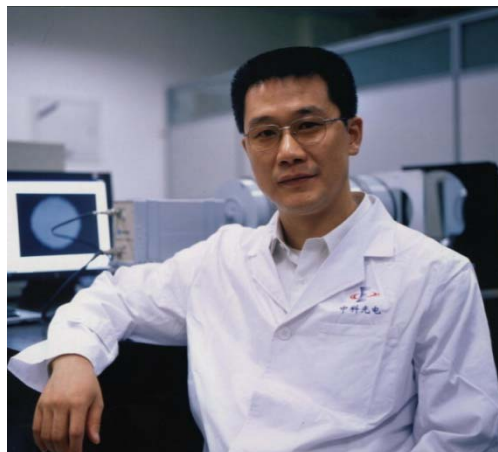
Prof. Zhou Liwei is engaged in electron optics and photoelectronic imaging. Since 1978, Prof. Zhou Liwei has published 6 monographs and 6 printed teaching materials and more 270 academic and technical papers at home and abroad. His monograph "Electron Optics with Wide Beam Focusing" has been awarded the Chinese Books Prize in 1994, the National Books Prize (nominative prize) in 1995 and the Nation-wide Scientific Excellent Books First Prize in 1995.

Achievements of Prof. Zhou Liwei in scientific research were awarded the National Science Congress Prize in 1978, the Ministry 's First and Second Prizes for Science and Technology Progress in 1980, 1990, 1995 and 1996, the Guang Hua Fund First Prize for Science and Technology in 1991. He was also twice of the winner of State Prize for Science and Technology Progress in 1991 and 1996. In 1996 , he was given a title of "Advanced Worker" by State Personnel Ministry for his outstanding service in educational and scientific field. In 1997, he got an Honorary Degree of Doctor of Science by Samara State Aerospace University, Russia. In 1999, he was elected member of Chinese Academy of Sciences, and in 2000, he was elected Foreign member of Academy of Engineering Sciences of the Russian Federation.

### *Chairman of the Organization Committee:*

**ZHANG Yudong**, President of Institute of Optics and Electronics, CAS (China)

**Mr. Zhang Yudong**, PhD and Research Professor, President of IOE (Institute of Optics and Electronics), CAS (Chinese Academy of Sciences) is a member of the Appraisal Expert Team of Information Directorate of NSFC (National Natural Science Foundation of China), a vice-chair of Bio-optics and Laser Medicine Subcommittee of COS (Chinese Optical Society), a vice-Chair of Electro-Optical Specialty Committee of Chinese Society of Astronautics, and a committeeman of Quantum Electronics and Electro-Optical Subcommittee of CIE (Chinese Institute of Electronics), an adjunct professor of UESTC (University of Electronic Science and Technology of China) and Zhejiang University respectively.



Mr. Zhang received his BS from Zhejiang University in 1984, his MS from IOE in 1987, and his PhD from Shanghai Institute of Optics and Fine Mechanics, CAS, in 1991. From 1991 to 1997 he held the technical posts of Research Assistant, Research Associate Professor and Research Professor in Fujian Institute of Research on the Structure of Matter, CAS. He has been working in IOE since 1998 and serving as President since 2003.

For more than 10 years, he has carried out many frontier researches in the fields of adaptive optics, microlithography and new materials of non-linear optics and has obtained many innovative achievements which are leading in China or advanced in the world. He has won one first-grade award of CAS Prize for S&T Progress and CAS Prize for Invention respectively. Altogether, he has applied for and obtained 38 pieces of patents, and published more than 50 theses among which 30 are included in EI Database and 10 in SCI Database.

From 1985 to 1987, he participated in the development of Wavefront Correction System with Dither Technology for the ICF (Inertial Confinement Fusion) experiment in China and proposed an adaptive search method for multiple-extreme optimization. It is the first time to successfully apply the adaptive optical technology to laser atomic fusion system in the world.

From 1998 to 1991, he engaged in the development of Submicron Excimer Laser Lithography System, which worked out the first prototype system in China. He successfully developed the precision submicron objective lens which was the core component of the system and obtained two related patents.

From 1991 to 1997, he took part in the research into new nonlinear optical crystal materials and related devices, obtained five national invention patents and won one first-grade award of CAS Prize for Invention.

From 1998 to present, he has been taking charge of the development of the adaptive optical (AO) system for imaging live human eye retina with high resolution. The system is the first practical compact AO system for this application in the world.

He is also in charge of the development of Dynamic Wavefront Correction AO System for the new generation of ICF prototype system in China. It is the first AO system which can reduce the wavefront distortion of laser beam in ICF system from  $9\lambda$  to about  $1.5\lambda$  in China. This extends the application of adaptive optics in the ICF field and is at the advanced world level.

## Daily Event Schedule

<i>Date</i>	<i>Time</i>	<i>Contents</i>	<i>Place</i>
<b>Friday April 25, 2014</b>	8:00-20:00	Registration for domestic authors	the first floor, Huaqi Hotel, Harbin
	8:00-20:00	Registration for overseas authors	the first floor, Huaqi Hotel, Harbin
	After 20:00	Contact US	
<b>Saturday April 26, 2014</b>	8:30-9:00	Opening Ceremony	Globe Theatre, Harbin International Conference Center
	9:00-12:40	Plenary Presentation 1 to 5	
	14:00-17:00	Plenary Presentation 6 to 9	
	18:30-21:00	Welcome Banquet (floor 2)	
<b>Sunday April 27, 2014</b>	8:30-12:00	Session 1-1, Session 2-1 Session 3-1, Session 4-1 Session 5-1, Session 6-1	room 407, room 408 room 409, room 410 room 411, room 412
	13:00-17:00	Session 1-2, Session 2-2 Session 3-2, Session 4-2 Session 5-2, Session 6-2	room 407, room 408 room 409, room 410 room 411, room 412
	18:00-21:00	social gathering	Student Center of Harbin Institute of Technology
<b>Monday April 28, 2014</b>	9:00-12:00	Workshop	room 410 & 412
	13:00-17:20	Poster Presentations	room 501, Harbin International Conference Center
<b>Tuesday April 29, 2014</b>		museum of Harbin Institute of Technology	
<b>April 30, 2014</b>		The Meeting Ended.	

## Opening Ceremony

8:30-9:00 April 26, 2014

Opening Ceremony

Location: Globe Theatre, Harbin International Conference Center**Chair: YANG Li**, Committee of Optical Manufacturing Technology, COS**WANG Jinxue**, SPIE, USA

***Plenary Presentation*****9:00-12:40 April 26 Plenaries 1 to 5 Globe Theatre*****Location: Globe Theatre, Harbin International Conference Center******Plenary Session 1*****Chair: JIANG Wenhan**, Academician, Institute of Optics and Electronics (IOE), CAS**(Time: 9:00 to 9:40)****1. Manufacturing the Optics for the Thirty Meter Telescope****Prof. Larry Stepp (USA)***Telescope Department Head for the Thirty Meter Telescope Project, USA***(Time: 9:40 to 10:20)****2. The Progress of the European Extremely Large Telescope****Dr. Bernard Delabre (Germany)***Optical Design Engineer, ESO-European Southern Observatory***(Time: 10:20 to 11:00)****3. Method and procedure for the high-efficiency and ultra-precision diamond turning of large optical mirrors****Dr. Tao Sun (China)***Prof. and Director of the Centre for Precision Engineering(CPE)**Tea time (11:00-11:20)****Plenary Session 2*****Chair: YAN Yongda**, Vice President, School of Mechanical and Electrical Engineering, Harbin Institute of Technology**(Time: 11:20 to 12:00)****4. Precision nanometrology for fabrication of micro optics****Dr. Wei Gao (Japan)***Professor and the Director of Research Center for Precision Nanosystems, Dept. of Nanomechanics of Tohoku University***(Time: 12:00 to 12:40)****5. Advanced Manufacturing and Testing Technologies for Multiple Mirror Space Telescopes****Dr. Zhang Xuejun (China)***Prof. Vice President of Changchun Institute of Optics, Fine Mechanics and Physics, CAS*

*Lunch time (13:00-14:00)*

**14:00-17:00 April 26**

**Plenaries 6 to 9**

**Globe Theatre**

***Location: Globe Theatre, Harbin International Conference Center***

***Plenary Session 3***

**Chair: Myung K. Cho, National Optical Astronomy Observatory (USA)**

**(Time: 14:00 to 14:40)**

**6. Diffractive optical elements: fabrication and application**

**Prof. A.G. Poleshchuk & Dr. Victor P. Korolkov (Russia)**

*Head of the Laboratory Of Diffractive Optics*

*Institute of Automation and Electrometry, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia*

**(Time: 14:40 to 15:20)**

**7. Advanced ion beam finishing and atmospheric plasma technology for high end optics**

**Dr. Axel SCHINDLER (Germany)**

*Science and Technology Consultant in ion beam and plasma technology for ultra-precision surface processing*

*Leibniz Institute of Surface Modification, IOM*

*Tea time (15:20-15:40)*

***Plenary Session 4***

**Chair: LI Yanqiu, Key Laboratory of Photoelectronic Imaging Technology and System, Ministry of Education of China**

**(Time: 15:40 to 16:20)**

**8. Complex plasmonic applications: 3D chiral, nonreciprocal and active plasmonics**

**Dr. Harald Giessen (Germany)**

*Chair for Ultrafast Nanooptics in the Department of Physics at the University of Stuttgart*

**(Time: 16:20 to 17:00)**

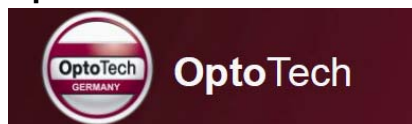
**9. Manipulating the polarization states of electromagnetic waves using sub-wavelength structures**

**Prof. LUO Xiangang (China)**

*Director of State Key Laboratory of Optical Technologies on Nano-Fabrication and Micro-Engineering*

**Session Schedule and Session Chair**

Time	Session No.	Place	Session Chair
8:30-12:00 April 27	Session 1-1	room 407	WU Fan(伍凡)
	Session 2-1	room 408	CHENG Qiang(程强)
	Session 3-1	room 409	WEN Shangming(温尚明)
	Session 4-1	room 410	XIN Tingwen(邢廷文)
	Session 5-1	room 411	WANG Xiao(王晓)
	Session 6-1	room 412	LUO Xiangang(罗先刚)
13:00-17:00 April 27	Session 1-2	room 407	FAN Bin(范斌)
	Session 2-2	room 408	LI Shengyi(李圣怡)
	Session 3-2	room 409	ZHANG Rongzhu(张蓉竹)
	Session 4-2	room 410	ZHAO Qingliang(赵清亮)
	Session 5-2	room 411	QI Yige(祈一歌)
	Session 6-2	room 412	WANG Changtao(王长涛)

**Workshop Schedule****9:00-12:00 April 28****Workshop****Room 407 & 408****Chair: XIN Qiming(辛企明)****1. NTG****9:00-9:55****2. TRIOPTICS****9:55-10:50****Tea Time (10:50-11:00)****3. Opto Tech****11:00-11:55**

9:00-9:40 April 26..... Plenary Presentation 1  
Globe Theatre

■ Plenary Presentation 1

Title: Manufacturing the Optics for the Thirty Meter Telescope



**Prof. Larry Stepp (USA)**

Telescope Department Head for the Thirty Meter Telescope Project, USA

**Abstract:** Astronomy is in the midst of a revolution fueled in part by the widespread availability of ground-based optical/infrared telescopes in the 8-10 meter class. Just as the total collecting area of large ground-based telescopes more than trebled in the decade from 1993 to 2002, it is poised to double again in the next decade with the construction of several extremely large telescopes. These ELTs are designed with integral adaptive optics systems that will make their images several times sharper than existing telescopes combined with ~10-fold increase in collecting area. To achieve the large aperture size, all of these ELTs will use primary mirrors

composed of multiple segments.

The Thirty Meter Telescope will have a 30-meter diameter primary mirror comprising 492 hexagonal segments. Its design is based on the highly successful Keck Observatory 10-meter telescopes, but with an order of magnitude more segments. The secondary and tertiary mirrors are scaled up similarly to sizes more than 3 meters across. As a result, TMT faces new technical and programmatic challenges in manufacturing and testing of its optical elements.

This paper provides an introduction to TMT and discusses the evolution of its optical and optomechanical designs from key decisions based on the science goals. It describes the manufacturing challenges for production of the mirrors and their support systems. Progress in optical fabrication technology development and prototype testing activities is also described. The TMT scientific and industrial partners have made significant advances in developing the technical and manufacturing approaches necessary to successfully build TMT, and the project is now poised to start construction on Mauna Kea in Hawai'i.

**Principal Author's Biography:** Larry Stepp is the Telescope Department Head for the Thirty Meter Telescope Project, responsible for the telescope structure, optics and controls. Prior to joining TMT, he was the Manager of the AURA New Initiatives Office, which developed the design concept for the 30m Giant Segmented Mirror Telescope, a TMT precursor. From 1991 to 2001, he was the Optics Manager for the Gemini Project, which successfully built two 8-meter optical-infrared telescopes – one on Mauna Kea in Hawai'i and the other on Cerro Pachon in Chile. Before that he was the Manager of the Advanced Optical Telescope Technology Group at NOAO in Tucson, and was responsible for building and testing the 3.5m primary mirror assembly for the WIYN Telescope on Kitt Peak. Stepp has a master's degree in engineering mechanics from the University of Nebraska – Lincoln, followed by graduate courses in Optics at the University of Arizona. He has been involved in the optomechanical design, fabrication and testing of large optics for 30 years and is one of few engineers who has been responsible for producing primary mirror systems using all three of the mirror types used in modern large telescopes: borosilicate honeycomb, thin meniscus, and hexagonal segments. He has been active in the SPIE symposiums on telescopes and instruments for astronomy and has chaired and co-chaired numerous conferences on large telescopes.

9:40-10:20 April 26..... Plenary Presentation 2  
Globe Theatre

■ ***Plenary Presentation 2***

**Title: The Progress of the European Extremely Large Telescope**



**Dr. Bernard Delabre (Germany)**

*Optical Design Engineer, ESO-European Southern  
Observatory*

**Abstract:** The European Extremely Large Telescope (E-ELT) is a 39 m aperture telescope, the largest of three ELT projects currently underway. The large aperture and diffraction limited performance of the telescope will enable a new era of scientific discovery, such as characterizing the atmospheric composition of near-by extra-solar planets and tackling fundamental problems in cosmology. The telescope will be situated in Amazonas in Chile, close-by to the existing ESO facility at Paranal. The telescope is a 5 mirror design which includes 3 powered mirrors (a three-mirror anastigmat or TMA) for a perfect correction of the 10 arc min field of view. The two other mirrors are used for correction of the atmosphere (flat deformable mirror) and field stabilization. To achieve a performance near the theoretical limit, various technical challenges must be met, including maintaining 798 1.4 m hexagonal segments, that comprise the primary mirror, in co-alignment and individual shape to within a few tens of nanometers. This presentation will describe the telescope and presents the actual status of the project.

**Principal Author's Biography:**

Born on 28-02-1952

Optical engineer

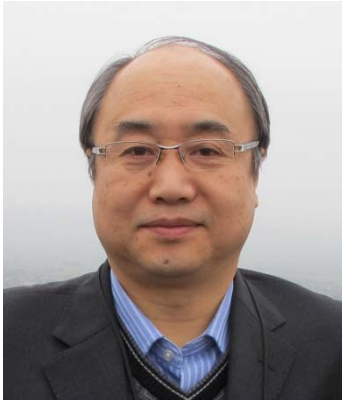
From 1975 to 1977 Design of headlight for car industry

Since 1977 In charge of Optical design for telescope and instrumentation at the European Southern Observatory

10:20-11:00 April 26..... Plenary Presentation 3  
Globe Theatre

■ ***Plenary Presentation 3***

**Title: Method and procedure for the high-efficiency and ultra-precision diamond turning of large optical mirrors**



**Dr. Tao Sun (China)**

*Prof. and Director of the Centre for Precision Engineering (CPE), Harbin Institute of Technology*

**Abstract:** Diamond turning is a deterministic process of mechanical machining for optical components. The machining accuracy is dependent not only on the accuracies of lathes, but also on cutting trajectory, diamond cutting tools, and measurement techniques. In this work, we presented a novel diamond turning machine tool for large optical mirrors. And we introduced the relevant key technologies, such as structure design and testing method for the high-precision tool swing feeding system, motion mode of spherical and aspheric surface machining, cutting trajectory planning of aspheric surface contouring, design of diamond cutting tool, and in-situ shearing interference measurement techniques. Based on the lathe and relevant procedure we have developed, a series of spherical and aspheric optical mirrors can be fabricated with high-efficiency than traditional polishing method, which suits for the mass production of large optical metal mirrors.

**Principal Author's Biography:** Dr. Tao Sun is currently working as a professor of Mechanical Engineering in Harbin Institute of Technology(HIT), a Ph. D. supervisor of the discipline of Mechanical Manufacturing and Automation. He received his B.E. and M.E. degree in Precision Instrument, and Ph.D. degree in Mechanical Engineering from HIT in 1986, 1991, and 1999, respectively. He has been appointed to the director of the Center for Precision Engineering (CPE) since 2005. He has also been involved as the deputy director of the Center for Technological Applications of Ultra-precision Mechanical Machining, and the director of the Heilongjiang Key Laboratory of Ultra-precision Machining and Nontraditional Machining Techniques. His current research interests are focusing on ultra-precision machining techniques, such as design and application of ultra-precision machine tool, fabrication of diamond cutting tool, micro/nano-fabrication and micro/nano-measurement. He has more than 140 publications.

11:20-12:00 April 26..... Plenary Presentation 4  
Globe Theatre

■ *Plenary Presentation 4*

Title: Precision nanometrology for fabrication of micro optics



**Dr. Wei Gao (Japan)**

*Professor and the Director of Research Center for Precision Nanosystems, Dept. of Nanomechanics of Tohoku University*

**Abstract:** This keynote will start from an overview of micro-optics from fundamental functions, fabrication methods and applications in precision engineering and nanotechnology.

State-of-the-art measuring systems for precision nanometrology of micro-optics with micro-structured surfaces, including diffractive micro-optics such as diffraction gratings and refractive micro-optics such as micro lenses and micro-lens arrays, will then be presented. The measuring systems introduced in the presentation are classified into scanning probe microscope-based systems, mechanical stylus profiling systems and optical evaluation systems. Related research activities carried out in the author's group will also be highlighted.

**Principal Author's Biography:** Wei Gao received his Bachelor of Precision Instrumentation from Shanghai Jiao Tong University, China, in 1986, followed by MSc and Ph. D from Tohoku University, Japan, in 1991 and 1994, respectively. He is currently a professor and the director of Research Center for Precision Nanosystems, Department of Nanomechanics of Tohoku University. His research interests include precision metrology and micro/nano-metrology. He is a fellow of CIRP, and the International Society for Nanomanufacturing. He serves as the Vice-Chairman of The Scientific Technical Committee Precision Engineering and Metrology of CIRP. He is also an associate editor of the journal of Precision Engineering, and IEEE Transactions on Instrumentation & Measurement. He has published 150 journal papers and applied 50 patents (20 issued). He is the author of the book "Precision Nanometrology – Sensors and Measuring Systems for Nanomanufacturing" (Springer). He has won five Paper Awards from The Japan Society for Precision Engineering (1998, 2003, 2004, 2010, 2011).

12:00-12:40 April 26..... Plenary Presentation 5  
Globe Theatre

■ ***Plenary Presentation 5***

**Title: Advanced Manufacturing and Testing Technologies for Multiple Mirror Space Telescopes**



**Dr. Zhang Xuejun (China)**

*Prof. Vice President of Changchun Institute of Optics, Fine Mechanics and Physics, CAS*

**Abstract:** Three Mirror Anastigmat (TMA) systems including both on-axis and off-axis configurations have been widely used in space applications. In some designs, to correct for high order aberrations and realize large FOV, freeform surfaces are used to provide more design freedoms. This trend brings challenges to optical manufacturing and testing community. In this paper, some new manufacturing technologies such as direct CNC generation, deterministic polishing techniques including CCOS, MRF and IBF Polishing were presented in detail, most importantly the combination strategy of using those modern techniques were discussed. Since testing is critical to make high accurate aspheres, the paper also addressed Computer Generated Hologram (CGH) design and implement to measure large freeform mirrors. In particular, CGH assisted alignment procedure for TMA telescopes were discussed in detail.

**Principal Author's Biography:** Xuejun Zhang received his Ph.D degree from Changchun Institute of Optics and Fine Mechanics (CIOMP) in 1997. He is now vice president of CIOMP and director of Key Laboratory of Optical Manufacturing and Testing. Dr. Zhang has been engaged in optical system design, manufacturing and testing for more than 20 years, as principle investigator, he has completed numbers of national research projects and won three National Awards for Achievements in Science and Technology (1999, 2008, 2011). He is now in charge of 5 national projects and also the leader of the team of 30 Meter Telescope (TMT) Tertiary Mirror Manufacturing. Dr. Zhang is members of SPIE and OSA and has published over 100 peer reviewed technical papers.

14:00-14:40 April 26..... Plenary Presentation 6  
Globe Theatre

■ ***Plenary Presentation 6***

**Title: Diffractive optical elements: fabrication and application**



**Prof. A.G. Poleshchuk (Russia)**

*Head of the Laboratory Of Diffractive Optics*

*Institute of Automation and Electrometry, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia*

**Principal Author's Biography:** Alexander G. Poleshchuk is ahead of the Laboratory of Diffractive Optics of the Institute of Automation and Electrometry, Siberian Branch of Russian Academy of Sciences (IAE SB RAS) in Novosibirsk, since 1997. He received an

MS degree in radio electronics from the Institute of Communication, Novosibirsk, Russia, and a PhD degree in applied optics from the Institute of Precision Mechanics and Optics, Leningrad, Russia, in 1980. He received a Doctor of

Science in laser physics from the Institute of Laser Physics SB RAS, Novosibirsk, Russia, in 2003. His research interests include application for diffractive optical elements (DOE) in optics, laser physics and optical metrology, development of technologies and equipment for fabrication of DOE, laser interferometry and testing of aspherical surfaces.



**Dr. Victor P. Korolkov**

*Institute of Automation and Electrometry, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russia*

**Principal Author's Biography:** Dr. Victor P. Korolkov is senior scientist of Laboratory of Diffractive Optics of the Institute of Automation and Electrometry, Siberian Branch of Russian Academy of Sciences (IAE SB RAS) in Novosibirsk, since 2003. He received an

MS degree in physics from the Novosibirsk State University and a PhD degree in applied optics from the IAE SB RAS in 2000. He presented a Doctor of Science degree in applied optics in the IAE SB RAS in 2013.

His research interests include development of laser technologies and precision laser writing systems for fabrication of diffractive optics and computer generated holograms, optical metrology of diffractive microstructures, femtosecond laser induced surface nanostructuring and etc.

**Abstract:** We review our recent progress on development of the methods for fabrication of precision binary and as well as high-efficiency continuous-relief diffractive optical elements (DOEs) by combining complementary advantages of circular laser writing system (CLWS), direct laser beam writing in thermal and photo-sensitive materials and analog lithography. The main limitation and tolerances of writing methods are identified, and their influence on optical performance of DOEs is investigated. The latest results of fabrication and practical applications of DOEs with more than 200 mm diameter and a minimum feature size of 0.5 micrometer for testing large aspheric surfaces with a Fizeau-type interferometer are presented.

14:40-15:20 April 26..... Plenary Presentation 7  
Globe Theatre

■ Plenary Presentation 7

**Title: Advanced ion beam finishing and atmospheric plasma technology for high end optics**



**Dr. Axel SCHINDLER (Germany)**

*Science and Technology Consultant in ion beam and plasma technology for ultra-precision surface processing  
Leibniz Institute of Surface Modification, IOM*

**Abstract:** Today ultra-precision surface processing is mandatory in high class optics fabrication for almost all modern optics fields like photo lithography advanced optics for measurement equipment, synchrotron and x-ray optics, space and telescope optics laser optics and even more. The high degree of processing accuracy and the wide range of processing parameter adjustment together with their automatic tight control including scaling of the tool size make particle beam related surface techniques like low energy ion beam and plasma

assisted chemical processing very attractive in advanced surface processing. Their capability to etch, to figure, to smooth, to structure surfaces and to modify other surface characteristics like to tailor the surface energy and to deposit thin films gives them some kind of key solution. Their status of integration in production lines of optics elements is different today. Ion beam figuring (IBF) is more or less the lens shape finishing standard in the absolute top class optics lithography of DUV and future EUV optics. Atmospheric plasma jet technology is on the way to enter niches in optics fabrication technology. Latest Improvements in IBF technology allow to reduce the cost of ownership of the technology and to enhance its performance with the tendency to extend their use for lower class optics production. The talk summarizes the present status of ion beam figuring for series production in optics and highlight recent advances achieved in R&D mature for ion beam figuring (IBF), ion beam smoothing (IBS), and atmospheric plasma jet machining (PJM) for deep aspherization, nanometer shape error correction and surface smoothing mainly achieved at IOM Leipzig and in more and more cases in tight collaboration with NTG.

**Principal Author's Biography:** Axel SCHINDLER graduated in semiconductor physics at the Karl-Marx-University in Leipzig, Germany, 1974.

He worked as a Group Leader on R&D of low energy ion beam surface processing in the Leibniz-Institute for Surface Modification Leipzig (IOM) from 1973 and in this position in the field of ultra-precision surface processing by ion beams and plasma jets from 1986 up to his retirement in December 2012. He managed many R&D projects and R&D orders from industry mainly in the field of high class optics manufacturing applications during this time. Axel Schindler's main scientific and technological interests are low energy ion beam technology and atmospheric plasma jet technology, ultra-precision surface processing by ion beams and plasma jets, ion beam and atmospheric plasma jet etching, deposition and surface modification and last but not least atmospheric plasma jets for future therapy and prophylaxis applications in dentistry.

He holds several patents and is author and co-author, respectively of more than 100 papers and talks.

Today Axel Schindler works as a Science and Technology Consultant in ion beam and plasma technology for ultra-precision surface processing and atmospheric plasma jet application in medicine.

15:40-16:20 April 26..... Plenary Presentation 8  
Globe Theatre

■ ***Plenary Presentation 8***

**Title: Complex plasmonic applications: 3D chiral, nonreciprocal and active plasmonics**



**Dr. Harald Giessen (Germany)**

*Chair for Ultrafast Nanooptics in the Department of Physics  
at the University of Stuttgart*

**Abstract:** We present a novel approach to create large-area ( $\text{cm}^2$ ) 3-dimensional chiral plasmonic structures. Large transmission differences between right- and left-hand circularly polarized light in the percent range have been measured in the near-infrared spectral region. Additionally, by introducing magneto-optical hybrid plasmonic structures and applying a static magnetic field, nonreciprocal Faraday rotation in the near-infrared was measured. We are also going to present a number of novel sensing applications, ranging from 3D rulers to novel plasmonic gas and liquid sensors.

**Principal Author's Biography:** Harald Giessen (\*1966) graduated from Kaiserslautern University with a diploma in Physics and obtained his M.S. and Ph.D. in Optical Sciences from the University of Arizona in 1995. After a postdoc at the Max-Planck-Institute for Solid State Research in Stuttgart he moved to Marburg as Assistant Professor. From 2001-2004, he was associate professor at the University of Bonn. Since 2005, he holds the Chair for Ultrafast Nanooptics in the Department of Physics at the University of Stuttgart. He was guest researcher at the University of Cambridge, and guest professor at the University of Innsbruck and the University of Sydney, at A\*Star, Singapore, as well as at Beijing University of Technology. He is associated researcher at the Center for Disruptive Photonic Technologies at Nanyang Technical University, Singapore. He received an ERC Advanced Grant in 2012 for his work on complex nanoplasmonics. He has published more than 290 technical papers in optics related fields. He is on the advisory board of the journals "Advanced Optical Materials", "Nanophotonics: The Journal", and "ACS Photonics". He is a Fellow of the Optical Society of America.

16:20-17:00 April 26..... Plenary Presentation 9  
Globe Theatre

■ ***Plenary Presentation 9***

**Title: Manipulating the polarization states of electromagnetic waves using sub-wavelength structures**



**Prof. LUO Xiangang (China)**

*Director of State Key Laboratory of Optical Technologies on Nano-Fabrication and Micro-Engineering, Institute of Optics and Electronics, CAS*

**Abstract:** The polarization states of electromagnetic waves are of significant interest for various applications including but not limited to imaging, antennas, remote sensors, radiometer, microwave and optical communications. In this work, we present our recent results designs and techniques for manipulation of polarization states using subwavelength structures. Specifically, the broadband anisotropic

polarization transformer, inhomogeneous metallic inclusions with polarization singularity, novel chiral antennas with multiband circular dichroism, circular polarized thermal infrared radiation with high efficiency and purity are demonstrated. Realizations in spin-orbital momentum conversion in a particular way through a nanowire are also presented. The proposed designs and method can find applications in various scenarios including nanofabrication, photodetectors, imaging optics, thin absorbers/emitters.

**Principal Author's Biography:** Xiangang Luo is the Professor at The Institute of Optics and Electronics, Chinese Academy of Sciences and the Director of State Key Lab of Optical Technologies on Nanofabrication and Micro-engineering. Professor Luo received Ph.D from Chinese Academy of Sciences (2001). He was a Research Scientist at The Institute of Physical and Chemical Research (RIKEN) of Japan (2001-2005). Professor Luo's current research focused on micro-nano-optics, subwavelength optics. He has published more than 200 technical papers and 100 patents in optics related fields. He has been a Program Leader and Chief Scientist of the National Key Basic Research and Development Program.

## Session 1-2

## Invited Talk

■ Invited Talk

**Title: Development of a Fast Steering Secondary Mirror Prototype for GMT**

**Dr. Myung K. Cho (USA)**

*National Optical Astronomy Observatory*



**Abstract:** A Fast Steering Secondary Mirror (FSM) will be installed as a commissioning M2 for the Giant Magellan Telescope (GMT). The FSM consists of seven segments, and each segment is approximately 1m in diameter. The center segment is an on-axis and its surrounding six segments are off-axis mirrors. FSM has a feature to compensate the image degradations caused by wind disturbances and structure jitter by using a tip-tilt

mechanism. The Korea Astronomy and Space Science Institute is developing a prototype of the FSM together with several collaborators in Korea and the National Optical Astronomy Observatory in USA. The prototype (FSMP) is a full-size off-axis mirror, and it has been fabricated and tested by an interferometer with a CGH and other test methods. In this presentation, current progress of the prototype development, the optical figuring and tests are addressed. In addition, a tip-tilt system development and its test results are to be addressed.

**Keywords:** GMT Secondary Mirror Prototype, Fast Steering Mirror, off-axis mirror fabrication, tip-tilt system.

**Principal Author's Biography:** Dr. Myung Cho serves as a principal engineer at the National Optical Astronomy Observatory (NOAO). He has been involved in the design and development of the optical telescopes and optical instruments including the Thirty Meter Telescope Project, the Giant Magellan Telescope, the Advanced Technology Solar Telescope, the Large Synoptic Survey Telescope, the GEMINI 8m Telescopes, and the WIYN 3.5m telescope.

■ Invited Talk

Title: technology readiness for E-ELT critical optics



**Dr. Roland GEYL (France)**

*REOSC Optics*

**Abstract:** The European –Extremely Large Telescope (E-ELT) is under process of consolidating its full budget in order to have a soon start. In the past years Reosc has consolidated its technological and industrial skill and capability to address the various critical optical elements constituting this telescope :

Primary mirror (M1) segments require achieving tough mid spatial frequency specifications on a large scale production. Industrial state of the art processes have been developed.

M2 and M3 mirrors are now both 4-m class and shall come in the category of "standard optics". A new production line is under set up.

The adaptive M4 requires thin glass shell. Successful demonstrations have been made and VLT M2 AO shell supplied.

M5 is a large Tip-Tilt Flat made from Silicon Carbide. Our SiC optics skill gained on many space programs like Gaia recently launched and our experience in large test equipment capability shall bring the most efficient answer to this last E-ELT need.

**Principal Author's Biography:** Roland GEYL graduated from the Ecole Supérieure d'Optique in Orsay-France in 1979.

He worked in the various domains of lens design for high performance space and defense optics, precision metrology including absolute calibration and precision manufacturing with computer controlled technology of large aspheric optics. His latest work is focused on DUV and EUV optics as well as large segmented optics manufacturing and testing.

He holds 10 patents and gave many talks at international symposia. Roland GEYL managed several key space optics and astronomy projects at REOSC, now SAGEM and is now VP Sales and Business Development of the Business Unit. In parallel, Roland GEYL ensured theoretical and practical lens design courses at the Ecole Supérieure d'Optique for nearly 20 years.

## Session 2-1

## Invited Talk

■ Invited Talk

**Title: Advances in optical design and its future**



**Prof. Yi-Chin Fang (CHINA Taiwan)**

*Advanced Optical Design and Manufacture Center, Institute of Electro-Optical Engineering, National Kaohsiung First University of Science and Technology*

**Abstract:** Optical design and lens technology has been developed for more than 150 years. Although there is no significant cosmetic change during these days, performance of optical lens has been amazingly improved thanks to anti-reflection coating, optimization via fast CPU, special-made optical glasses, advanced manufacture technique and others. What is the next step for modern

optics and future optics? In my current research, a compensative optimization method with assistance of Genetic Algorithm is introduced in this research with a new concept of DLGS, which not only solve the complicated problem of liquid optics itself but also improve the performance of optics. Genetic algorithms (GA) written in CODE V plays the role at finding out the appropriate parameters such as curvatures, thicknesses, glass materials and etc. Besides, one table with great lens groups shifts by GA would be created to move the lens groups on the optimal positions of different zooms. As a result, the DLGS optimization method associated with the GA optimization improve the zoom lens performance averagely 40% better than traditional ones.

**Keywords:** Liquid Lens, Genetic Algorithm, Discrete Lens Groups Shifts, Digital Signal Processor.

**Principal Author's Biography:** My name is Yi Chin Fang and I was born in Tainan, Taiwan, in 1967. I graduated from Applied Optics group, Physics, Reading University in 2000. I majoring in optical design, opto-mechatronics, infrared physics, optical measurement and bio-optics.

I have near twenty years' experience in optical design, testing and fabrication including active optics, projection optics, micro optics, optoelectronics and opto-mechatronics.

As I am in charge of a professor, former head of Graduated Institute of Electro-Optical Engineering department, National Kaohsiung First University of Science and Technology, founder of Taiwan Society of Optical Design,(TSOD), senior consultant of ChiMei, ITRI and manager of ITRI etc. More than ten patents inclusive of three U.S.A.patents are obtained in past years. Therefore, I have good relationship with most well-known optical companies in Taiwan. Recently, I am editor in chief of Applied Optics special issue "Optical Design and Testing".

Now I am concentrating on research and development work for optics of next generation "Optics Next", which is more likely module micro opto-mechatrical system rather than so called "Field Optics".

## Session 2-1

## Invited Talk

■ Invited Talk

**Title: The Finishing of Ultra Precision and High Precision Moulds – Commercial Applications by Zeeko**



**Dr. Richard Freeman, et al. (UK)**  
*Zeeko Ltd*

**Abstract:** the ever more competitive market for the “handheld technology market” and for developments in automotive design (and in particular to “Head Up Displays” in cars has been leading in recent times to new processes being required for the volume production of new ultra precision optics and high precision components that are being manufactured by innovative developments of processes originally developed for optics but now finding application in the high volume market of automotive and “handheld device” applications. This paper discusses several of the techniques in general and specifically analyses one process in particular and a new technique developed by Zeeko to polish SiC coated moulds for the volume production of these parts. The new technique known as “Shape Adaptive Grinding” or “SAG” is both fast and effective in this market segment as it applies ductile grinding techniques to the production of high volume moulds.

## Session 3-2

## Invited Talk

■ Invited Talk

**Title: Towards a One Machine Optics Fabrication Solution – Latest Developments by Zeeko**



**Dr. Richard Freeman, et al. (UK)**  
*Zeeko Ltd*

**Abstract:** over recent times Zeeko has reported on pioneering work to introduce “on machine measurement” to the optics industry and the embodiment of this concept into its Optics Fabrication Centre machines. This concept is now well adopted by the market place. Recently Zeeko has been further developing the technologies that it has been able to apply to these machines introducing additional processes and measurement techniques to the single machine platform. This paper discusses the advances these new innovations and developments bring and the new challenges that have resulted from this ambition.



# ZEEKO<sup>Ltd</sup>

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**Contact:**

Mr. Richard Freeman - Managing Director  
www.zeeko.co.uk [info@zeeko.co.uk](mailto:info@zeeko.co.uk)

Established in 2000, Zeeko has progressed from being a start-up company with innovative technology to polish ultra precision surfaces for telescope mirrors and other optical surfaces, to become a market leading company with a wide polishing and metrology product portfolio that competes impressively in a global market place. Zeeko remains to be an innovative, young and dynamic technology based business with globally protected Intellectual Property extending to over 52 worldwide patents.

Zeeko specialise in the manufacturing and commercialisation of Ultra-Precision Polishing Machines famously known as the Intelligent Robotic Polishers (IRP). Zeeko Ltd manufactures corrective polishing machines for fabricating high precision optics, orthopaedic joints, semiconductor applications and precision moulds in a number of different materials.

The machines are supplied with state of the art software and processes suitable for the production of the most complex freeform artefacts. Covering a range of sizes from 1.5mm to 6m they utilise patented processes including the mechanical "ZeekoClassic" technology and the "ZeekoJet" solution. These cost effective solutions are deterministic and scalable from the smallest cell-phone requirements to the largest astronomy applications and are suitable for polishing most materials from traditional optics materials, stainless steel etc to both tungsten carbide and silicone carbide.

Zeeko has worked hard to establish itself as a viable business and, having learned some of the skills needed to survive and prosper, it has more recently developed a number of ideas for ways in which the business and the product base can grow laterally across sectors, thus protecting the business in times of market slow-down.

Richard himself is a mechanical engineer with a manufacturing background. He first managed a volume manufacturer of components for the global diesel engine market before becoming Managing Director of Rank Taylor Hobson, a well known name in both precision metrology and cinematography optics. Shortly after leaving Taylor Hobson he founded Zeeko Ltd. With a background both in volume manufacture and also in metrology he was well equipped to study the similar challenges of the Ultra-Precision Polishing Industry.

■ Invited Talk

**Title: Manipulating the emission of dye molecules using micro-nano structures**



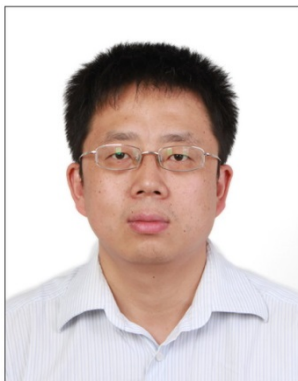
**Prof. MING Hai (明海) (CHINA)**

*Institute of photonics, Department of Optics and Optical Engineering, University of Science and Technology of China*

**Abstract:** Fluorescence detection is widely used in the biosciences, medical diagnostics, sequencing and imaging. However fluorescence detection is reaching some natural limits and only incremental improvements in sensitivity — using classical far-field free-space optics — can be expected. To circumvent these limits, we have used the near-field effects of dielectric or metallic micro-nano structures to control the emission from the dye molecules. The optical near-field of these structures can interact with the nearby fluorophores, which converts the usual omni-directional emission into directional emission and modify the polarization of the coupled emission without the use of any lenses or polarizers. The near-field coupling also results in the separation of wavelengths at different angles and also fluorescence enhancement. In this talk, we will present several experimental works in this field, such as controlling the fluorescence emission with the metallic thin films[1], dielectric gratings on the metallic film[2,3,4], metallic gratings[5], metallic nanoparticles[6], one dimensional dielectric photonic crystals (1DPC)[7,8], and also polymer micro tubes[9]. All these experiments are carried out with a home-built instrument, leakage radiation microscopy (LRM)[10], which demonstrates great power in characterizing the fluorescence emission and also has the potential to realize the super-resolution fluorescence imaging[11].

**Principal Author's Biography:** Hai Ming, professor, male, born in February 1947. He was graduated from University of Science and Technology of China and works there until now. During his research career, he was a visiting scholar of the University of Tokyo, International Centre for Theoretical Physics and America for academic communication. Now he is the director of the Institute of Photonics in the USTC, vice chairman of the Opto-Electronic Technology Professional Committee and chairman of the Optics Education Committee of the Chinese Optical Society,.

Hai Ming's major interests are micro-nano optics, advanced photonic technology and devices. He has published more than 200 papers on PRL, APL, Opt. Lett, Opt. Exp and other journals. He has been in charge of more than 20 key national funds and obtained several ministerial and provincial level scientific research achievement awards. Ming has edited "Opto-Electronic Technology", "The foundation of Modern Optics" and some conference proceedings of SPIE. Prof. Ming has got more than 20 patents including 6 American patents and is honored with the Special Dedicative Allowance of the State Council.

■ Invited Talk**Title: Full vector optical field modulation based on metasurface****Prof. ZHANG Yan (张岩)(CHINA)***Department of Physics, Capital Normal University*

**Abstract:** Field modulation is quite important for communications, imaging, and other applications of the electromagnetic radiation. Many methods have been proposed to alter the phase, intensity, polarization of the wave front for achieving better results, for example, small focusing point, high resolution imaging, special field distribution, and vortex beams. Metasurface is a kind of subwavelength antenna array

which can modulate the amplitude, phase, and polarization of illuminating light simultaneously with a subwavelength resolution. Furthermore, the thickness of the metasurface is much thin than the conventional optical components, even smaller than the wavelength of the illuminating light, which brings a great advantage for system integration. Different metasurface devices with desired functions are designed and fabricated for modulate the vector field of the terahertz radiation, the performances of these devices have been demonstrated with the terahertz focal plane imaging system. It was found that these novel devices can perform the preset functions well.

**Keywords:** Metasurface, terahertz, super thin device

**Principal Author's Biography:** Prof. Dr. Yan Zhang, received his Master and Doctoral degree from the Harbin Institute of technology and Institute of Physics, Chinese Academy of Science in 1996 and 1999, respective. From 1999 to 2001, he worked in the Yamagata University, Japan, as a JSPS research fellow. From 2001 to 2002, he worked in the Hong Kong Polytechnic University as a research associate. From 2002 to 2003, he worked in the Institute of Applied Optics, University Stuttgart, as a Humboldt research fellow. He is now the dean of the Department of Physics, Capital Normal University. His researches include optical information processing, THz spectroscopy and imaging, surface plasmonic optics, and metasurface. He has published more than 150 prereviewed journal papers and given more than 20 invited presentations in the international conferences.

## Session 6-1

## Invited Talk

■ Invited Talk

**Title: Far field observation and theoretical analyses of light directional imaging in hyperbolic metamaterial with stacked metal-dielectric films**



**Dr. WANG Changtao(王长涛) (CHINA)**

*IOE, CAS*

**Abstract:** We report experimental observation of directional imaging of evanescent waves in layered metal-dielectric metamaterial. The investigation is performed by Ag/SiO<sub>2</sub> multilayers combined with nano-object featured by a silicon mask slit. Instead of measuring surface plasmon behaviors by photoresist or near-field scanning methods, evanescent waves of directional imaging are transferred to the far field by

roughening the top Ag layer and directed by a microscope objective. After directional propagating in the hyperbolic metamaterial, the evanescent waves form two light lines with about 1.78  $\mu\text{m}$  offset on the output plane. The corresponding imaging angle  $\theta$  is about 70.2° and agrees well with the simulation result of 68.2°. In addition, directional imaging behavior dependences on geometrical parameters are further presented and show great deviations with effective medium theory in some cases.

**Principal Author's Biography:** Changtao Wang was graduated from the physics department of Sichuan University in 1999 with bachelor degree. He received his master degree in 2002 in the same university and got the doctor degree of philosophy in the Institute of Electronics and Optics in 2013. Now he is as an associate research fellow in the state key lab of optical technologies on nano-fabrication and micro-engineering, Chinese academy of sciences. His research is mainly focused on the plasmonics, subwavelength optics, metamaterial and their potential applications in nano lithography, optical imaging beyond the diffraction limit etc.

**Conference 1: Large Mirror and Telescopes**

Conference Chairs:

**JIANG Wenhan**, Academician, Chinese Academy of Engineering (China)**Myung K. Cho**, National Optical Astronomy Observatory (USA)**WU Fan**, Institute of Optics and Electronics, CAS (China)**8:30-12:00 April 27 ..... SESSION 1-1  
room 407 (20 min/report)***Session chair: WU Fan(伍凡)*

- ✓ Technology readiness for E-ELT critical optics, Roland GEYL (Roland GEYL, SAGEM DEFENSE SECURITE)(France) ..... (25 min) (Invited)
- ✓ Design and analysis of Space Remote Sensor structure , WANG Kejun, et al.(王克军, 中科院长春光机所)(CHINA) ..... [1-0006]
- ✓ Simulation Analysis of On-orbit Adjustment and Compensation for Large Aperture Optical System, LIU Jianfeng, et al.(刘剑峰, 北京空间机电研究所)(CHINA) ..... [1-0028]

*Tea time*

- ✓ Summary of Locking and Releasing Structure in Space Telescope, WANG Yijian, et al.(王一建, 中国科学院长春光机所)(CHINA) ..... [1-0030]
- ✓ Research on grinding block wear in grinding of SiC, ZHANG Feihu, et al.(张飞虎, 哈尔滨工业大学)(CHINA) ..... [1-0032]
- ✓ Design scheme for optical manufacturing support system of TMT M3 prototype, hhf, et al.(hhf, 中科院长春光机所)(CHINA) ..... [1-0034]

**13:00-17:00 April 27 ..... SESSION 1-2  
room 407 (20 min/report)***Session chair: FAN Bin(范斌)*

- ✓ Development of a Fast Steering Secondary Mirror Prototype for GMT, Myung Cho(Myung Cho, NOAO)(USA).....(25 min) (Invited) [1-0058-1]
- ✓ Edge Control in the Precessions Polishing Process for Manufacturing Large Mirror Segments, LI Hongyu, et al.(李洪玉, 哈尔滨工业大学)(CHINA) ..... [1-0049]
- ✓ Fabrication and Metrology study for M3M of TMT, LUO Xiao, et al.(罗霄, 中国科学院长春光机所)(CHINA) ..... [1-0051]
- ✓ Environmental simulation evaluation of SSiC brazed optical mirror, LIU Yan, et al.(刘岩, 中科院上海硅酸盐所)(CHINA) ..... [1-0056]

*Tea time*

- ✓ The realization of the light source for star simulator with multi-color temperature and multi-magnitude , LI Xiaoni, et al.(李晓妮, 西安光机所)(CHINA) ..... [1-0058]
- ✓ Status of cleanliness maintaining in target beam enclosures in SG III facilities and contamination sources analysis, WANG Meicong, et al.(王美聪, 中国工程物理研究院)(CHINA) ..... [1-0060]
- ✓ Experimental Research on 3D Reconstruction through Range Gated Laser Imaging, LI Sining, et al.(李思宁, 哈尔滨工业大学)(CHINA) ..... [1-0061]

## Conference 2: Advanced Optical Manufacturing Technologies

Conference Chairs:

**YANG Li**, COMT, COS (China)

**Eric Ruch**, SAGEM Défense Sécurité REOSC Department Avenue de la Tour Maury 91220 Saint Pierre du Perray (France)

**LI Shengyi**, National University of Defense Technology (China)

**8:30-12:00 April 27 ..... SESSION 2-1  
room 408 (10 min/report)**

Session chair: *CHENG Qiang*(程强)

- ✓ Advances in optical design and its future, Yi-Chin Fang (方怡钦, National Kaohsiung First University of Science and Technology)(CHINA Taiwan) ..... (15 min) (Invited)
- ✓ The Finishing of Ultra Precision and High Precision Moulds – Commercial Applications by Zeeko, Richard Freeman, et al. (Richard Freeman, Zeeko Ltd)(UK) ..... (15 min) (Invited)
- ✓ Surface generation of a  $\Phi$  1.35-meter Off-axis aspherical SiC mirror blank, ZHANG Zhiyu, et al.(张志宇, 中国科学院长春光机所)(CHINA)..... [2-0000]
- ✓ Fourier transform based dynamic error modeling method for ultra-precision machine tool , CHEN Guoda, et al.(陈国达, 哈尔滨工业大学)(CHINA)..... [2-0001]
- ✓ Contamination analysis and control countermeasure in ICF facility beam enclosure, WANG Meicong, et al.(王美聪, 中国工程物理研究院)(CHINA) ..... [2-0008]
- ✓ Fast axis servo for the fast and precise machining of non-rotational symmetric optics, TIAN Fujing, et al.(田富竟, 国防科学技术大学)(CHINA)..... [2-0018]
- ✓ A new High Efficiency Machining Method of SiC: Inductively Coupled Plasma Processing Technology, SHI Baolu, et al.(史宝鲁, 国防科技大学)(CHINA) ..... [2-0021]

### Tea Time

- ✓ Diamond tool wear detection method using cutting force and its power spectrum analysis in ultra-precision fly cutting, Guoqing ZHANG, et al.(Guoqing ZHANG, The Hongkong Polytechnic University)(Chinese hongkong) ..... [2-0024]
- ✓ Research on Design, Fabrication and Testing of EUV Source Collector by Turning, XU Qiang, et al.(徐强, 哈尔滨工业大学)(CHINA) ..... [2-0028]
- ✓ Fabrication of microlens array on convex surface by meaning of micro-milling, ZHANG Peng, et al.(张鹏, 哈尔滨工业大学)(CHINA) ..... [2-0039]
- ✓ Form Control In Atmospheric Pressure Plasma Processing of Ground Fused Silica, LI Duo, et al.(李铎, 哈尔滨工业大学)(CHINA)..... [2-0046]
- ✓ Dressing of diamond grinding wheels by abrasive water jet for freeform optical surface grinding, WANG Wei, et al.(王伟, 山东大学机械工程学院)(CHINA) ..... [2-0052]
- ✓ Study on Light Source of Extreme Ultraviolet Lithography Radiated by Capillary Discharge Produced Xe Plasma with Repetition Rate of 1kHz, ZHAO Yongpeng, et al.(赵永蓬, 哈尔滨工业大学)(CHINA) ..... [2-0058]

- ✓ Simulation analysis of grinding wheel motion trajectory on SiC ceramics aspheric surface grinding, ZHANG Feihu, et al.(张飞虎, 哈尔滨工业大学)(CHINA) ..... [2-0060]
- ✓ Novel MRF fluid for ultra-low roughness optical surfaces, Paul Dumas, et al.(Paul Dumas, QED Technologies Inc.)(USA) ..... [2-0077]

**13:00-17:00 April 27 ..... SESSION 2-2**  
**room 408 (10 min/report)**

*Session chair: LI Shengyi(李圣怡)*

- ✓ High performance Fluoride optical coatings for DUV optics, ZHANG Lichao, et al.(张立超, 中国科学院长春光机所)(CHINA) ..... [2-0080]
- ✓ Surface quality of silicon wafer improved by hydrodynamic effect polishing, PENG Wenqiang, et al.(彭文强, 国防科技大学)(CHINA) ..... [2-0087]
- ✓ Study on the method to test large-aperture hyperboloid convex mirror, MENG Xiaohui, et al.(孟晓辉, 北京空间机电研究所)(CHINA) ..... [2-0091]
- ✓ Ultrasonic -Lightweight techniquis applied in reflect mirror, GUO Wen, et al.(郭文, 北京空间机电研究所)(CHINA) ..... [2-0103]
- ✓ Study on Optical Polishing Experiment of Zerodur Mirror, WANG Huijun, et al.(王慧军, 北京空间机电研究所)(CHINA) ..... [2-0106]
- ✓ A method of measuring the 3D topography of grinding wheel using a laser displacement, PAN Yongcheng, et al.(潘永成, 哈尔滨工业大学)(CHINA) ..... [2-0107]
- ✓ Changes in mechanical properties of metals heated by continuous infrared laser, WANG Yanshen, et al.(王延深, 哈尔滨工业大学)(CHINA) ..... [2-0108]

*Tea Time*

- ✓ Dwell time algorithm for multi-mode optimization in manufacturing large optical mirror, LIU Zhenyu, et al.(刘振宇, 中科院长春光机所)(CHINA) ..... [2-0119]
- ✓ Numerical simulation on aspherical lens modulated by electrostatic force, CAO Zhaolou, et al.(曹兆楼, 中国科学技术大学)(CHINA) ..... [2-0121]
- ✓ Multi-Tool Sub-Aperture Polishing High-Slope Aspheric Surface, ZHANG Jian, et al.(张健, 中科院长春光机所)(CHINA) ..... [2-0122]
- ✓ Fabricating effect of electrified ion beam on optical lenses, GU Yongqiang, et al.(谷勇强, 中科院长春光机所)(CHINA) ..... [2-0123]
- ✓ Research on Mid-Frequency Error of Nd-doped Glass Based on Continuous Polishing, CAO Jun, et al.(曹俊, 中国科学院上海光机所)(CHINA) ..... [2-0129]
- ✓ The Real-Time Monitoring Surface Figure of Optical Elements in Continuous Polishing, CHEN Jun, et al.(陈军, 中科院上海光机所)(CHINA) ..... [2-0130]
- ✓ Subsurface damage on ground fused silica surfaces, XU Jiafeng, et al.(许家锋, 上海光机所)(CHINA) ..... [2-0132]

## Conference 3: Optical Test, and Measurement Technology, and Equipments

Conference Chairs:

**ZHANG Yudong**, Director of Institute of Optics and Electronics, CAS (China)

Jose M. Sasian, Prof. of University of Arizona (USA)

**Wei Gao**, Professor of Tohoku University(Japan)

**Sandy To**, Hong Kong Polytechnic University (China HK)

**8:30-12:00 April 27 ..... SESSION 3-1  
room 409 (10 min/report)**

Session chair: WEN Shangming(温尚明)

- ✓ Test Diffraction Properties of Reflection Waveguide Holograms, XIE Yi, et al.(谢意, 东南大学)(CHINA) ..... [3-0008]
- ✓ Subsurface Damage Detection and Mechanism on Chemical Mechanical Polishing Optical Elements, YE Hui, et al.(叶卉, 厦门大学)(CHINA) ..... [3-0020]
- ✓ Design of Laser Radar Based Feature Points Measurement Scheme, HE Binggao, et al.(何秉高, 长春理工大学)(CHINA) ..... [3-0025]
- ✓ A new illumination source for Shack-Hartmann wavefront sensor, LU Zengxiang, et al.(卢增雄, 中国科学院光电研究院)(CHINA) ..... [3-0030]
- ✓ Restoration of Broadband Light Illumination Image Using Phase Diversity Technology, CHENG Qiang, et al.(程强, 中科院长春光机所)(CHINA) ..... [3-0031]
- ✓ The applied research and solar simulation spectral design based on pulse Xenon Lamp with coating film, CHEN Wenzhi, et al.(陈文志, 厦门大学)(CHINA) ..... [3-0035]
- ✓ High-accuracy inspection of defects and profile of wafers by phase measuring deflectometry, WU Yuxiang, et al.(吴雨祥, 电子科技大学)(CHINA) ..... [3-0048]

### Tea Time

- ✓ Reosc large flats, collimators and hollow corner cubes, Roland GEYL, et al.(Roland GEYL, REOSC)(France) ..... (15 min) (Invited)[3-0133]
- ✓ Removal of Optical Surface Figure Deformation Due to Gravity, GU Wei, et al.(顾伟, 中科院光电技术研究所)(CHINA) ..... [3-0052]
- ✓ Detection and Analysis of 1/f Noise Correlation in Semiconductor Laser Diodes, FAN Huijuan, et al.(樊慧娟, 吉林大学 电子学院)(CHINA) ..... [3-0057]
- ✓ Design and analysis of Cryogenic Infrared Target, WANG Chao, et al.(王超, 哈尔滨工业大学)(CHINA) ..... [3-0059]
- ✓ Analysis of power spectral density as a performance metric for TMT M3, AN Qichang, et al.(安其昌, 中科院长春光机所)(CHINA) ..... [3-0070]
- ✓ Accuracy enhancement of three-dimensional surface shape measurement using curvelet transform, ZHAO Biyu, et al.(赵必玉, 电子科技大学)(CHINA) ..... [3-0071]
- ✓ Research on Simulation and Verification System of Satellite Remote Sensing Camera Video Processor Based on Dual-FPGA, MA Fei, et al.(马飞, 北京空间机电研究所)(CHINA) ..... [3-0078]

**13:00-17:00 April 27 ..... SESSION 3-2**  
**room 409 (10 min/report)**

Session chair: ZHANG Rongzhu(张蓉竹)

- ✓ Towards a One Machine Optics Fabrication Solution – Latest Developments by Zeeko, Richard Freeman, et al. (Richard Freeman, Zeeko Ltd)(UK) ..... (15 min) (Invited)
- ✓ Mirror pendulum pose measurement based on camera calibration, LI Lulu, et al.(李璐璐, 中科院光电所)(CHINA) ..... [3-0090]
- ✓ Improvement on object detection accuracy by using two compound eye systems, MA Mengchao, et al.(马孟超, 中国科学技术大学)(CHINA) ..... [3-0095]
- ✓ Metrology Research on PDMS Phantoms for Evaluating Resolution Performance of OCT Systems , HAO Bingtao, et al.(郝冰涛, 中国计量科学研究院)(CHINA) ..... [3-0105]
- ✓ Optomechanical design of near-null subaperture test system based on counter-rotating CGH plates, LI Yepeng, et al.(李业鹏, 国防科学技术大学)(CHINA) ..... [3-0109]
- ✓ A Sampling Method to Measure Surface Roughness of Circular Flat, MENG Kai, et al.(孟凯, 中国科学院光电所)(CHINA) ..... [3-0111]
- ✓ Dual Wavelength Digital Holographic Refocusing in the Micro Measurement, SUN Yan, et al.(孙燕, 北京工业大学)(CHINA) ..... [3-0119]

Tea Time

- ✓ Study of the detector error in the new long trace profiler: theory and simulation, YANG Fugui, et al.(杨福桂, 中科院高能物理研究所)(CHINA) ..... [3-0123]
- ✓ The Research of composite light scattering angle distribution between optical surface and multi-body particles , GONG Lei, et al.(巩蕾, 西安工业大学)(CHINA) ..... [3-0125]
- ✓ Realization of sub-micron radius of curvature measurement in vertical interferometer workstation, MIAO Erlong, et al.(苗二龙, 长春光机所)(CHINA) ..... [3-0127]
- ✓ High-resolution digital holographic imaging by using a spatial light modulator, LI Bin, et al.(李斌, 北京工业大学)(CHINA) ..... [3-0130]
- ✓ Integration Design of FPGA Softwear for A Miniaturizing CCD Remote Sensing Camera, YIN Na, et al.(尹娜, 北京空间机电研究所)(CHINA) ..... [3-0132]
- ✓ Nonlinearity analysis in homodyne multi-pass interferometer with Jones matrix and correction with Fourier harmonic components method, LI Qi, et al.(李琪, 中国计量科学研究院)(CHINA) ..... [3-0134]
- ✓ A new algorithm for spectroscopic ellipsometry: the spectroscopic 4+1 phase shifting algorithm, HAN Zhigang, et al.(韩志刚, 南理工电光院 431 室)(CHINA) ..... [3-0135]

## Conference 4: Design, Manufacturing and Testing of Micro and Nano Optical Devices and Systems

Conference Chairs:

**YE Tianchun**, Director of Institute of Microelectronics, Chinese Academy of Science (China)

**A.G. Poleshchuk**, Head of the Laboratory Of Diffractive Optics of Russian Academy of Sciences (Russia)

**HU Song**, Institute of Optics and Electronics (IOE), CAS (China)

**8:30-12:00 April 27 ..... SESSION 4-1**  
**room 410 (20 min/report)**

Session chair: *XIN Tingwen*(邢廷文)

- ✓ Analysis and optimization of a novel laterally deformable optical NEMS grating transducer, WANG Chen, et al.(王晨, 浙江大学光电系)(CHINA) ..... [4-0004]
- ✓ Experimental study on elliptical vibration cutting for optical microstructure, LI Guo, et al.(李国, 哈尔滨工业大学)(CHINA) ..... [4-0006]
- ✓ A novel device for grinding and polishing thin-walled microstructures, WANG Shilei, et al.(王石磊, 哈尔滨工业大学)(CHINA) ..... [4-0008]
- ✓ Space focusing mirror assembly with flexure hinge, GUO Quanfeng, et al.(郭权锋, 长春光机所)(CHINA) ..... [4-0022]

*Tea Time*

- ✓ Gold mushroom array: a plasmonic refractive index sensor with an ultimate figure of merit, JIN Chongjun, et al.(金崇君, 中山大学)(CHINA) ..... [4-0023]
- ✓ New approaches in the use of optical forces in particle/cell manipulation, Murat Muradoglu, et al.(Murat Muradoglu, Monash University)(Australia) ..... [4-0028]
- ✓ An efficient microsphere probe assisted scanning microscopic imaging method with super-resolution results, WANG Shuying, et al.(王淑莹, 浙江大学)(CHINA) .... [4-0030]

**13:00-17:00 April 27 ..... SESSION 4-2**  
**room 410 (20 min/report)**

Session chair: *ZHAO Qingliang*(赵清亮)

- ✓ Simulation of three-layer-coated microsphere resonators in temperature and refractive index sensing, DONG Yongchao, et al.(董永超, 中国科学技术大学)(CHINA) ..... [4-0031]
- ✓ Micromachined fiber optic Fabry-Perot underwater acoustic probe, WANG Fuyin, et al.(王付印, 国防科技大学)(CHINA) ..... [4-0041]
- ✓ A method for compensating the polarization aberration of projection optics in immersion lithography, JIA Yue, et al.(贾玉娥, 北京理工大学光电学院)(CHINA) [4-0045]
- ✓ Design of a MWIR and LWIR Dual-band / Dual-filed Optical System, WANG Yuanpeng, et al.(王元鹏, 长春理工大学)(CHINA) ..... [4-0047]

*Tea Time*

- ✓ Transmission characteristics analysis of a hybrid SNIMS plasmonic waveguide , ZHANG Man, et al.(张曼, 深圳大学)(CHINA) ..... [4-0049]
- ✓ Vector simulation of pinhole diffraction behavior for high-numerical aperture converging incident beam at deep ultraviolet wavelength, LIU Bo, et al.(刘博, 北京理工大学光电学院)(CHINA) ..... [4-0050]
- ✓ Methods on microlens compact applied in zoom systems, LIU Hua, et al.(刘华, 中国航空工业集团公司)(CHINA) ..... [4-0052]

## Conference 5: Opto Electronics Material and Devices for Sensing and Imaging

Conference Chairs:

**JIANG Yadong**, Dean of School of Optoelectronic Information, University of Electronic Science and Technology of China

**Bernard Kippelen**, Vice Director, Center of Organic Photonics and Electronics, Georgia Institute of Technology (USA)

**YU Junsheng**, State Key Laboratory of Electronic Thin Films and Integrated devices (China)

### 8:30-12:00 April 27 ..... SESSION 5-1 room 411 (20 min/report)

*Session chair: WANG Xiao(王晓)*

- ✓ Development of the large area microchannel plate photomultiplier tube, LIU Shulin, et al.(刘术林, 中科院高能物理研究所)(CHINA) ..... [5-0001]
- ✓ In-Situ Laser-induced Surface Damage Inspection Method for ICF Large Aperture Final Optics Based on Laser Total Internal Reflection Dark-field Imaging, CHEN Fengdong, et al.(陈凤东, 哈尔滨工业大学)(CHINA) ..... [5-0011]
- ✓ Studied of 640&#215;512 MCT Dual Band Focal Plane ROIC, BAI Piji, et al.(白丕绩, 昆明物理研究所)(CHINA) ..... [5-0014]

#### *Tea Time*

- ✓ Implementation and Application of Digital BINNING Algorithm based on linear TDI CCD, CHENG Yun, et al.(程芸, 北京空间机电研究所)(CHINA) ..... [5-0019]
- ✓ highly efficient non-doped orange-red phosphorescent organic light emitting devices based on a novel iridium complex, QI Yige, et al.(祁一歌, 电子科技大学)(CHINA) ..... [5-0022]

### 13:00-17:00 April 27 ..... SESSION 5-2 room 411 (20 min/report)

*Session chair: QI Yige(祁一歌)*

- ✓ High photo-response organic ultraviolet photodetectors based on phosphorescent materials, WANG Xiao, et al.(王晓, 电子科技大学)(CHINA) ..... [5-0023]
- ✓ Performance of extended wavelength InGaAs/InAsP SWIR detector, CAO Gaoqi, et al.(曹高奇, 上海技术物理研究所)(CHINA) ..... [5-0027]
- ✓ Characteristic analysis on the thermal noise of infrared CCD, ZHANG Rongzhu, et al.(张蓉竹, 四川大学电子信息学院)(CHINA) ..... [5-0039]

#### *Tea Time*

- ✓ Study on the transmission characteristics of infrared laser in period dielectric films, DU Lifeng, et al.(杜立峰, 四川大学)(CHINA) ..... [5-0040]
- ✓ Smell Sensing and Visualizing Based on Multi-quantum wells Spatial Light Modulator, TIAN Fengchun, et al.(田逢春, 重庆大学)(CHINA) ..... [5-0090]

## Conference 6: Smart Structure and Materials for Manufacturing and Testing

Conference Chairs:

**LUO Xiangang**, Institute of Optics and Electronics, CAS (China)

**Harald Giessen**, University of Stuttgart. (Germany)

**Xiaoyi Bao**, Prof. of University of Ottawa(Canada)

**8:30-12:00 April 27 ..... SESSION 6-1**  
**room 412 (20 min/report)**

*Session chair: LUO Xiangang(罗先刚)*

- ✓ Manipulating the emission of dye molecules using micro-nano structures, Douguo Zhang, Pei Wang and Hai Ming (明海, University of Science and Technology of China)(CHINA) ..... (25 min) (Invited)
- ✓ Far field observation and theoretical analyses of light directional imaging in hyperbolic metamaterial with stacked metal-dielectric films., WANG Changtao, et al.(王长涛, 光电所)(CHINA).....(25 min) (Invited)[6-0022]

*Tea Time*

- ✓ Changes in speckle patterns induced by load application onto an optical fiber and its detection through image processing, Makoto Hasegawa, et al.(Makoto Hasegawa, Chitose Institute of Science and Technology)(Japan) ..... [6-0008]
- ✓ Fabrication of a gas sensor array with microwells for VOCs gas sensing based on polymer/carbon nanotube thin films, XIE Guangzhong, et al.(谢光忠, 电子科技大学)(CHINA).....[6-0017]

**13:00-17:00 April 27 ..... SESSION 6-2**  
**room 412 (20 min/report)**

*Session chair: WANG Changtao (王长涛)*

- ✓ Full vector optical field modulation based on metasurface, Yan Zhang (张岩, Capital Normal University)(CHINA)..... (25 min) (Invited)
- ✓ Superresolution phase-contrast imaging of transparent nano-objects by plasmonic lens, YAO Na, et al.(姚纳, 光电所)(CHINA) ..... [6-0023]
- ✓ Plasmonic Electric and Magnetic Mode Manipulating via Chiral Symmetry Breaking Induced Fano Resonance (Plasmonic Electric and Magnetic Mode ), wang bo, et al.(wang bo, 首都师范大学)(CHINA) ..... [6-0030]

*Tea Time*

- ✓ Characterization of a polarization controlled plasmonic focusing lens, WANG Sen, et al.(王森, 哈尔滨工业大学)(CHINA) ..... [6-0031]
- ✓ Sidebands Suppression of Terahertz Rayleigh Anomalies Reflection Peaks via Fabry-Perot Resonance, FENG Shengfei, et al.(冯胜飞, 首都师范大学)(CHINA) [6-0032]
- ✓ Dynamic optical control of the terahertz wavefront with photo-generated carrier, XIE Zhenwei, et al.(谢振威, 哈尔滨工业大学)(CHINA) ..... [6-0033]

13:00-17:00 April 28

POSTER

room 502

- ✓ Disassembling and Reintegration of Large Telescope Primary Mirror, XU Qirui, et al.(徐祺瑞, 中科院光电技术研究所)(CHINA) ..... [1-0000]
- ✓ Simulation of Segmented mirror telescope and Calculating Asphericity of Optical Sapheric Surface, LIAO Zhou, et al.(廖周, 光电所)(CHINA) ..... [1-0001]
- ✓ Analysis and optimization of mounting configuration of large aperture optics, LIANG Yingchun, et al.(梁迎春, 哈尔滨工业大学)(CHINA) ..... [1-0002]
- ✓ Processing and Error Compensation of Diffractive Optical Element, WANG Zhibin, et al.(汪志斌, 西安应用光学研究所)(CHINA) ..... [1-0003]
- ✓ Study of thermal evaporation downwards for large primary mirror, PEI Wenjun, et al.(裴文俊, 中科院光电技术研究所)(CHINA) ..... [1-0004]
- ✓ A Piston Error Detection Method of Optical Synthetic Aperture System, WEI Xiaofeng, et al.(魏小峰, 解放军信息工程大学)(CHINA) ..... [1-0005]
- ✓ Study on the sensitivity of temperature gradient for large aperture SiC lightweight mirror based on active optics , LIU Xiangyi, et al.(刘祥意, 中国科学院长春光机所)(CHINA) ..... [1-0007]
- ✓ Integrated Modeling and Dynamics Simulation for the Large Telescope Control System, DENG Yongting, et al.(邓永停, 中科院长春光机所)(CHINA) ..... [1-0008]
- ✓ Optimization design and simulation analysis for the key components of 1m aperture photoelectric theodolite , SAN Xiaogang, et al.(伞晓刚, 中科院长春光机所)(CHINA) ..... [1-0009]
- ✓ Conceptual Design of Giant Steerable Science Mirror Cell Assembly for TMT, YANG Fei, et al.(杨飞, 长春光机所)(CHINA) ..... [1-0010]
- ✓ Structure Performance Analysis for TMT Teritiary Mirror System, SU Yanqin, et al.(苏燕芹, 长春光机所)(CHINA) ..... [1-0011]
- ✓ Compensation analysis of low frequency distorted wave front of laser beam, FENG Youjun, et al.(冯友君, 四川旅游学院)(CHINA) ..... [1-0012]
- ✓ Measuring the conic constant of large aspheric with scanning pentaprism, XU Hongyan, et al.(徐洪艳, 中科院光电技术研究所)(CHINA) ..... [1-0013]
- ✓ Study of tilt axis bearing arrangement for TMT project, ZHAO Hongchao, et al.(赵宏超, 中国科学院长春光机所)(CHINA) ..... [1-0014]
- ✓ Analysis of friction wheel drive system applied on TMT-M3S, YAO Kainan, et al.(姚凯男, 中科院长春光机所)(CHINA) ..... [1-0015]
- ✓ A secondary mirror adjusting system with hexapod structure for optical telescope application, ZHOU Nan, et al.(周楠, 中国科学院西安光机所)(CHINA) ..... [1-0016]
- ✓ Stitching Error Influence on Imaging Quality of Large Aperture Thin Lens , ZHOU Xudong, et al.(周旭东, 光电技术研究所)(CHINA) ..... [1-0017]
- ✓ Research on the Measurement Technology of Effective Arm Length of Swing Arm Profilometer, CHEN Lin, et al.(陈林, 中科院光电技术研究所)(CHINA) ..... [1-0018]
- ✓ Development of hot slumped thin foil glass for high energy X-ray telescope , YANG Xinyan, et al.(杨鑫燕, 同济大学)(CHINA) ..... [1-0019]
- ✓ Analysis of the impact on infrared radiation calibration caused by stray radiation of collimator, YANG Zhihui, et al.(杨智慧, 北京环境特性研究所)(CHINA) ..... [1-0020]
- ✓ Influence of surface treatment of components on thermal , LUO Wenfei, et al.(罗文飞, 四川大学电子信息学院)(CHINA) ..... [1-0021]

- ✓ Influence of particle contamination on stray radiation performance in infrared optical system, WU Jianpeng, et al.(吴建鹏, 四川大学电子信息学院)(CHINA)..... [1-0022]
- ✓ The design and analysis of 2m telescope' s K Mirror system, GUO Peng, et al.(郭鹏, 长春光机所)(CHINA) ..... [1-0023]
- ✓ Distance measurement method using Fizeau interferometry and laser-beam wavelength-shifting phenomena, Sheng Lih Yeh, et al.(Sheng Lih Yeh, Lunghwa University of Science and Technology)(CHINA Taiwan) ..... [1-0024]
- ✓ Analysis of Thermal Shock and Stress with Infrared Optical Domes, GAO Youtang, et al.(高有堂, 南阳理工学院)(CHINA)..... [1-0026]
- ✓ A New Method of Infrared Dim Small Target Detection Based on Wavelet and Multivariate Statistical Analysis, GUO Shibo, et al.(郭士波, 国防科技大学)(CHINA) ..... [1-0027]
- ✓ The design method of CGH for testing the  $\Phi 404, F2$  primary mirror, XIE Nian, et al.(谢念, 中科院西安光机所)(CHINA) ..... [1-0029]
- ✓ Test of a Prototype of Lightweight, Active Mirrors , LU Weixin, et al.(路伟欣, 中科院光电技术研究所)(CHINA) ..... [1-0031]
- ✓ Influence of humidity on CO2 gas sensors with Polyetherimide polymer film, Ting Kang, et al.(Ting Kang, State Key Laboratory of Electronic Thin Films and Integrated Devices)(CHINA)..... [1-0033]
- ✓ Dynamics Analysis on Adhesive Bonds of Tilt Mirror, CAO Shang, et al.(曹尚, 中科院西安光机所)(CHINA) ..... [1-0035]
- ✓ The design of an active support control system for a thin 1.2m primary mirror, LIU Rong, et al.(刘容, 中科院光电技术研究所)(CHINA) ..... [1-0036]
- ✓ Research On Support Truss Structure of Foreign Space Remote Sensor with Large-scale and Flexibility, AN Mingxin, et al.(安明鑫, 中国科学院长春光机所)(CHINA) ..... [1-0037]
- ✓ Improvement of active lap in grinding of a 1.8m honeycomb primary mirror, LIU Haitao, et al.(刘海涛, 中科院光电技术研究所)(CHINA) ..... [1-0038]
- ✓ The research about multi-degree of freedom parallel tracking structure , TAN Sen, et al.(谭森, 中科院光电技术研究所)(CHINA)..... [1-0039]
- ✓ Lightweight design of the rectangular mirror using topology optimization, XIANG Meng, et al.(相萌, 中国科学院西安光机所)(CHINA) ..... [1-0040]
- ✓ Theory of circular plate for mirrors on back-point support, LIANG Yuanqing, et al.(梁元庆, 中国科学院西安光机所)(CHINA) ..... [1-0041]
- ✓ A compact multi-core based adaptive optics real-time controller, CHEN Shanqiu, et al.(陈善球, 中科院光电技术研究所)(CHINA)..... [1-0042]
- ✓ Test and Study on Mirror Quality of Ultra-precision Diamond Turning, CHANG Yanyan, et al.(常艳艳, 哈尔滨工业大学)(CHINA) ..... [1-0043]
- ✓ Test for convex paraboloid by using aspheric test plate, ZHANG Yonghong, et al.(张永红, 中科院光电所)(CHINA) ..... [1-0044]
- ✓ The Research of The Space Remote Sensor Precision Replaced on Orbit, WANG Yijian, et al.(王一建, 长春光机所)(CHINA) ..... [1-0045]
- ✓ Ultra-lightweight Design for the Focal Plane of Deep Space Exploration Camera, LI Yanchun, et al.(李延春, 中科院长春光机所)(CHINA) ..... [1-0046]
- ✓ The Optimized Design and Research for Cylindrical Electrically Controlled Box of Space Camera, WANG Haiping, et al.(王海萍, 中科院长春光机所)(CHINA) ..... [1-0047]

- ✓ Phase transition characteristics of vanadium oxide films under the CO<sub>2</sub> laser irradiation, LU Yuan, et al.(路远, 电子工程学院)(CHINA)..... [1-0048]
- ✓ ATTITUDE ANGULAR MEASUREMENT SYSTEM BASED ON MEMS ACCELEROMETER, LUO Lei, et al.(罗雷, 武警工程大学)(CHINA) ..... [1-0050]
- ✓ Research of the solid-state laser resonator phase modulation technology using adaptive optics, CHEN Junjie, et al.(陈俊杰, 中国科学技术大学)(CHINA) ..... [1-0052]
- ✓ A new method on measuring radius of curvature of a conic aspherical mirror , HUANG Chuanke, et al.(黄传科, 中科院光电所)(CHINA) ..... [1-0054]
- ✓ The Mechanical Design and Study of the Second Antarctic Survey Telescope , WEN Hai, et al.(温海焜, 南京天光所)(CHINA)..... [1-0055]
- ✓ Study on weak signal detection method in a strong noise background, WANG Jun, et al.(王君, 中科院西安光学机所)(CHINA) ..... [1-0059]
- ✓ Athermal Design For Infrared Refractive/Diffractive/Reflective Hybrid Optical System, CHENG Ximin, et al.(程习敏, 中科院光电技术研究所)(CHINA)..... [1-0062]
- ✓ Gear fault diagnosis in support structure using wavelet correlation feature scale entropy and SOM neural network (Gear fault diagnosis), Pei-yun Qian, et al.(Pei-yun Qian, China University of Mining and Technology, College of Mechanical and Electrical Engineering, China)(CHINA) ..... [1-0063]
- ✓ The enhancement algorithm of laser image of metal objects, LUO Cong, et al.(罗聪, 光电技术研究所)(CHINA) ..... [1-0064]
- ✓ Active deformation and engineering analysis of CFRP thin mirror in quasi-isotropic laminates, ZENG Chunmei, et al.(曾春梅, 苏州大学)(CHINA)..... [2-0002]
- ✓ Research on the low speed stability of the fly-cutting machine for KDP crystals, CHEN Dongsheng, et al.(陈东生, 中国工程物理研究院)(CHINA)..... [2-0003]
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9:00-9:55 April 28

Workshop

room 410 &amp; 412

**Title: Advanced ion beam finishing and atmospheric plasma technology for high end optics**

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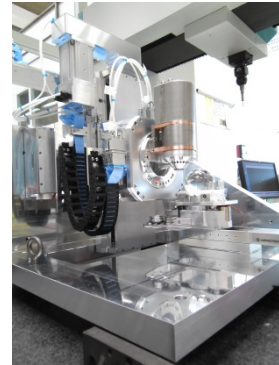
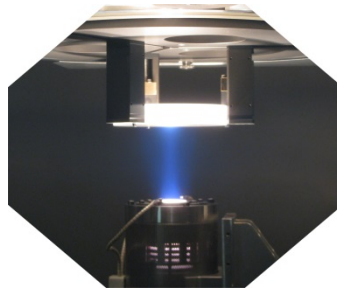
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**Abstract:** Today ultra-precision surface processing is mandatory in high class optics fabrication for almost all modern optics fields like photo lithography advanced optics for measurement equipment, synchrotron and x-ray optics, space and telescope optics laser optics and even more. The high degree of processing accuracy and the wide range of processing parameter adjustment together with their automatic tight control including scaling of the tool size make particle beam related surface techniques like low energy ion beam and plasma assisted chemical processing very attractive in advanced surface processing. Their capability to etch, to figure, to smooth, to structure surfaces and to modify other surface characteristics like to tailor the surface energy and to deposit thin films gives them some kind of key solution. Their status of integration in production lines of optics elements is different today. Ion beam figuring (IBF) is more or less the lens shape finishing standard in the absolute top class optics fabrication for DUV/EUV lithography, space telescopes, synchrotron beam lines and others. Atmospheric plasma jet technology is on the way to enter niches in optics fabrication technology. Latest Improvements in IBF technology allow to reduce the cost of ownership of the technology and to enhance its performance with the tendency to extend their use for lower class optics production. The talk summarizes the present status of ion beam figuring for series production in optics and highlight recent advances achieved in R&D mature for ion beam figuring (IBF), ion beam smoothing (IBS), and atmospheric plasma jet machining (PJM) for deep aspherization, nanometer shape error correction and surface smoothing mainly achieved at IOM Leipzig and in more and more cases in tight collaboration with NTG.

Principal Author's Biography:

**Principal Author's Biography:** Axel SCHINDLER graduated in semiconductor physics at the University in Leipzig, Germany, 1974. He worked as a Group Leader on R&D of low energy ion beam surface processing in the Leibniz-Institute for Surface Modification Leipzig (IOM) from 1973 and in this position in the field of ultra-precision surface processing by ion beams and plasma jets from 1986 up to his retirement in December 2012. He managed many R&D projects and R&D orders from industry mainly in the field of high class optics manufacturing applications during this time. Axel Schindler's main scientific and technological interests are low energy ion beam technology and atmospheric plasma jet technology, ultra-precision surface processing by ion beams and plasma jets, ion beam and atmospheric plasma jet etching, deposition and surface modification and last but not least atmospheric plasma jets for future therapy and prophylaxis applications in dentistry. He holds several patents and is author and co-author, respectively of more than 100 papers and talks. Today Axel Schindler works as a Science and Technology Consultant in ion beam and plasma technology for ultra-precision surface processing and atmospheric plasma jet application in medicine.

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NTG is a worldwide operating mechanical engineering company. Made in Germany is not just an empty phrase for us. No difference if simple job order parts or complex procedural plants, everything is manufactured inhouse. NTG co-operates successfully with customers in Industry and Research. Our activities concentrate on Design, Manufacturing, Assembly and Commissioning of parts or complete plants mainly in the fields of particle accelerators, IBF technology, vacuum technology, nanotechnology and components for nuclear power plants, as well as special custom-made plants for industrial clients. In our characteristic as designer of custom made solutions we are always looking for new challenges.

**IBF**

Since 1991 NTG is engaged in IBF-technology. IBF-Technology is needed when the required quality of optical surfaces can not be achieved by using conventional polishing techniques. Our Customers are the world leader in fabrication of high performance optics. Whereas in the past the use of technology was limited in producing stepper objectives for the semiconductor industry recently a growing demand of this technology even in the traditional optic industry can be recognized. Actually ten(!) different standard types of IBF-plants are available at NTG for different sizes and applications. NTG has sold the largest number of IBF plants worldwide and offers the widest range of plant types. For substrates between 5mm and 2000mm in diameter we have well designed, approved and ready to build solutions available.

**IBE**

NTG builds IBE plants to transfer pattern and structure from photo resist to the substrate. This etching process is for example used for fabricating diffractive optical elements, which have a series of technological advantages over "classic" refractive optics. The IBE-plants are available with either a Kaufman ion source or an RF-type ion source. Both ion sources allow to etch substrates with a diameter of 2" up to 16", whereas reactive ion beam etching (RIBE) as well as non-reactive ion beam etching (IBE) techniques can be applied. The plants are equipped with load locks which allow transferring substrate into and out of the plant without breaking the vacuum in the process chamber, which is a very critical parameter of the etching process.

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**9:55-10:50 April 28****Workshop****room 410 & 412****Title: High Precision Mounted Lens Production: Directional Adhesive Bonding versus Alignment Turning**

TRIOPTICS GmbH, Hafenstraße 35-39, 22880 Wedel, Germany

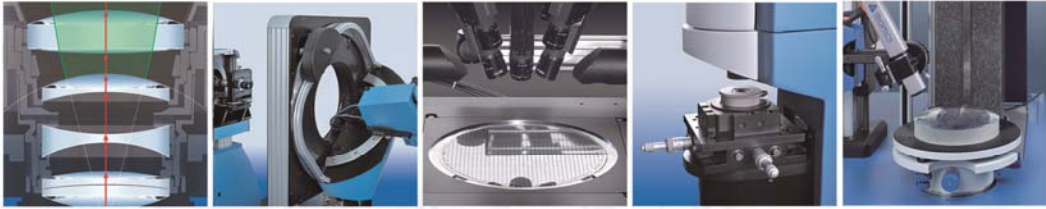
**Abstract:** Today's optical systems require up-to-date assembly and joining technology. The trend of keeping dimensions as small as possible while maintaining or increasing optic imaging performance leaves little room for mechanical equipment to adjust the individual lens elements that remain in the end product. Two technologies, the directional adhesive bonding of lenses in the final mount and alignment turning provide attractive solutions under current conditions.

Directional adhesive bonding is the precise alignment of the optical axis of a lens with respect to the axis of symmetry of the mount including the subsequent fixation of the lens by glue. Depending on the accuracy demands and mechanical constraints the alignment can be done with up to five degrees of freedoms.

Alignment turning is used to align the optical axis of an already glued lens with its mount. In effect, the mount is cut on a lathe in respect to the optical axis of the mount. This process relies on an alignment chuck to align the optical axis of a mounted lens to the spindle axis of the machine. Using hard metal or diamond tools, the mount is then cut on the lathe. In addition to bonding, further dimensions can be controlled in a very precise manner, e.g. the position of the lens in the vertical direction. Using alignment turning, no further alignment of the lenses during assembly is necessary.

This contribution describes the measurement technology behind each process, the techniques themselves and outlines strengths and limitations of the bonding and alignment method.

**Keyword:** alignment turning, directional adhesive bonding, lens alignment, lens adjustment, centration measurement, machining of infrared and aspherical lenses



## Optical Metrology - The Entire Spectrum

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Tea time(10:50-11:00)

11:00-11:55 April 28

Workshop

room 410 & 412

**Title: Industrial manufacturing of lambda / 50 optical components**



Dipl. Ing. Roland Mandler (Germany)

Dipl. Ing. Mechanical Engineering and chief executive officer (CEO) from OptoTech Optikmaschinen GmbH

**Abstract:** The requirements for the "high-end" quality in the production of optical components have increased dramatically in the last five years. There are three key challenges:

- a) Quality: Here it is now clear that accuracies lambda/50 and higher requirements must be made with RMS value of 1 to 2nm.
- b) The components in this high accuracy are up to diameter of 2meter.
- c) Partial very high quantities are required.

The three challenges have the consequence that the total production must be brought to a whole new way for such components.

Firstly, it is necessary to develop a completely new generation of grinding and polishing machines and on the other side it is important to optimize the complete process chain that components with such extreme requirements also can be made highly efficient and economical.

OptoTech developed therefore specially manufacturing cell to fulfill this requirements.

The speech is to present these projects, as well as highlight the current state of technology.

**Principal Author's Biography:** Roland Mandler was born in Giessen in 1954. His vocational education was in the beam center of the Justus Liebig University in Giessen (JLU). He graduated the tertiary education from 1972 to 1978 at the Technical University in Central Hessen THM.

1978 to 1985 Mr. Mandler was hired as development manager at the company LOH in Wetzlar.

Since 1985 he is the CEO and owner of OptoTech Optikmaschinen GmbH.



OptoTech

## UPG 2000 CNC

8-Axis Universal Grinding and Polishing Center for High-Precision Processing of Optics up to  $\varnothing$  2000 mm



Smart Solutions for Professionals



The new universal grinding and polishing machine UPG 2000 CNC was especially designed for the production of mirrors and other big optical parts up to a diameter of 2 m.

The integration of the 3 processing technologies grinding, polishing and measuring, offers the complete production of challenging optics at the highest stage.

The UPG 2000 CNC is the first ASTRO processing center that allows highest precision grinding (all axes needed for the grinding process mounted hydrostatically) as well as lapping and polishing with our universal Multitool concept in one single machine.

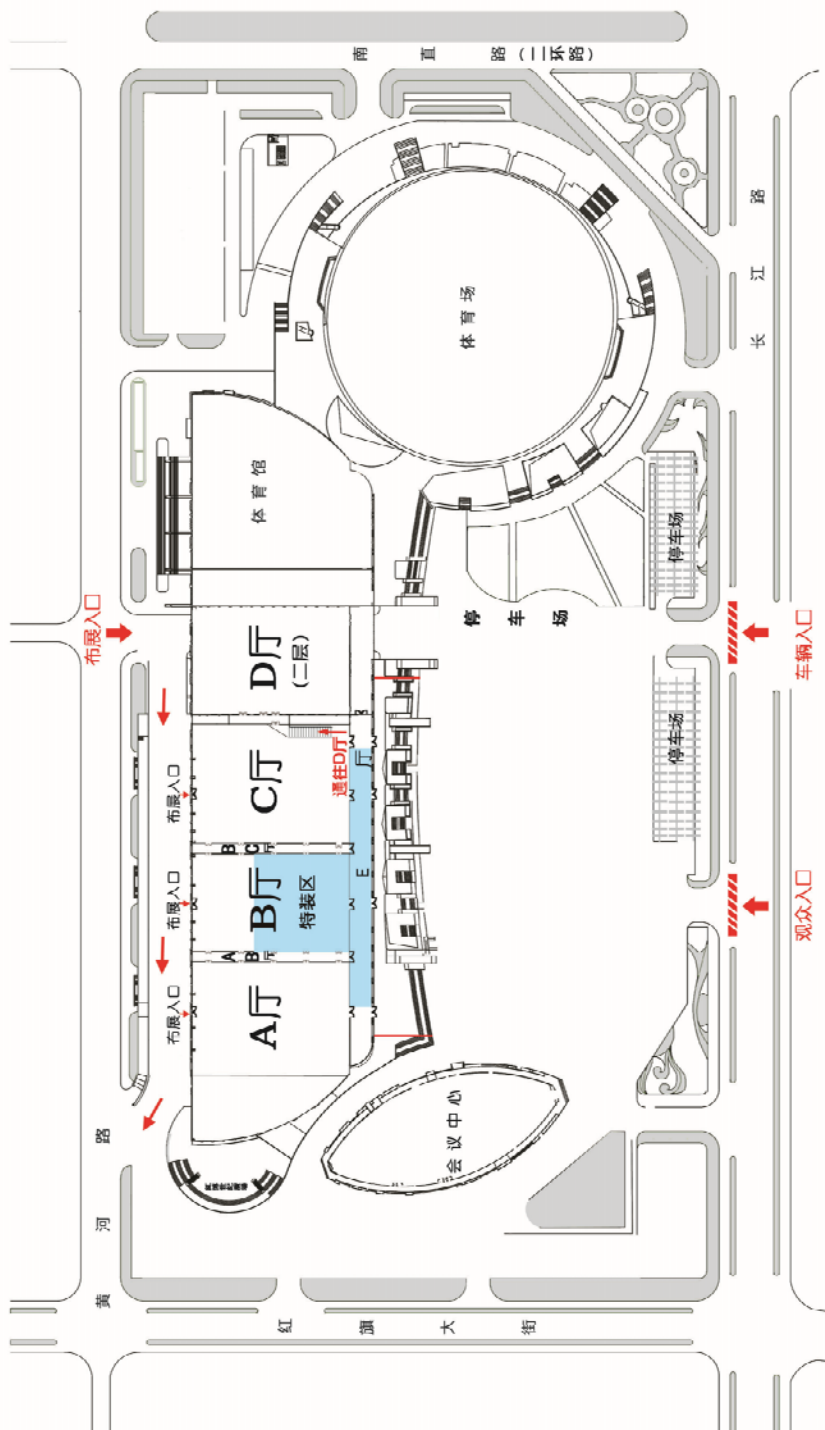
This compact and high efficient design allows an optimal production of all important future parts in the area of ASTRO-Optics, EUV-Optics and aerospace technology.

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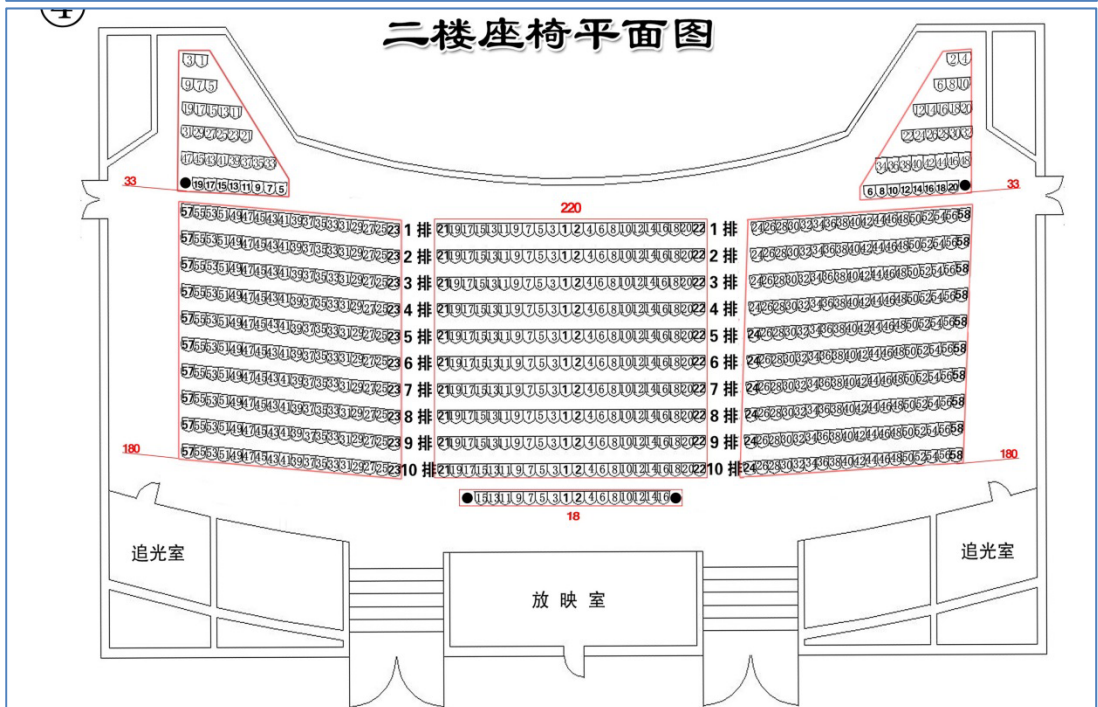
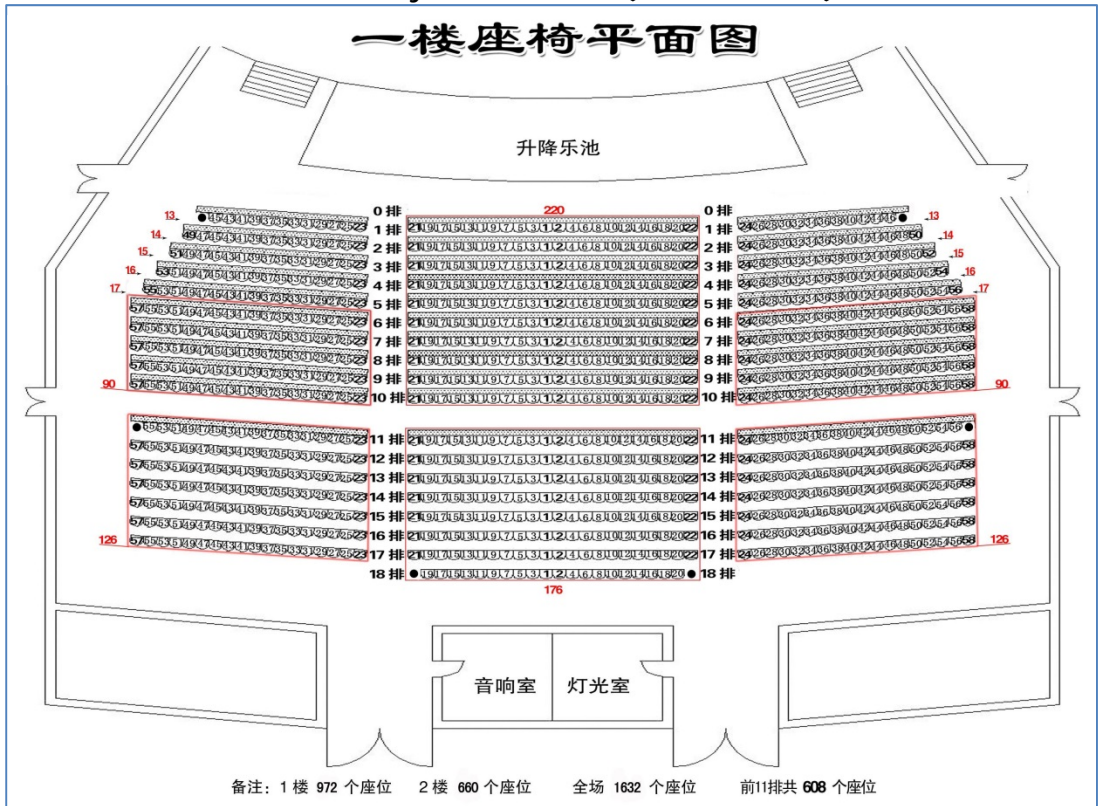
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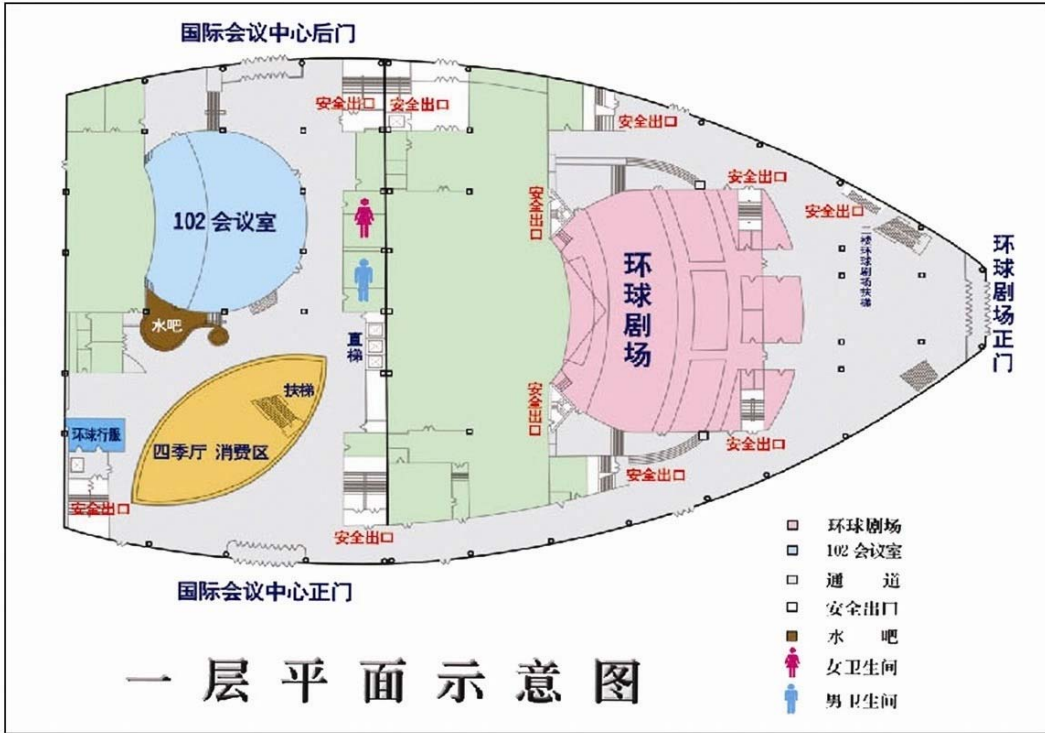
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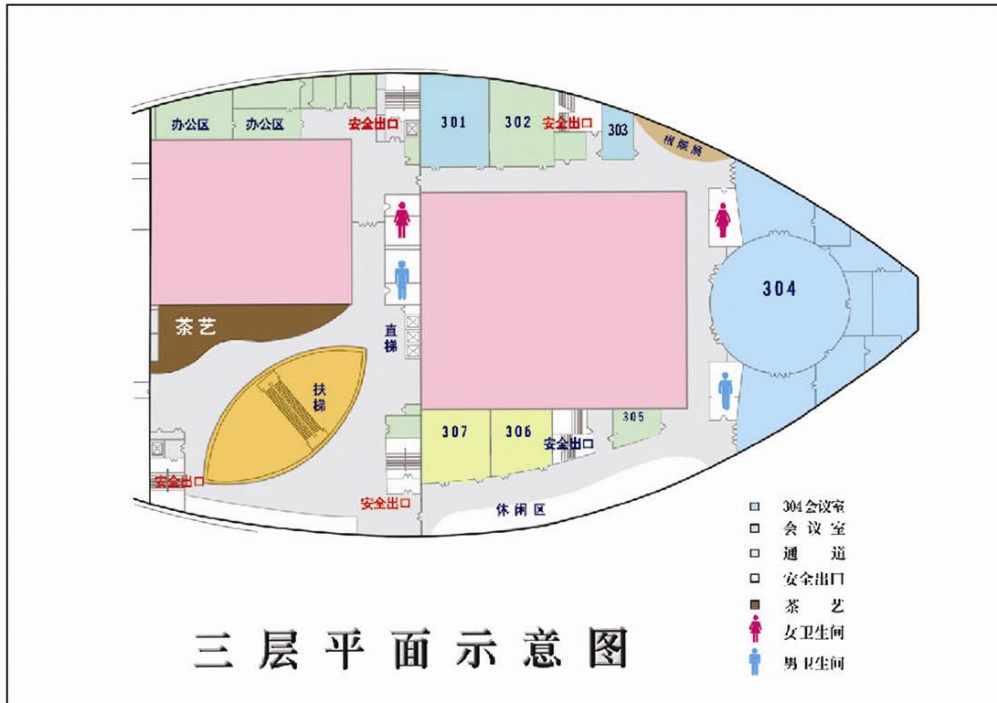
The conference hall for Plenary Presentation. (Globe Theatre)



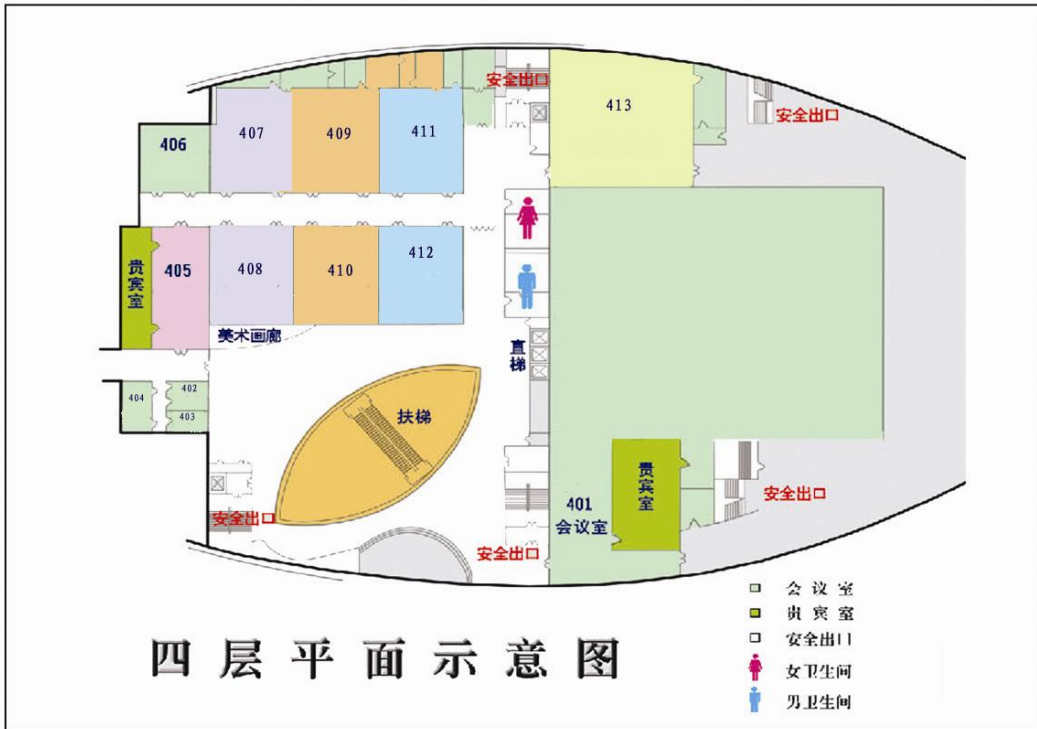
Floor 1



Floor 3



Floor 4 Conference 1 - 6, room 407 - 412, workshop room 410 & 412



Floor 5 Poster room 501

