International Optical Design Conference

and Tabletop Exhibit

June 4-8, 2006

Sheraton Wall Centre
Vancouver, British Columbia, Canada

Postdeadline Submission Deadline: May 25, 2006, 12:00 p.m. noon EDT (16.00 GMT)
Hotel Reservation Deadline: May 4, 2006
Pre-Registration Deadline: May 12, 2006

Program Committee General Chairs

Groot Gregory, Lambda Research Corp., General Chair
Joseph Howard, NASA Goddard Space Flight Center, USA, General Chair
John Koshel, Lambda Res. Corp., College of Optical Sciences, Univ. of Arizona, USA

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Technical Co-Sponsor:

American Society for Precision Engineering

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“IODC is the conference where optical engineers present leading edge optical designs, algorithms, and novel developments.”

-John Koshel, Lambda Research Corp., USA, General Chair

"IODC has great presentations and great discussions in optical design; Vancouver BC has great weather, great sights, great restaurants and great sushi. Come join the greatness this June at IODC."

–Joseph Howard, NASA Goddard Space Flight Center, USA, General Chair

"The IODC can be traced back to the 1905 Optical Convention and Exhibition in London, England and the 100th year anniversary meeting will be held this June in British Columbia, Canada. Join us in Vancouver where, like 100 years ago, we see that optical design continues at the forefront of technology."

–Kevin Thompson, Optical Res. Associates, USA

IODC Program Committee

General Chairs

Groot Gregory, *Lambda Res. Corp., General Chair*
Joseph Howard, *NASA Goddard Space Flight Ctr., USA, General Chair*
John Koshel, *Lambda Res. Corp., College of Optical Sciences, Univ. of Arizona, USA, General Chair*

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Yongtian Wang, *Beijing Inst., China*
David Williamson, *NRCA, USA*
Roland Winston, *Univ. of California at Merced, USA*
Andrew Wood, *Thales Optics Ltd., UK*
Kimiak Yamamoto, *Olympus Advanced Tech. Res. Ctr., Japan*
Richard Youngworth, *Ball Aerospace, USA*

About IODC

June 4-8, 2006

Optical design remains a rapidly developing field due to the increased performance demands, improved software and computing platforms for modeling, better algorithms, and new fabrication technologies for better performance. The International Optical Conference (IODC), which occurs every four years, provides the most important meeting in optical design for engineers, scientists and designers to stay abreast of the changes in this field. Attendees from around the world in a breadth of optical design disciplines will be able to interact in both informal and formal settings.

This year IODC includes a separate track for the burgeoning illumination field, from design to systems to metrology. Additionally, precision engineering sessions highlight the importance of integrating manufacture and metrology into the design and fabrication processes respectively, especially for freeform surfaces. The IODC will cover a wide range of applications and developments throughout the industry–see the Meeting Scope page. There will be hands-on software demonstrations and exhibits from companies in the area of optical design software and manufacturing. Two design problems will be proposed in advance of the meeting so that attendee solutions can be covered during two evening sessions. The Lens Design problem will once again be held, and for the first time an Illumination Design problem will be introduced.

Post-Submission Deadline: May 25, 2006 12:00 p.m. NOON EST (16.00 GMT)
Hotel Reservation Deadline: May 4, 2006
Pre-Registration Deadline: May 12, 2006

IODC 2006 Meeting Topics

Topics and related areas to be presented include:

1. **Lens Design**
    - Adaptive optics in optical systems
    - Coherence detection modeling and optical system design
    - Astronomical optics
    - Asymmetric optics
    - Conformal optics
    - Diffractive and holographic optics
    - Gradient index optics
    - Lithographic optics
    - Liquid optics
    - New lens designs
    - Micro-and nano-optics
    - Zoom optics and multi-configuration optics
    - Vision testing and enhancement optics
    - Space-borne optics
2. **Illumination Design**
    - Displays, including LCD, 3-D, backlit, laser and heads-up
    - Freeform optics design, modeling, metrology and manufacture
    - Illumination optics design, modeling, manufacture and metrology
    - Non-imaging optics
    - Solid-state lighting
    - Source-coupling optics
    - Source modeling
3. **System Design**
    - High-power laser system optics
    - Instrument design
    - IR systems
    - Medical/Bio-optics
    - Ophthalmic optics and instruments
    - Optical data storage systems
    - Photonic and optical interconnect systems
    - X-ray systems
    - Telecommunications optics
    - Micro-electro-mechanical systems (MEMS)
4. **Fabrication Design**
    - Fabrication and testing developments that expand the design horizon
    - Integration of design, manufacturing, and metrology
    - Materials (glass and other) and material characterization
    - Testing and alignment of optical surfaces and systems
    - Tolerance generation and application
    - Plastic optics
    - Thin film coatings in optical designs
5. **Software Design**
    - Advances in optical design software
    - Optimization developments in local and global methods
    - Theory and mathematical methods applied to optical design including new optical surface descriptions
    - Visualization and virtual-reality optical systems
    - Physical optics modeling and design methods
    - Polarization aspects including optics, design, ray tracing, metrology and applications
6. **Other**
    - Education in optics, optical design and optical system modeling
    - History of optics and optical design
    - Other topics

Plenary Speakers

Plenary Panel: The Past, Present, and Future of Optical Design

MA1, Warren Smith*, Rockwell Collins Kaiser Electro-Optics, USA*

MA2, Ellis I. Betensky*, Consultant, Canada*

MA3, David Williamson*, Nikon Res. Corp. of America, USA*

MA4, Juan C. Minano, Univ. Politecnica de Madrid, Spain

Invited Speakers

MB3, **Twenty-First Century Optical Tolerancing: A Look at the Past and Improvements for the Future,** Richard Youngworth, *Ball Aerospace, USA*

MB4, **Alignment of Optical Systems,** Robert Parks, *Optical Perspectives Group, USA*

MD2, **Ultra High Performance Microscope Objectives: The State of The Art in Design, Manufacturing and Testing,** Thomas Sure[1], Peter Euteneuer[1], Armin Pausch[1], Lambert Danner[2], Gerhard Hoppen[2], Wolfgang Vollrath[2]; *[1]Leica Microsystems CMS GmbH, Germany, [2]Vistec Semiconductor Systems GmbH, Germany*

TuB6, **Off the Beaten Path with Total Internal Reflection,** Lorne Whitehead, *Univ. of British Columbia, Canada*

TuD1, **Freeform Optical Systems with Prescribed Irradiance Properties,** Vladimir Oliker*, Emory Univ., USA*

TuD5, **A Near-field Goniospectroradiometer for LED Measurements,** Ian Ashdown*, TIR Systems Ltd., Canada*

WB2, **Digital Correction of Lens Aberrations in Light Field Photography,** Ren Ng. Pat Hanrahan, *Stanford Univ., USA*

WD2, **All Reflective Zoom System for Infrared Optics,** Jun Chang[1], Yongtian Wang[1], Zhicheng Weng[2], Xiaojie Cong[2]; *[1]Beijing Inst. of Technology, China, [2]Changchun Inst. of Optics, Fine Mechanics and Physics, China*

ThB1, **Single Point Diamond Turning: Progress in Precision,** John Schaefer, *Raytheon, USA*

International Optical Design Conference 2006
Sheraton Wall Centre, Vancouver, British Columbia, Canada

Welcome to Vancouver, the host city for the International Optical Design Conference (IODC) 2006. Starting in 1905 in London, England, IODC has now passed 100 years as the premiere meeting for optical design professionals. It is now held every four years, with the last three events located in Tucson, Arizona (2002), Kona, Hawaii (1998), and Rochester, New York (1994).

IODC 2006 engages many fields of optical design, including: lens design, illumination design, ray-tracing techniques, optimization, fabrication methods, and the many applications that make use of optical design. Of special note is the increased content of the illumination design field at IODC this year. This trend is expected to continue since the illumination design field is growing rapidly, in both design methods and applications. IODC 2006 will also include tabletop exhibits from a number of companies.

This week you will be exposed to over 100 presentations of the highest caliber over the four days of the conference— 79 oral presentations and approximately 25 poster presentations. Nine invited talks are included which range the gamut of optical design. Opening the conference is a plenary session entitled, "The Past, Present, and Future of Optical Design," with four imminent members of the optical design community encompassing the plenary panel.

We have three evening events this week. On Monday night will be the conference poster session, and on Tuesday night we will have the conference reception. Finally, on Wednesday we will present the results and announce the winner of the traditional optical design problems. This year the Lens Design problem is joined by the inaugural Illumination Design problem.

As always, the most exciting aspect of IODC is the gathering of the optical design community itself. In fact, it is always interesting to partake of the many fascinating hallway conversations between attendees. We hope that you enjoy your time with us this week and the unique opportunity to catch up with your peers, and to explore Vancouver and British Columbia.

Sincerely,

Groot G. Gregory, *Lambda Research Corporation, USA*
Joseph M. Howard, *NASA Goddard Space Flight Center, USA*
R. John Koshel, *Lambda Research Corporation, USA*
General and Program Chairs, IODC 2006

Program Agenda

Sunday, June 4, 2006		
4:00 p.m.–6:00 p.m.	**Registration**	*Pavilion Ballroom Foyer*
Monday, June 5, 2006		
7:00 a.m.–5:00 p.m.	**Registration**	*Pavilion Ballroom Foyer*
8:00 a.m.–8:10 a.m.	**Opening Remarks**	*Pavilion Ballroom CD*
8:10 a.m.–10:00 a.m.	**MA • Plenary Session**	*Pavilion Ballroom CD*
10:00 a.m.–10:30 a.m.	**Coffee Break**	*Pavilion Ballroom AB*
10:00 a.m.–4:30 p.m.	**Exhibit Open**	*Pavilion Ballroom AB*
10:30 a.m.–12:50 p.m.	**MB • IODC Overview**	*Pavilion Ballroom CD*
12:50 p.m.–2:00 p.m.	**Lunch Break (on your own)**	
2:00 p.m.–4:00 p.m.	**MC • Aberration Theory**	*Pavilion Ballroom CD*
4:00 p.m.–4:30 p.m.	**Coffee Break**	*Pavilion Ballroom AB*
4:30 p.m.–6:40 p.m.	**MD • Medical Optics**	*Pavilion Ballroom CD*
6:40 p.m.–8:00 p.m.	**ME • Super Duper Poster Session Extravaganzia**	*Pavilion Ballroom AB*
Tuesday, June 6, 2006		
7:00 a.m.–5:00 p.m.	**Registration**	*Pavilion Ballroom Foyer*
8:00 a.m.–10:00 a.m.	**TuA • Ray Tracing and Optimization**	*Pavilion Ballroom CD*
10:00 a.m.–10:30 a.m.	**Coffee Break**	*Pavilion Ballroom AB*
10:00 a.m.–4:10 p.m.	**Exhibit Open**	*Pavilion Ballroom AB*
10:30 a.m.–12:40 p.m.	**TuB • Lightpipers**	*Pavilion Ballroom CD*
12:40 p.m.–1:40 p.m.	**Lunch Break (on your own)**	
1:40 p.m.–3:40 p.m.	**TuC • Displays**	*Pavilion Ballroom CD*
3:40 p.m.–4:10 p.m.	**Coffee Break**	*Pavilion Ballroom AB*
4:10 p.m.–6:50 p.m.	**TuD • Illumination Design and Source Modeling**	*Pavilion Ballroom CD*
6:50 p.m.–8:15 p.m.	**Conference Reception**	*Fountain Square*
Wednesday, June 7, 2006		
7:30 a.m.–5:00 p.m.	**Registration**	*Pavilion Ballroom Foyer*
8:00 a.m.–9:40 a.m.	**WA • Diffractive Optics**	*Pavilion Ballroom CD*
9:40 a.m.–10:10 a.m.	**Coffee Break**	*Pavilion Ballroom AB*
9:40 a.m.–4:30 p.m.	**Exhibit Open**	*Pavilion Ballroom AB*
10:10 a.m.–12:20 p.m.	**WB • Optics for Digital Systems**	*Pavilion Ballroom CD*
12:20 p.m.–2:00 p.m.	**Lunch Break (on your own)**	
2:00 p.m.–4:00 p.m.	**WC • Telescopes and Space Optics**	*Pavilion Ballroom CD*
4:00 p.m.–4:30 p.m.	**Coffee Break**	*Pavilion Ballroom AB*
4:30 p.m.–6:20 p.m.	**WD • Infrared and Lithographic Design and Systems**	*Pavilion Ballroom CD*
6:30 p.m.–8:00 p.m.	**Illumination Design and Lens Design Contests Results and Awards**	*Pavilion Ballroom CD*
Thursday, June 8, 2006		
7:30 a.m.–1:00 p.m.	**Registration**	*Pavilion Ballroom Foyer*
8:00 a.m.–10:00 a.m.	**ThA • Interferometry and Testing**	*Pavilion Ballroom CD*
10:00 a.m.–10:30 a.m.	**Coffee Break**	*Pavilion Ballroom AB*
10:30 a.m.–1:00 p.m.	**ThB • Design for Fabrication**	*Pavilion Ballroom CD*

Notes

CONFERENCE HIGHLIGHTS

The organizers of IODC would like to acknowledge the generous support of the **Air Force Office of Scientific Research** and the **Defense Advanced Research Project Agency.**

Poster Session ▪ Monday, June 5, 2006 ▪ 6:40pm-8:00pm
Pavilion Ballroom AB
Join your colleagues for light food and drink during the poster presentations. Authors are requested to remain near their poster boards for the duration of the session to facilitate discussion.

Illumination and Lens Design Contests Results and Awards ▪ Wednesday, June 7, 2006 ▪ 6:40pm-8:00pm
Pavilion Ballroom CD
All conference participants are invited to attend the Illumination and Lens Design Contest results and awards presentations.

Conference Reception ▪ Tuesday, June 6, 2006 ▪ 6:50pm-8:15pm ▪ Fountain Square
Enjoy local fare and drink while you network outside of the session room in the Fountain Square of the Sheraton Wall Centre. Guest tickets may be purchased by Monday, June 5, 2006 at 12:00 p.m. for $50 US.

GENERAL INFORMATION

TECHNICAL DIGESTS
The *International Optical Design Conference Technical Digest CD-Rom* is comprised of the summaries of papers being presented during the meeting. At the meeting, each registrant receives a copy of the technical digest CD-Rom. Extra copies may be purchased at the meeting for a special price of $60 US.

INTERNATIONAL OPTICAL DESIGN CONFERENCE PROCEEDINGS
SPIE, in conjunction with OSA, will be publishing the IODC proceedings. The IODC Proceedings order form will be available on-site and the actual proceedings will be available after the meeting.

SPEAKER AND PRESIDER CHECK-IN
All speakers and presiders are requested to check-in at the registration desk at least 30 minutes before their session begins for a quick review of equipment and procedures.

EXHIBITS
An informal exhibit of tabletop displays featuring state-of-the-art products, services, and technologies will be held in conjunction with IODC. Ample time will be allowed for all attendees to visit the exhibit and speak with representatives from the industry.

The exhibit is located in the Pavilion Ballroom AB of the Sheraton Wall Centre Hotel.

Exhibit Hours

Monday, June 5	10:00am– 4:30pm
Tuesday, June 6	10:00am– 4:10pm
Wednesday, June 7	9:40am– 4:30pm

MESSAGES
Messages for participants at the meeting should be directed to the IODC Registration Desk. The address, telephone number, and fax number for the Sheraton Wall Centre Hotel is as follows:

Sheraton Wall Centre Hotel
1088 Burrard Street
Vancouver, Canada
Ph: (604) 331-1000
Fax: (604) 893-7200

Abstracts

● Sunday, June 4, 2006 ●

Pavilion Ballroom Foyer
4:00 p.m.–6:00 p.m.
Registration

● Monday, June 5, 2006 ●

Pavilion Ballroom Foyer
7:00 a.m.–5:00 p.m.
Registration

MA • Plenary Session

Pavilion Ballroom C/D
8:00 a.m.–10:00 a.m.
MA • Plenary Session
Joseph Howard; NASA Goddard Space Flight Ctr., USA, Presider

8:00 a.m.–8:10 a.m.
Opening Remarks

MA1 • 8:10 a.m. ▸ Plenary ◂
Plenary Panel: The Past, Present and Future of Optical Design, *Warren Smith; Rockwell Collins Kaiser Electro-Optics, USA.*

MA2 • 8:10 a.m. ▸ Plenary ◂
Plenary Panel: The Past, Present and Future of Optical Design, *Ellis Betensky; Consultant, Canada.*

MA3 • 8:10 a.m. ▸ Plenary ◂
Plenary Panel: The Past, Present and Future of Optical Design, *David Williamson; Nikon Res. Corp. of America, USA.*

MA4 • 8:10 a.m. ▸ Plenary ◂
Plenary Panel: The Past, Present and Future of Optical Design, *Juan Minano; Univ. Politecnica de Madrid, Spain.*

Pavilion Ballroom A/B
10:00 a.m.–10:30 a.m.
Coffee Break

Pavilion Ballroom A/B
10:00 a.m.–4:30 p.m.
Exhibit Open

MB • IODC Overview

Pavilion Ballroom C/D
10:30 a.m.–12:50 p.m.
MB • IODC Overview
G. Groot Gregory; Lambda Res. Corp., USA, Presider

MB1 • 10:30 a.m.
The 1st Optical Convention (in English): The 1905 London Optical Convention, *Kevin P. Thompson; Optical Res. Associates, USA.* One hundred years ago optical workers of London assembled to discuss a variety of topics in optics. This talk will provide an overview of the 1905 Proceedings and some on the interesting attendees.

MB2 • 10:50 a.m.
Double Gauss Lens Design: A Review of Some Classics Using Modern Methods, *Reginald P. Jonas, Michael D. Thorpe; ELCAN Optical Technologies, Canada.* Walter Mandler (1922-2005) designed many double Gauss lenses for Leica cameras. We review form and aberration balance for his most renowned lenses. Designs are re-evaluated using modern optimisation routines with special attention to glass replacement.

MB3 • 11:10 a.m. ▸ Invited ◂
Twenty-First Century Optical Tolerancing: A Look at the Past and Improvements for the Future, *Richard Youngworth; Ball Aerospace & Technologies, USA.* The goal of the talk is to stimulate a discussion on optical tolerancing in the greater optical design community.

MB4 • 11:40 a.m. ▸ Invited ◂
Alignment of Optical Systems, *Robert E. Parks; Optical Perspectives Group, LLC, USA.* As optical systems and packaging constraints become more complex, the demands on optical alignment become more severe. We describe a straightforward method of alignment that optimizes optical system performance.

MB5 • 12:10 p.m.
Use of an Application Programming Interface (API) to Allow Non-Optical Designers to Perform Specific Optical Evaluations, *Mark C. Sanson; Corning Tropel Corp., USA.* Individuals lacking training in optical design programs may still use the program's power. This paper addresses how API allows a person lacking understanding of the operation of the design program to run optical sensitivity routines.

MB6 • 12:30 p.m.
The Current State of the International Standard for the Exchange of Optical Data in Electronic Form, *Prudence M. J. H. Wormell; Imperial College, UK.* An update on work which has been in progress for nearly twenty years on the development of a machine-independent, language-independent format for transferring optical information between all types of Computer-Aided-Design programs.

12:50 p.m.–2:00 p.m.
Lunch Break (on your own)

MC • Aberration Theory

Pavilion Ballroom C/D
2:00 p.m.–4:00 p.m.
MC • Aberration Theory
Virendra Mahajan; Aerospace Corp., USA, Presider

MC1 • 2:00 p.m.
Wavefront Correction Using Micromirror Arrays: Comparing the Efficacy of Tip-Tilt-Piston and Piston-Only Micromirror Arrays, *William C. Sweatt, Olga B. Spahn, William D. Cowan, David V. Wick; Sandia Natl. Lab, USA.* Micromirrors arrays can correct residual wavefront aberrations in certain optical systems. The ability to correct Zernike aberrations using arrays of piston-only and arrays of piston-tip-tilt micromirror arrays are compared. Our micromirror fabrication program is discussed.

MC2 • 2:20 p.m.
Pupil Aberrations in Tilted Component Systems That Are Plane Symmetric, *Jose Sasian; Univ. of Arizona, USA.* This paper presents some interesting relations between the image and pupil aberrations of a tilted component system that is plane symmetric. The third group of image aberrations shows equality with the corresponding pupil's aberrations.

MC3 • 2:40 p.m.
General Sine Condition for Plane-Symmetric Imaging Systems and Some Example Aplanatic Designs, *Chunyu Zhao; College of Optical Sciences, Univ. of Arizona, USA.* General sine condition for plane-symmetric imaging system has been derived before. Here we present some special types of plane-symmetric aplanatic imaging systems to show the effectiveness of the condition.

MC4 • 3:00 p.m.
Third-Order Aberrations of an AGRIN Thin Lens as a Function of the Shape Factor and Conjugate Variable , *José A. Díaz[1], Carles Pizarro[2], Josep Arasa[2]; [1]Univ. de Granada, Spain, [2]Univ. Politécnica de Catalunya, Spain.* This work presents the third-order aberration coefficients of a thin lens made with an axial gradient-index material (AGRIN). These are derived from those corresponding to an homogeneous aspheric thin lens, as it has been proposed.

MC5 • 3:20 p.m.
Description of Spherical Aberration and Coma of a Microlens Using Vector Diffraction Theory, *Glen D. Gillen[1], Shekhar Guha[2]; [1]AFRL/Anteon Corp., USA, [2]AFRL, USA.* Light distributions of a plane wave refracted by a microlens are calculated using Kirchhoff vector diffraction theory. Numerical results for beam profiles and the onset and effects of spherical aberration and coma will be presented.

MC6 • 3:40 p.m.
Sub-Wavelength Grating Induced Spherical Wavefront Aberrations: A Case Study, *Karlton Crabtree, Russell A. Chipman; College of Optical Sciences, Univ. of Arizona, USA.* An example of the spherical wavefront aberrations of a one-dimensional sub-wavelength grating anti-reflection coating is presented. The polarization aberration pattern is dominated by astigmatism, and the magnitude is not extreme.

Pavilion Ballroom A/B
4:00 pm.–4:30 p.m.
Coffee Break

MD • Medical Optics

Pavilion Ballroom C/D
4:30 p.m.–6:40 p.m.
MD • Medical Optics
Alexander Epple; Carl Zeiss, Germany, Presider

MD1 • 4:30 p.m.
Human Eye Modeling Using a Single Equation of Gradient Index Crystalline Lens for Relaxed and Accommodated States, *Yanqiao Huang[1], Duncan T. Moore[2]; [1]Dept. of Biomedical Engineering, Univ. of Rochester, USA, [2]Inst. of Optics, Univ. of Rochester, USA.* A human eye model is proposed using a single equation for GRIN profile representation in crystalline lens. The role of GRIN in providing optical power and maintaining image quality during accommodation is studied and simulated.

MD2 • 4:50 p.m. ▸ Invited ◂
Ultra High Performance Microscope Objectives: The State of the Art in Design, Manufacturing and Testing, *Thomas Sure[1], Peter Euteneuer[1], Armin Pausch[1], Lambert Danner[2], Gerhard Hoppen[2], Wolfgang Vollrath[2]; [1]Leica Microsystems CMS GmbH, Germany, [2]Vistec Semiconductor Systems GmbH, Germany.* High-NA immersion objectives are key components for modern state of the art microscopy. These objectives require special measuring and testing technologies and a manufacturing precision which have never been realized before in series production.

MD3 • 5:20 p.m.
2mm Catheter Design for Optical Coherence Microscopy, *Kye-Sung Lee[1], Jannick P. Rolland[1], Olusegun Ilegbusi[2], Marco Costa[3]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Univ. of Central Florida/MMAE, USA, [3]Univ. of Florida/Core Lab, Medical School, USA.* A 2 mm biophotonics catheter was conceived with collimation optics, an axicon lens, and custom design imaging optics yielding a 360 degree scan within concave structures such as arteries and lung lobes.

MD4 • 5:40 p.m.
Apochromatic Immersion Objective for *in vivo* Imaging for Low Coherence Confocal Microscopy, *Julie L. Bentley[1,2], James M. Zavislan[2]; [1]Corning Tropel Corp., USA, [2]Univ. of Rochester, USA.* This paper discusses the optical design and tolerancing of an apochromatic, 0.9 NA immersion objective to be used in a coherence reflectance confocal microscope for *in vivo* clinical imaging.

MD5 • 6:00 p.m.
Dynamic-Focusing Microscope Objective for Optical Coherence Tomography, *Supraja Murali, Jannick Rolland; College of Optics and Photonics: CREOL & FPCE, USA.* Abstract: This paper presents a novel method for dynamic focusing in biological tissue samples using a variable-focus microscope objective within an OCT probe for a resolution of 5 microns.

MD6 • 6:20 p.m.
A Miniaturized Fluorescence Imaging System for Detecting Disease Genes on a Micro PCR Biochip, *Yin Tan[1], Haiqing Gong[1], Naveen Ramalingam[1], Qinghui Wang[1], Liqun Deng[1], Chiew Hoon Neo[1], Peng Huat Yap[2]; [1]Nanyang Technological Univ., Singapore, [2]Defense Medical and Environment Res. Inst.@DSO, Singapore.* This paper presents the design and experimental evaluation of a miniaturized fluorescence imaging instrument for genetic diagnostics on a biochip. It further demonstrates the capability of the instrument to perform multiple quantitative PCR in microscale.

ME • Super Duper Poster Session Extravaganzia

Pavilion Ballroom A/B
6:40 p.m.–8:00 p.m.
ME • Super Duper Poster Session Extravaganzia

ME1
Fast and Low Noise Adaptive Optics System for the Correction of Micro-Aberrations of Laser Beam, *Saverio Avino[1], Enrico Calloni[1], Rosario De Rosa[1], Luciano Di Fiore[2], Leopoldo Milano[1], Sergio Restaino[3], Alessio Tierno[1]; [1]Univ. Federico II di Napoli and INFN sez. Napoli, Italy, [2]INFN sez. Napoli, Italy, [3]NRL, Remote Sensing Div., USA.* We present an adaptive optics system for the suppression of laser geometrical aberrations represented as higher order modes. The performances obtained are those required for the application, as laser pre-cleaning system, in gravitational wave interferometers.

ME2
High Resolution Biochemical Sensor by Using Photonic Bandgap Fiber, *Jian Sun, Chi Chiu Chan, Xin Yong Dong, Ping Shum; Nanyang Technological Univ., Singapore.* A PBG fiber based biochemical sensor has been demonstrated with a resolution better than Δn=7.3×10-6. It is based on the detection of the wavelength shift of the photonic-band-edge due to the refractive index variations.

ME3
Mathematical and Computer Model for Designing Telescope with Segmented-Mirror , *Dewen Cheng, Yongtian Wang, Jun Chang, M. M. Talha; Beijing Inst. of Technology, China.* Mathematical and computer modeling of a segmented system are designed and applied to a telescopic system. Segment results are discussed and image quality of the design based on these results is evaluated in this paper.

ME4
Performance Comparison of an Anamorphic Spatial Heterodyne Spectrometer with Conventional Spectrometer, *Ian Powell, Pavel Cheben, Siegfried Janz, Dan-Xia Xu; NRC, Canada.* This article describes an anamorphic spatial heterodyne spectrometer and compares its performance with that of a conventional spectrometer.

ME5
Aberration Functions for Microlithographic Lens, *Tomoyuki Matsuyama, Tomoko Ujike; Nikon Corp., Japan.* We proposed a series of orthogonal aberration functions, which is suitable for a microlithographic projection lens. In this paper, general explanation and numbering of the orthogonal aberration functions are reviewed.

ME6
Merit Function Segmentation Dependence on the Isoplanatic Patch Criterion, *Carles Pizarro[1], Jose Antonio Díaz[2]; [1]Ctr. for Sensors, Instrumentation and Systems Development, Spain, [2]Dept. de Òptica, Univ. de Granada, Spain.* In a previous work, the dynamic merit function segmentation has been proved by using the aplanatism condition. We present the merit function dependence on the isoplanatic patch criterion and the different optimization trajectories provided.

ME7
Design of Aspheric Lens to Collimate and Uniform Irradiance of a Light Source with Lambertian Angular Distribution, *Chieh-Jen Cheng, Jyh-Long Chern; Dept. of Photonics, Inst. of Electro-Optical Engineering, Microelectronics and Information System Res. Ctr., Natl. Chiao Tung Univ., Taiwan Republic of China.* A design of aspheric lens is proposed to collimate a light source of Lambertian angular distribution and generate homogenous irradiance. A numerical solution is calculated and the performance of designed lens also evaluated.

ME8
Application of Global Optimization to Design of an Aspherical Pickup Head for Multiple Wavelengths, *Chao-Hsi Tsao, Jyh-Long Chern; Natl. Chiao Tung Univ., Taiwan Republic of China.* A global optimization process is demonstrated in designing an objective lens with diffraction-limit performance for CD/DVD wavelengths. Furthermore, a hybrid lens is proposed to extend the CD/DVD pickup head to work with the Blu-ray wavelength.

ME9
Optical Design with Aspheric Surfaces and Exact Ray Tracing: An Analytic Method, *Omar García-Lievanos, Sergio Vazquez-Montiel, Jorge Castro-Ramos, Juan Hernández-Cruz; Inst. Nacional de Astrofisica, Optica y Electronica, Mexico.* We present a method to compensate the spherical aberration for any optical system, any object position, in different pupil positions. The aspheric coefficients are variables for compensate, and they are calculated solving first degree equations.

ME10
A "Polarization Fidelity" Tracking Mount Optical Geometry and Comparison with Az El Mount: Polarization and Transmission Modeling Using ZEMAX, *Richard F. Horton; ad hoc Optics, USA.* "Polarization Fidelity" is an El El tracking mount and relay mirror geometry, preserving the image polarization fidelity from telescope, through gimbal, to a stationary sensor package. Modeling and comparison to an Az El using ZEMAX.

ME11
Analytical and Exact Method for Design Diffractive Lenses Free of Spherical Aberration , *Sergio Vazquez-Montiel, Omar García-Lievanos, Juan Hernández Cruz, Jorge Castro Ramos; Inst. Nacional de Astrofisica, Optica y Electronica, Mexico.* We propose a method to design diffractive lenses. Our method calculates the surface profiles for any substrate, for any f-number and any object position. The calculations are exact and an optimization process is not required.

ME12
Jones Calculus for Stepped Polarization of Lightwave, *Changsheng Li; School of Instrument Science & Optoelectronic Engineering, Beihang Univ., China.* The introduction of step functions into Jones vectors and matrices enables us to concisely describe the polarized light with stepped states of polarization. These vectors and matrices are useful to design optical polarization multiplexing system.

ME13
Equilibrium-State Emission of Electron-Trapping Material Thin-Film for Applications in Nonlinear-Dynamics, *Ramin Pashaie, Nabil Farhat; Univ. of Pennsylvania, USA.* It is shown that the equilibrium-state emission of the electron-trapping material has highly nonlinear behavior. Thin film of this stimulable storage phosphor can be used in optical signal processing for the generation of one-dimensional maps.

ME14
Schmidt-Like Spherical Aberration Corrector for Large Spectral Region Intended for the Space Optics, *Gennady Popov, Evgeny Popov; Crimean Astrophysical Observatory, Ukraine.* An original Schmidt-like spherical aberration corrector is designed. The corrector consists of spherical surfaces, and can be used for telescopes and cameras instead of aspherical Schmidt corrector for ground and space optics.

ME15
Optical Design of a Compact and Anastigmatic Telescope with Three Mirrors, *Sergio Vazquez y Montiel, Joel Herrera Vazquez; Inst. Nacional de Astrofisica, Optica y Electronica, Mexico.* We design a telescope with three mirrors, two mirrors are integrated on the same glass, with a third mirror we obtain an anastigmatic and compact telescope. We present an exact analysis of this telescope.

ME16
Design and Implementation of Organic LED-Based Displays for Signage Application, *Pratibha Sharma, Harry Kwok; Dept. of Electrical and Computer Engineering, Canada.* Novel design techniques for implementing OLEDs as light sources for signage are presented. Advantages and limitations of each design are examined. Based on the design analysis, the optimal design is chosen for implementation and evaluation.

ME17
Design of a Lens System for Micro Lens Lithography, *Hamid R. Fallah, Ayatollah Karimzadeh; Physics Group, Univ. of Isfahan, Iran (Islamic Republic of).* Design details of a micro lens lithography system are discussed. This system contains three micro lens arrays with aspheric surfaces. We simulate and optimize this system with geometrical and diffraction-based methods using available software.

ME18
Designing Pillow Optics for Signal Lighting, *Steve Mulder; Optical Res. Associates, USA.* Abstract: Pillow optics are used in signal lighting to control intensity distributions. This paper discusses design considerations for pillow optics, strategies for obtaining particular intensity distributions, and trade-offs between optical function and ease of manufacture.

ME19
Tuning a Lens Design Optimization for Digital Mammography Applications, *Leslie D. Foo[1], Liying Chen[2], Harrison H. Barrett[3], Rebecca Cortesi[4]; [1]Optical Res. Associates, USA, [2]Dept. of Radiology, Univ. of Arizona, USA, [3]College of Optical Sciences and Dept. of Radiology, Univ. of Arizona, USA, [4]Inst. of Optics, Univ. of Rochester, USA.* The lens in radiological imaging systems influences complexity of these systems. Using a statistical simulation model1 of the x-ray fluorescence image together with a human observer model, we define the imaging characteristics of the lens.

ME20
Optical Design Compensation from Engineering to Production Manufacturing, *C. T. Tienvieri, Tim Rich; Corning Tropel Corp., USA.* This paper will discuss transitioning a precision optical system from engineering to a manufacturing process stream.

ME21
Design of F-Theta Lenses Used in Laser Marking Machines, *Ji Yiqun, Shen Weimin, Yu Jianjun; Inst. of Modern Optical Technology of Soochow Univ., China.* Design of f-theta lenses, whose image height is proportional to its field view angle through introducing reasonable barrel distortion so as to mark linearly, is introduced. Its working area is as large as 500mm ×500mm.

ME22
Withdrawn

ME23
Infrared Fabry-Perot Spectrometer Design, Optimization and Simulation, *Chungte Bill Chen, Steven C. Fry, Jeffery J. Puschell; Raytheon Co., USA.* This paper describes design of an infrared Fabry-Perot spectrometer (FPS). Parameters that affect FPS signal-to-noise ratio such as reflectivity, absorption, scattering and surface flatness are analyzed. Single vs. Double Cavities trade-off is discussed.

ME24
A Proposal of Photoelastic Stress Multiplier, *Changsheng Li; School of Instrument Science & Optoelectronic Engineering, Beihang Univ., China.* A photoelastic stress multiplier is proposed which can perform the multiplication of two stresses or voltages using two cascaded photoelastic modulators. This new multiplier has potential applications in many interdisciplinary fields.

● Tuesday, June 6, 2006 ●

Pavilion Ballroom Foyer
7:00 a.m.–5:00 p.m.
Registration

TuA • Ray Tracing and Optimization

Pavilion Ballroom C/D
8:00 a.m.–10:00 a.m.
TuA • Ray Tracing and Optimization
Scott A. Lerner; Hewlett Packard, USA, Presider

TuA1 • 8:00 a.m.
Ray-Tracing CAD Objects, *Mark G. Nicholson[1], Kenneth E. Moore[1], Ingolf Hörsch[2]; [1]ZEMAX Development Corp., USA, [2]Sick AG, Germany.* This paper describes a computational approach to handling CAD objects within the framework of optical design software. Very fast ray-tracing speeds can be achieved through realistic objects used in the manufacture of optical systems.

TuA2 • 8:20 a.m.
Forward Tracing Technique for Diffraction Analysis of Apertures in Optical Systems, *Andres F. Cifuentes, Josep Arasa, Carles Pizarro; Ctr. for Sensors, Instrumentation and Systems Development, Technical Univ. of Catalonia, Spain.* A numerical technique for calculating the influence of diffraction of an electromagnetic wave by a boundary in an optical system within a ray-tracing environment is demonstrated. The results are comparable to those of analytical solutions.

TuA3 • 8:40 a.m.
Designing Lithographic Objectives by Constructing Saddle Points, *Florian Bociort, Oana Marinescu; Delft Univ. of Technology, The Netherlands.* Optical designers often insert or split lenses in existing designs. Here, we present, with examples from Deep and Extreme UV lithography, an alternative that consists of constructing saddle points and obtaining local minima from them.

TuA4 • 9:00 a.m.
Using Global Synthesis to Find Tolerance-Insensitive Design Forms, *John R. Rogers; Optical Res. Associates, USA.* A method of using Global Synthesis™ for finding tolerance-insensitive systems is described. By altering the merit function to include information that prefers less sensitive solutions, the space of tolerance-insensitive design configurations may be explored.

TuA5 • 9:20 a.m.
Lens Design: Global Optimization of Both Performance and Tolerance Sensitivity, *Masaki Isshiki[1], Douglas C. Sinclair[2], Seiichi Kaneko[3]; [1]Isshiki Optics, Japan, [2]Sinclair Optics, Inc., USA, [3]Chart, Inc., Japan.* A global optimization method was developed that takes into account the robustness of the lens with respect to manufacturing errors as well as its image quality. We propose a technique called 'θ -segmentation'.

TuA6 • 9:40 a.m.
Designing Easily Manufactured Lenses Using a Global Method, *James P. McGuire, Jr.; Optical Res. Associates, USA.* Easily manufactured lenses can be designed using global optimization with the results sorted based on their predicted as-built performance. The most easily manufactured lens depends critically on the performance goals.

Pavilion Ballroom A/B
10:00 a.m.–10:30 a.m.
Coffee Break

Pavilion Ballroom A/B
10:00 a.m.–4:10 p.m.
Exhibit Open

TuB • Lightpipes

Pavilion Ballroom C/D
10:30 a.m.–12:40 p.m.
TuB • Lightpipes
Miguel A. Alonso; Inst. of Optics, Univ. of Rochester, USA, Presider

TuB1 • 10:30 a.m.
Optimization of Parameterized Lightpipes, *R. John Koshel[1,2]; [1]Lamba Res. Corp./College of Optical Sciences, Univ. of Arizona, USA, [2]College of Optical Sciences, Univ. of Arizona, USA.* Parameterization via the bend locus curve allows optimization of single-spherical-bend lightpipes. It takes into account the bend radii, the bend ratio, allowable volume, thickness, and other terms. The modified simplex method is used for optimization.

TuB2 • 10:50 a.m.
Non-Rotationally Symmetric Mixing Rods, *William Cassarly, Thomas L. Davenport; Optical Res. Associates, USA.* Uniformity remains a central topic in illumination system design. We investigate the use of mixing rods with rippled surface structures to provide enhanced uniformity.

TuB3 • 11:10 a.m.
Etendue Preserving Mixing and Projection Optics for High Brightness LEDs Applied to Automotive Headlamps, *Aleksandra Cvetkovic[1], Oliver Dross[2], Julio Chaves[3], Pablo Benitez[1,2], Juan Carlos Miñano[1,2]; [1]CEDINT, Technical Univ. of Madrid (UPM), Spain, [2]LPI Europe, Spain, [3]Light Prescriptions Innovators LLC, USA.* A novel LED light extraction and mixing optic and two free form SMS surfaces are employed in a high efficiency legal LED headlamp.

TuB4 • 11:30 a.m.
Equiangular-Spiral Non-Loss Bent Lightpipe and Its Applications, *Shu-Chun Chu, Jyh-Long Chern; Dept. of Photonics, Inst. of Electro-Optical Engineering, Taiwan Republic of China.* The operation scheme of bending lightpipe with an arbitrary bent angle and no light leakage accompanying with its applications, light-splitting element and light-mixing element, were demonstrated here.

TuB5 • 11:50 a.m.
Optimizing Density Patterns to Achieve Desired Light Extraction for Displays, *Thomas L. R. Davenport; Optical Res. Associates, USA.* In displays such as backlights and signage, it is often desirable to produce a particular spatial distribution of light. This work demonstrates an iterative, optimization technique for determining the density of such light extractors.

TuB6 • 12:10 p.m. ▸ **Invited** ◂
Off the Beaten Path with Total Internal Reflection, *Lorne Whitehead; Univ. of British Columbia, Canada.* This paper begins by discussing "total" in TIR, and "critical" in critical angle, both in relation to controlling TIR. Two applications, specifically illumination with hollow light guides and image displays employing frustrated TIR, are discussed.

12:30 p.m.–1:40 p.m.
Lunch Break (on your own)

TuC • Displays

Pavilion Ballroom C/D
1:40 p.m.–3:40 p.m.
TuC • Displays
Douglas Kreysar; Radiant Imaging, USA, Presider

TuC1 • 1:40 p.m.
Stereoscopic Vision and the Design of Stereoscopic Displays, *Joshua M. Cobb; Corning Tropel Corp., USA.* Designing optical systems that take advantage of stereopsis creates a different set of constraints and image artifacts. This paper reviews some methods of creating a stereo image and highlights the unique system design considerations.

TuC2 • 2:00 p.m.
Dual-Element Off-Axis Eyeglass Based Display, *Ozan Cakmakci[1], Adam Oranchak[2], Jannick Rolland[1]; [1]Univ. of Central Florida, College of Optics/CREOL, USA, [2]Human Artifact R&D, USA.* We describe the optical system design and analysis of a wearable dual-element off-axis display based on a magnifier form that supports an 8mm exit pupil and a 20 degree diagonal full field of view.

TuC3 • 2:20 p.m.
Dual Purpose Lens for an Eye-Tracked Projection Head-Mounted Display, *Costin E. Curatu[1], Jannick Rolland[1], Hong Hua[2]; [1]CREOL College of Optics and Photonics, USA, [2]College of Optical Sciences, Univ. of Arizona, USA.* We propose a novel conceptual design for a Head-Mounted Projection Display (HMPD) with Eye-Tracking (ET) capabilities based on sharing the optical path between the HMPD and the ET. A lens performing both tasks is presented.

TuC4 • 2:40 p.m.
Catadioptric Projection Optical System for Flat Panel Exposure Tool, *Michio Kohno; Canon Inc., Japan.* Advanced catadioptric projection optics installed on update flat panel exposure tool is introduced. Scale up and aspheric lenses added to conventional two-mirror optics enlarge off-axis aberration-free image field, and contribute to increase of machine throughput.

TuC5 • 3:00 p.m.
High Definition DLP Zoom Projector Lens Design with TIR Prism for HDTV, *Yi Chin Fang, Wei Tang Lin, Hsien Lin Tsai; Natl. Kaohsiung First Univ. of Science and Technology, Taiwan Republic of China.* In this paper the lens design samples given were focused on the application of projector with DMD system. There are three different optical design at this moment; non-telecentric, telecentric with TIR prism and Field Lens Type.

TuC6 • 3:20 p.m.
Wide Angle Hybrid Magnifier for Micro-Display Source, *David Lingwood, Mark Jeffs; Qioptiq, UK.* Design configurations for a 45° field magnifier are investigated systematically. A hybrid surface is essential. Stray light effects due to surface microstructure are considered. A demonstration unit with 8μm features is described.

Pavilion Ballroom A/B
3:40 p.m.–4:10 p.m.
Coffee Break

TuD • Illumination Design and Source Modeling

Pavilion Ballroom C/D
4:10 p.m.–6:50 p.m.
TuD • Illumination Design and Source Modeling
R. John Koshel; Lambda Res. Corp., College of Optical Sciences, Univ. of Arizona, USA, Presider

TuD1 • 4:10 p.m. ▸ **Invited** ◂
Freeform Optical Systems with Prescribed Irradiance Properties, *Vladimir Oliker; Emory Univ., USA.* We review some new computational methods for freeform optical designs of refractive and reflective systems in 3D with capabilities to redirect an input beam and redistribute its radiation intensity in a prescribed manner.

TuD2 • 4:40 p.m.
Parametric Design of Non-Imaging Collimators, *Sergey V. Kudaev, Peter Schreiber; Fraunhofer IOF, Germany.* We describe Bezier spline-based parametric description of non-imaging collimators and implementation into optical design software. Together with non-linear optimization routines and adopted merit functions this provides flexible tools for development of light sources with LED.

TuD3 • 5:00 p.m.
New High-Concentration Mirror-Based Kohler Integrating Optical Design for Multijunction Solar Cells, *Pablo Benitez[1,2], Aleksandra Cvetkovic[1,2], Roland Winston[1], Luke Reed[1]; [1]Univ. of California at Merced, USA, [2]Technical Univ. of Madrid (UPM), ETSI Telecomunicacion, Spain.* A novel two-mirror high concentration non-imaging optic has been developed that shares the advantages of present two mirror imaging concentrators but also overcomes their main limitation like their trade-off between acceptance angle and irradiance uniformity.

TuD4 • 5:20 p.m.
Geodesic Lens: Review and New Designs for Illumination Engineering, *Juan C. Miñano[1,2], Pablo Benítez[1,2], Fernando Garcia[1], Dejan Grabovickic[1], Asunción Santamaria[1], Daniel Pérez[1], Julio C. P. Chaves[2], Waqidi Falicoff[2], Bill Parkyn[2]; [1]Univ. Politécnica de Madrid, Spain, [2]Light Prescriptions Innovators, LLC, USA.* Prior art of geodesic lens design is reviewed. New Kohler illuminators made of Luneburg and Rinehart geodesic lenses are presented. Illumination applications are introduced, and their performance modeled under manufacturing constraints and with surface scattering.

TuD5 • 5:40 p.m. ▸ **Invited** ◂
A Near-Field Goniospectroradiometer for LED Measurements, *Ian Ashdown, Marc Salsbury; TIR Systems Ltd., Canada.* Designing micro-optics for light-emitting diodes must take into account the near-field radiance and spectral power distributions of the emitting LED die surfaces. We present the design and application of a near-field goniospectroradiometer for this purpose.

TuD6 • 6:10 p.m.
LED Intensity Distribution, *Ivan Moreno; Univ. Autonoma de Zacatecas, Mexico.* A radiometric approach to realistically model the intensity spatial distribution of encapsulated LEDs (light-emitting diodes) is presented. We provide an analytical relationship between the radiated pattern and the main LED parameters (chip, encapsulant, and reflector).

TuD7 • 6:30 p.m.
Optical Modeling for LED in Mid-Field Region, *Ching-Cherng Sun, Tsung-Xian Lee, Shih-Hsin Ma, Ya-Luan Lee, Shih-Ming Huang; Natl. Central Univ., Taiwan Republic of China.* A new algorithm for modeling LED is proposed. We use normalized cross correlation to verify the validity of the simulation in 1-D intensity pattern as well as 2-D irradiance pattern in various mid-field distances.

Fountain Square
6:50 p.m.–8:15 p.m.
Conference Reception

● Wednesday, June 7, 2006 ●

Pavilion Ballroom Foyer
7:30 a.m.–5:00 p.m.
Registration

WA • Diffractive Optics

Pavilion Ballroom C/D
8:00 a.m.–9:40 a.m.
WA • Diffractive Optics
Barry Johnson; Optical ETC, USA, Presider

WA1 • 8:00 a.m.
Novel Lens Design for Free-Space Optical Interconnects, *Jamie L. Ramsey[1], T. J. Hall[1], W. Pijitrojana[2]; [1]Univ. of Ottawa, Canada, [2]Thammasat Univ., Thailand.* We propose a new free-space optical interconnect which utilises a Fourier transform lens system at its centre, with the system being aberration and distortion-free.

WA2 • 8:20 a.m.
Diffractive Nano-Focusing and Nano-Imaging, *Qing Cao; Optische Nachrichtentechnik, Germany.* Diffractive nano-focusing and nano-imaging with photon sieves and modified Fresnel zone plates are introduced. Especially, the individual far-field model for photon sieves and the equivalent pupil theory for modified Fresnel zone plates are presented.

WA3 • 8:40 a.m.
Optical Spatial Filter for Two-Dimensional Speed Measurement, Position Monitoring and Particle Sizing, *Swen Bergeler, H. Krambeer, H. Ewald; Univ. of Rostock, Germany.* With two orthogonal spatial filters all directions of two-dimensional motion can be measured. A modification of the aperture function of the lattice allows an innovative measuring real time system for particle sizing and position monitoring.

WA4 • 9:00 a.m.
En-Squared Power Based Optical Design for Holographic Storage Systems, *Yuzuru Takashima, Lambertus Hesselink; Stanford Univ., USA.* The Fourier transform lens consisting of an aspherical element is analyzed in terms of the supportable number of pixels by formalizing an en-squared-power ratio as a function of the Nyquist aperture ratio and aberrations.

WA5 • 9:20 a.m.
GASIR 1: A Promising Material for Dual Waveband Systems, *Marta C. de la Fuente; INDRA, Spain.* The use of several materials (Ge, ZnSe and GASIR 1) and bi-spectral diffractive surfaces are evaluated for the design of dual waveband optical systems, MWIR and LWIR. The design of a complex objective is described.

Pavilion Ballroom A/B
9:40 a.m.–10:10 a.m.
Coffee Break

Pavilion Ballroom A/B
9:40 a.m.–4:30 p.m.
Exhibit Open

WB • Optics for Digital Systems

Pavilion Ballroom C/D
10:10 a.m.–12:20 p.m.
WB • Optics for Digital Systems
Kevin Thompson; Optical Res. Associates, USA, Presider

WB1 • 10:10 a.m.
Panomorph Lens: A New Type of Panoramic Lens , *Simon Thibault; Univ. Laval, Canada.* The principle of operation, the optical design and the performances of a new type of lenses that enhanced the capabilities of 360° panoramic system will be presented. We will discuss the anamorphic and distortion profile.

WB2 • 10:30 a.m. ▸ **Invited** ◂
Digital Correction of Lens Aberrations in Light Field Photography, *Pat Hanrahan, Ren Ng; Stanford Univ., USA.* Recording the light traveling along ray bundles inside the camera (the light field) enables computation of photographs with reduced lens aberrations. Simulated results are presented for a set of 35mm format lenses.

WB3 • 11:00 a.m.
The Optics of Miniature Digital Camera Modules, *Jane Bareau, Peter Clark; Flextronics Intl., USA.* The challenges associated with designing lenses for cell phone cameras are different from those for traditional imaging systems and mainly result from the scale of the camera modules for which they are being developed.

WB4 • 11:20 a.m.
Joint Design of Lens Systems and Digital Image Processing, *Dirk Robinson, David G. Stork; Ricoh Innovations, USA.* We introduce a novel framework for designing digital imaging systems which considers subsequent digital processing of the sensed image. We adapt commercial ray tracing software to compute pixel-wise MSE merit functions enabling joint optical-digital optimization.

WB5 • 11:40 a.m.
Impact of the 2D-Structured Noise in the Post-Processing of Hybrid Optical-Digital Imaging Systems, *Salvador Bosch[1], Raul Tudela[1], Marta C. de la Fuente[2], Josep Ferre-Borrull[3]; [1]Univ. de Barcelona, Departament de Física Aplicada i Òptica, Spain, [2]INDRA SISTEMAS SA, Spain, [3]Univ. Rovira i Virgili, Dept Enginyeria Electronica Electrica i Automatica, Spain.* Impact of additive 2D-structured noise at detectors of hybrid optical-digital imaging systems is analyzed. The intermediate image is post-processed with Wiener and Phillips filters and the procedures to obtain their adjustable parameters is studied.

WB6 • 12:00 p.m.
2X Optical Digital Zoom Lens with Short Total Length and Extremely Small Front Aperture for Two Million Pixel CMOS on Mobile Phone, *Yi Chin Fang[1], Hsien Lin Tsai[1], Yu Han Chien[2]; [1]Natl. Kaohsiung First Univ. of Science and Technology, Taiwan Republic of China, [2]Industrial Technology Res. Inst., Taiwan Republic of China.* In this paper, a newly design is proposed that its overall total length is small compared to current two million pixels mobile phone. The most important is that the aperture stop is the first element.

12:20 p.m.–2:00 p.m.
Lunch Break (on your own)

WC • Telescopes and Space Optics

Pavilion Ballroom C/D
2:00 p.m.–4:00 p.m.
WC • Telescopes and Space Optics
Paul Manhart; Consultant, USA, Presider

WC1 • 2:00 p.m.
Four-Mirror Compact Afocal Telescope with Dual Exit Pupil, *Michael Rodgers; Optical Res. Associates, USA.* A concept is presented for a compact high-demagnification afocal telescope that feeds separate imaging channels for different spectral bands, using independently tilted mirrors instead of a dichroic beamsplitter or a switch mirror.

WC2 • 2:20 p.m.
Modified Offner Relay Systems for Future Adaptive Optical Telescope, *Alexander V. Goncharov, Chris Dainty; Dept. of Experimental Physics, Ireland.* Future optical telescopes will employ adaptive optical (AO) systems compensating atmosphere-induced image distortions. To integrate AO into telescope design, a modified Offner relay is proposed. Several possible designs are presented and their performance is analysed.

WC3 • 2:40 p.m.
Diffraction-Limited Constant-Resolution Zoom Lens Across Multi-Wavelengths for the Advanced Technology Solar Telescope, *Hyun Kyoung An, Stephen K. Pitalo; Ctr. for Applied Optics, Univ. of Alabama in Huntsville, USA.* Constant-resolution is needed over a wide spectral range (388nm to 805 nm) for CCD sampling. The zoom lens, consisting of eleven elements, yields a diffraction limited image at nine zoom positions for the given wavelengths.

WC4 • 3:00 p.m.
Design of an Infrared Integral Field Unit Specialized for Direct Imaging of Extrasolar Planets, *Jean-Francois Lavigne[1,2,3], Rene Doyon[1], Simon Thibault[4,5], Min Wang[2]; [1]Univ. de Montreal, Canada, [2]Inst. Natl. d'Optique, Canada, [3]Herzberg Inst. of Astrophysics, Canada, [4]Univ. Laval, Canada, [5]Immervision, Canada.* Principle of operation, optical design and performances measured on the testbed of an integral field unit camera used for speckle suppression in the attempt to image faint companions around other stars will be presented.

WC5 • 3:20 p.m.
Corrected Calculation of Star Trails Caused by Differential Atmospheric Refraction, *Eric H. Richardson; Univ. of Victoria, Canada.* Differential atmospheric refraction does not cause a net rotation of a field of stars thus a correctly tracking equatorial telescope does not require rotation of the detector during observations. I. S. Bowen was mistaken in 1966.

WC6 • 3:40 p.m.
The SCUBA-2 Polarimeter, *Melanie R. Leclerc[1], Sophie Bernier[1], Pierre Bastien[2], Eric Bissonnette[2], Giampaolo Pisano[3], Giorgio Savini[3]; [1]INO, Canada, [2]Dept. de physique, Univ. de Montréal, Canada, [3]Dept. of Physics and Astronomy, Univ. of Wales at Cardiff, UK.* A polarimeter is built to be used with the SCUBA-2 camera of the James Clerk Maxwell Telescope to study polarized sub-millimeter radiations. We simulated the effect of the polarimeter on image quality and polarization measurements.

Pavilion Ballroom A/B
4:00 p.m.–4:30 p.m.
Coffee Break

WD • Infrared and Lithographic Design and Systems

Pavilion Ballroom C/D
4:30 p.m.–6:20 p.m.
WD • Infrared and Lithographic Design and Systems
Jose Sasian; Univ. of Arizona, USA, Presider

WD1 • 4:30 p.m.
Optical Design of a Panoramic, Wide Spectral Band, Infrared Fisheye Lens, *Harvey M. Spencer[1], J. Michael Rodgers[2], Jeffrey M. Hoffman[2]; [1]DRS Sensor and Targeting Systems, USA, [2]Optical Res. Associates, USA.* Refractive infrared optical designs have traditionally covered modest FOVs in one spectral band. The design of a fast, extreme fisheye lens imaging 360° azimuth by 120° elevation over the full 3-12 micron band is described.

WD2 • 4:50 p.m. ▸ **Invited** ◂
All Reflective Zoom System for Infrared Optics, *Jun Cheng[1], Yongtian Wang[1], Zhicheng Weng[2], Xiaojie Cong[2]; [1]Beijing Inst. of technology, China, [2]Changchun Inst. of Optics, Fine Mechanics and Phisics, China.* Designs of zoom systems using all reflective aspheric surfaces for use with uncooled infrared detectors are described. Issues such as the paraxial design theory and aberration balancing are discussed.

WD3 • 5:20 p.m.
Extreme Ring Fields in Microlithography, *Alexander Epple; Carl Zeiss, Germany.* A new inline catadioptric design type is presented which is designed for use with extreme ring field geometries. This allows to increase the numerical aperture to the physical limits both in dry and immersion lithography.

WD4 • 5:40 p.m.
Use of Diffractive Lenses in Lithographic Projection Lenses, *Hans-Juergen Rostalski, Alexander Epple, Heiko Feldmann; Carl Zeiss SMT AG, Germany.* Diffractive lenses are very useful to correct chromatic aberrations of lithographic projection lenses. In addition they provide the possibility to correct the Petzval curvature although they do not deliver their own contribution to it.

WD5 • 6:00 p.m.
The Optical Design for Microlithographic Lenses, *Yasuhiro Ohmura; Nikon Corp., Japan.* The evolution of the microlithographic lens is described based on an analysis of main features of the lenses in each generation. Even current lenses, comprising more than 20 elements, can be understandable through the analysis.

Pavilion Ballroom C/D
6:30 p.m.–8:00 p.m.
Illumination Design and Lens Design Contests Results and Awards

● Thursday, June 8, 2006 ●

Pavilion Ballroom Foyer
7:30 a.m.–1:00 p.m.
Registration

ThA • Interferometry and Testing

Pavilion Ballroom C/D
8:00 a.m.–10:00 a.m.
ThA • Interferometry and Testing
Alex Sohn; North Carolina State Univ., USA, Presider

ThA1 • 8:00 a.m.
Determination of Measurement Uncertainty in the Developed Instantaneous Phase Shifting Interferometer, *Narayanswamy R. Sivakumar[1], Bo Tan[2], Krishnan Venkatakrishnan[2]; [1]Concorida Univ., Canada, [2]Ryerson Univ., Canada.* Abstract: Detection of noise in optical layout for instantaneous phase shifting is discussed. Experiments were done on a diamond-turned aluminum surface on the developed interferometer and compared with a commercial profiler to ascertain its uncertainty.

ThA2 • 8:20 a.m.
Maximum Likelihood Estimation as a General Method of Combining Sub-Aperture Data for Interferometric Testing, *Peng Su, Jim Burge, Robert Sprowl, Jose Sasian; Univ. of Arizona, USA.* By making multiple interferometric measurements of reference and test surfaces that are translated and rotated, we obtain sufficient information to reconstruct both surfaces. We use maximum likelihood estimation to obtain a 1 nm rms error.

ThA3 • 8:40 a.m.
CGH Null-Test Design and Fabrication for Off-Axis Aspherical Mirror Tests, *Min Wang[1], Daniel Asselin[1], Patrice Topart[1], Jonny Gauvin[1], Philippe Berlioz[2], Bernd Harnisch[3]; [1]INO, Canada, [2]EADS Astrium SAS, France, [3]European Space Agency, European Space Res. and Technology Ctr., The Netherlands.* A null-lens based on Computer Generated Hologram is designed to test the primary mirror of GAIA telescope. The null-test has multiple-zones to achieve simultaneous self-alignment and wavefront-verification. The RMS-wavefront error is estimated to 7.33 nm.

ThA4 • 9:00 a.m.
High-Precision Measurements of Reflectance, *Philippe Voarino, Herve Piombini; CEA, France.* The reflector's specifications of amplifying section of LMJ need to have a spectral reflectance measurements more accurate than 0.5 %. The innovative solution proposes to increase the precision of reflectance measurements.

ThA5 • 9:20 a.m.
Overview of the Line-Imaging VISAR Diagnostic at the National Ignition Facility (NIF), *Robert M. Malone[1], Brent C. Frogget[1], Morris I. Kaufman[1], Thomas W. Tunnell[1], Robert L. Guyton[1], Imants P. Reinbachs[1], Phillip W. Watts[1], John R. Celeste[2], Peter M. Celliers[2], Tony L. Lee[2], Brian J. MacGowan[2], Edmund W. Ng[2], Ronald B. Robinson[2], Lynn G. Seppala[2]; [1]Bechtel Nevada, USA, [2]Lawrence Livermore Natl. Lab, USA.* Optical relays collect light from inside the target chamber and pass it through velocity interferometers to be recorded by streak cameras. Light is split off before the interferometers and color corrected before another streak camera.

ThA6 • 9:40 a.m.
Chromatic Aberration-Eliminated Optical System of 3ω Target Alignment Laser for SG-III Prototype Facility, *Keyu Li, Zhan Sui, Huaiting Jia, Bin Feng, Yong Xiang, Fuquan Li, Chi Ma, Xiaofeng Wei; Res. Ctr. of Laser Fusion, CAEP, China.* To realize multi-beam positions and crystals alignment, the 3ω target alignment laser of SG-III Prototype Facility has been designed as a reflection optical system, which avoids the effect of chromatic aberration.

Pavilion Ballroom A/B
10:00 a.m.–10:30 a.m.
Coffee Break

ThB • Design for Fabrication

Pavilion Ballroom C/D
10:30 a.m.–1:00 p.m.
ThB • Design for Fabrication
Thomas Dow; North Carolina State Univ., USA, Presider

ThB1 • 10:30 a.m. ▸ **Invited** ◂
Single Point Diamond Turning: Progress in Precision, *John Schaefer; Raytheon, USA.* Single-point diamond turning has significantly progressed in the last 20 years. This paper will explain how key advancements in this field provide today's optical designer with a wide selection of affordable design solutions.

ThB2 • 11:00 a.m.
Localized Slope Errors and Their Impact on Image Performance Requirements, *Mark C. Sanson, C. Theodore Tienvieri, Steven VanKerkhove; Corning Tropel Corp., USA.* The performance effect of localized slope errors in an optical system will vary based on the system location as well as their magnitude. This paper looks at a method to model and analyze such errors.

ThB3 • 11:20 a.m.
Numerical Integration of the Profile of Aspheric Surfaces, *Juan L. Rayces[1], Xuemin Cheng[2]; [1]J. L. Rayces Consulting, USA, [2]Tsinghua Univ., China.* Points on the aspheric surface profile are computed by numerical integration of a differential equation. Integration errors are eliminated by adjusting the optical path difference to zero at each computed point of the profile.

ThB4 • 11:40 a.m.
Sensitivity Control to Surface Irregularity, *Akira Yabe; Consultant, Germany.* The surface irregularity of the aspherics frequently causes troubles. So it is necessary to design the aspherics insensitive to the manufacturing errors. In this paper a universal method to design the insensitive aspherics is proposed.

ThB5 • 12:00 p.m.
Approximation of Shrinked Aspheres, *Rene Schoene, Daniel Hintermann, Tobias Hanning; Univ. of Passau, Germany.* We present a strategy to determine shrinked rotation-symmetric aspheres. First, we approximate nonlinearly a conic based on a direct least squares start-solution with quadratic constraint to a set of datapoints. Afterwards, we smooth aspheres polynomially.

ThB6 • 12:20 p.m.
Improvements in Lenticular Lens Arrays Design and Fabrication, *R. Barry Johnson; Consultant, USA.* Elliptical lenticular lens arrays are shown to significantly improve image quality. The design methodology is presented and the evolution of advanced tooling necessary to fabricate lenticular lens-array extrusion cylinders is discussed.

ThB7 • 12:40 p.m.
Systematic Design Processes to Improve the Manufacturability of Zoom Lenses, *Chir-Weei Chang, Chy-Lin Wang, Chuan-Chung Chang, Yi-Ling Wu, Chen-Chin Cheng, Wei-Chung Chao; Opto-Electronics & Systems Labs/Industrial Technology Res. Inst., Taiwan Republic of China.* An integrated process for design and manufacturing of lens modules is proposed. A high end compact zoom lens is designed and analytic procedure has been developed for the root cause identification of the lens decentration.

Key to Authors and Presiders