AO/COSI/IP/SRS

Adaptive Optics: Analysis and Methods

Computational Optical Sensing and Imaging

Information Photonics

Signal Recovery and Synthesis

Collocated Topical Meetings and Tabletop Exhibit

June 6-9, 2005

Omni Charlotte Hotel
Charlotte, North Carolina

Sponsored by: Optical Society of America

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About AO

Scope

The scale and variety of proposed adaptive optical (AO) systems and concepts continues to expand, with applications including astronomy, communications, remote sensing and vision science. Modeling these systems and developing effective control algorithms continues to be an important and growing area of research. This topical meeting will study the computational and analytical aspects of AO at a level of sophistication that is usually not possible at larger, more general meetings. We will also investigate the possible synergies between the methods developed by various communities pursuing different applications.

Topics to be Considered

- Optimal wavefront estimation and control algorithms
- Algorithms for wide-field AO, multi-conjugate AO, and high dynamic AO
- Computationally efficient algorithms and signal processing architectures for very high order and high bandwidth systems
- Accurate, general, and efficient analytical modeling methods
- Numerical simulation methods for high-fidelity modeling
- Fundamental performance characteristics of wavefront sensors, deformable mirrors and laser guidestars
- Modeling wavefront propagation through random media
- Advancing turbulence models beyond the Kolmogorov spectrum and the Taylor hypothesis
- AO system calibration and system identification
- AO PSF reconstruction
- Estimating atmospheric turbulence parameters
- AO for full field compensation through strong scintillation
- Novel AO modeling methods and applications

About COSI

Scope

The mission of the Topical Meeting on Computational Optical Sensing and Imaging is

- to provide an international and interdisciplinary forum for fundamental analysis of interfaces between analog optical signals and digital information;
- to develop a multidisciplinary community covering optical and electro-optical components and systems, embedded processing, algorithms and applications for digital optical sensing, imaging and spectroscopy;
- to develop and promote integrated optical, electronic and algorithmic design of optical systems; and
- to facilitate optical solutions to challenges in biomedical sensors, digital imaging and digital video, national defense and homeland security, automated control systems, integrated spectroscopic sensors, robotics and human-computer interaction.

Topics to be Considered:

The COSI topical meeting will cover global design issues and comparative sensor analysis as well as components of computational systems and applications. Specific focus areas are listed below.

1. System analysis
    - Information theory and comparative sensor system analysis
    - System metrics
    - Radiation fields, vortices and localization
    - Coherence, spectra and polarization
    - Geometric analysis, spaces and computer vision
    - Biological systems and biological analogies
2. Components
    - Optical elements
    - Wavefront sensing and control systems
    - Optoelectronics
    - Illumination systems
    - Detectors and focal planes
    - Optoelectronic processing and interconnections
3. Algorithms, embedded processing, compression and communications

- Approximation methods, sampling, bases and frames
- Sparse or compressive coding
- Inverse problems
- Adaptive systems
- Sensor networks and communications

4. Applications
    - Biomedical diagnostic and research tools, including imaging and spectroscopic instruments
    - Security, defense and tracking systems
    - Human-computer interaction and robotic sensors
    - Machine vision and automated control systems

A computational optical sensor system abstracts information from objects that scatter or radiate optical fields. A system includes most or all of the following components:

1. Illumination or excitation signals, including pulsed or coded laser signals, spatially, spectrally or temporally encoded illumination or source excitation systems;
2. Optical components, such as lenses, gratings, coded apertures or reference structures, interferometers, telescopes and microscopes;
3. Electronic detectors, such as charge coupled devices, active focal planes and microbolometer arrays;
4. Analog-digital processing, sampling and conversion electronics; and
5. Digital signal processing algorithms.

In addition to these basic components, system design and deployment, array coordination, communications, human and machine interaction and display may be critical components of COSI systems. Global and layer-based system analysis, both from information theoretic and functional perspectives, may be critical to system design.

About IP

Scope

The meeting will focus on the processing of information by photonic means as fundamental technologies and applications. Invited and contributed talks and posters will address sensing/actuation, imaging, storage, interconnects, communications and switching. Additionally, special emphasis will be placed on emerging areas, such as nano-photonics, artificial photonic materials and methods for 3-D spatial, spectral and temporal confinement of photons and emerging applications, such as photonic actuation and security systems and bioimaging.

Collocation of IP with COSI, AO and SRS will present ample opportunity for emphasizing common intellectual themes and interests. Together, the meetings will provide a comprehensive review of the state of the art in the photonics field, ranging from materials and devices to applications.

Information Photonics Topical Meeting is in cooperation with:
International Commission for Optics (ICO)

Topics to be Considered

The topics to be considered in the main program will include (but will not be limited to):

Fundamentals:

- Information capacity and connectivity of photonic systems
- 3-D optical engineering (manipulation of light fields in 3-D space)
- Classical and quantum approaches to information photonics
- Analog and digital photonic information channels
- Information photonics using novel light states (ultra-fast, ultra-localized)

Technologies:

- SLMs and massively parallel photonic device technologies
- Heterogeneous integrations of photonic components and materials
- Passive optics: Micro-optics, diffractive optics, novel guiding and photon confining structures
- Silicon photonics and artificial photonic materials
- Nanophotonics, photonic crystals, plasmonics, quantum dots and

quantum optical device technologies
- Micro and nano opto-electro-mechanical photonic device technologies
- Photonic sensing and biophotonic device technologies

Applications:

- Photonic communication, interconnection and computation systems
- Photonics for switching, routing and data delivery
- Photonics for content access: servers, memories
- Photonics in data storage and photonic elastic buffers
- Photonics in imaging
- Photonics for secure systems
- Photonic sensing and sensor networks
- Biophotonics
- RF photonics

About SRS

Scope

Signal recovery and synthesis is concerned with methods for obtaining the best estimate of an image from the data and constraints at hand. The topical area is important to many fields of optics, as well as a broader constituency due to its interdisciplinary nature; examples include digital image reconstruction from Fourier intensity measurements, superresolution, tomographic reconstruction and blind deconvolution. This topical meeting is concerned with theory, algorithms and applications of signal recovery and synthesis in optics and other disciplines.

Topics to be Considered

- Methods for solving ill-posed problems
- Imaging from scattered fields
- Signal and array synthesis
- Image restoration
- Phase retrieval
- Design of diffractive optics and photonic band gap structures
- Tomography
- Point-spread-variant debluring
- Superresolution
- Bayesian estimation
- Quantum limited imaging
- Imaging through turbulence
- Imaging of, or through, highly scattering media
- Profile inversion
- Noise models and regularization
- Astronomical imaging
- Medical and geophysical image recovery
- Microscopy, crystallography and other applications

AO/COSI/IP/SRS Speakers

Adaptive Optics: Analysis and Methods Speakers

Invited Speakers

AWA, **Solving Propagation Problems in Turbulence Using Filter Functions and Mellin Transforms**, *Richard Sasiela; MIT, USA*

AWB1, **Wavefront Sensing in Strong Scintillation with a Self-Referencing Interferometer Wavefront Sensor**, *Troy Rhoadarmer; AFRL, USA*

AWC1, **Optimality, Observers and Controllers in Adaptive Optics**, *Caroline Kulcsar; L2TI, Inst. Galilée, Univ. Paris 13, France*

AThA1, **Control Theory and Adaptive Optics**, *John Burns; Virginia Tech, USA*

AThB1, **Assessment of Issues for Propagation through Strong Turbulence**, *Glenn Tyler; Optical Sciences Co., USA*

AThC1, **Curvature and Pyramid Sensing**, *Richard Lane; Applied Res. Associates NZ Ltd., New Zealand*

JTuB2, **Fast, Robust Algorithms for Wavefront Reconstruction under Weak Turbulence Conditions**, *Curt Vogel; Montana State Univ., USA*

Computational Optical Sensing and Imaging

COSI Plenary Speaker

CTuA3, *Ronald Coifman; Yale Univ., USA*

Invited Speakers

CMA3, **Fisher-Information-Based Performance Bounds of Certain Integrated Imaging Systems**, *Sudhakar Prasad; Univ. of New Mexico, USA*

CMB1, **Imaging Using Alternate Point Spread Functions: Lenslets with Pseudo-Random Phase Diversity**, *Mark Allen Neifeld, Amit Ashok; Univ. of Arizona, USA*

CMC1, **Phase-Space Representations for Phase-Engineering**, *Jorge Ojeda-Casteneda; Univ. of the Americas, Mexico*

CMC4, **Imaging Properties of Three-Dimensional Pupils**, *George Barbastathis; MIT, USA*

JMA1, **Lensless Coherent Imaging with Shaped Illumination and Phase-Retrieval Image Reconstruction**, *James R. Fienup; Inst. of Optics, Univ. of Rochester, USA*

CTuA1, **Military Imaging System Performance Models**, *Ronald Driggers; NVL, USA*

CTuA2, **Target Detection and Discrimination through Active Multispectral Polarimetric Imaging**, *Mehdi Alouini; Thales Res. & Technology, France*

CTuB1, **Image Reconstruction in Optical Tomography: Beyond the Diffusion Approximation**, *John Schotland; Univ. of Pennsylvania, USA*

JWA1, **Real-Time Aberration Compensation without a Wavefront Sensor**, *Christopher Dainty; Natl. Univ. of Ireland, Ireland*

COSI Panel Discussion: Technology Transfer and Commercialization of Comuputational Sensors

CTuD1, **Panel Participant**, *Ed Dowski; CDM Optics, USA*

CTuD2, **Panel Participant**, *Michael Feldman; Digital Optics Corp., USA*

CTuD3, **Panel Participant**, *Michael Sullivan; Centice Corp., USA*

CTuD4, **Panel Participant**, *Keith Fife; Stanford Univ., USA*

CTuD5, **Panel Participant**, *Ron Stack; Distant Focus Corp., USA*

Information Photonics

Invited Speakers

ITuA1, **GPC-Based Optical Manipulation**, *Jesper Glückstad; Risø Natl. Lab, Denmark*

ITuB1, **High Performance Holographic Data Storage**, *Kevin Curtis; InPhase, USA*

ITuC1, **Photonic Crystal Biosensors**, *Brian Cunningham; Univ. of Illinois at Urbana-Champaign, USA*

IWA1, **Electrically Injected Photonic Crystal Lasers**, *Yong Hee Lee, Hong-Gyu Park; KAIST, Republic of Korea*

IWB1, **Left-Handed Materials**, *David R. Smith, David Schurig; Duke Univ., USA*

IWC1, **Unified Theory of Polarization and Coherence and Some of Its Applications**, *Emil Wolf; Univ. of Rochester, USA*

IWC2, **TBA**, *David A. B. Miller; Stanford Univ., USA*

IWC3, **DARPA's Programs on Photonic Technologies and Applications**, *Jagdeep Shah; DARPA, USA*

IWD1, **New-Generation Interconnect**, *Helmut Albrecht[1], Axel Beier[2], Peter Demmer[3], Martin Franke[3], Roland Mödinger[4], Karl Pfeiffer[5], Peter Beil[6], Jan Kostelnik[7], Jörg Bauer[8], Frank Ebling[8], Elmar Griese[9]; [1]Infineon Technologies AG, Germany, [2]Infineon Technologies Fiber Optics GmbH, Germany, [3]Siemens AG, Germany, [4]Erni Elektroapparate GmbH, Germany, [5]Micro Resist Technology GmbH, Germany, ,[6]Ilfa Feinstleitertechnik, Germany, [7]Würth Elektronik GmbH, Germany, [8]Fraunhofer IZM,*

Germany, [9]Univ. of Siegen, Germany

IThA1, **2-D Optical Interconnects between CMOS IC's**, *Olivier Rits[1], Ronny Bockstaele[1], Michiel De Wilde[1], Wim Meeuws[1], Hendrik Sergeant[1], Johan De Baets[1], Jan Van Campenhout[1], Roel Baets[1], François Dorgeuille[2], Sven Eitel[3], Michaela Klemenc[4], Richard Annen[5], Jan Van Koetsem[6], Jacques Goudeau[7], Baudouin Bareel[8], François Marion[9], Julien Routin[9]; [1]Ghent Univ. - IMEC, Belgium, [2]Alcatel CIT, France, [3]Avalon Photonics Ltd, Switzerland, [4]Albis Optoelectronics, Switzerland, [5]Helix, Switzerland, [6]FCI, The Netherlands, [7]Nexans Res. Ctr., France, [8]Nexans Cabling System, Belgium, [9]CEA-LETI, France*

IThA2, **Optical Interconnects: Terabus**, *Trewhella; IBM, USA*

IThB1, **CMOS-Compatible Photonics**, *Barham Jalali; Univ. of California at Los Angeles, USA*

IThB2, **TBA**, *Michal Lipson; Cornell Univ., USA*

IThC1, **All-Optical CDMA and Switching**, *S. J. Ben Yoo; Univ. of California at Davis, USA*

IThD1, **Nonlinear Optical and Opto-Mechanical Oscillators Based on Ultra-High-Q Microtoroids**, *Kerry Vahala; Caltech, USA*

JWB1, **Optoelectronic Foundry: The CoOP Experience**, *Ravindra A. Athale; DARPA/MTO, USA*

Signal Recovery and Synthesis

Invited Speakers

SMA1, **Synthesis of Strongly Scattering Structures**, *Michael A. Fiddy[1], Andrey Kanaev[1], Umer Shahid[1], Markus Testorf[2]; [1]Univ. of North Carolina, USA, [2]Dartmouth College, USA*

SMB1, **Resolution and Its Enhancements in Imaging**, *Peyman Milanfar; Univ. of California at Santa Cruz, USA*

JMA2, **Extended-Resolution Reconstruction of Structured Illumination Microscopy Data**, *Mats Gustafsson; Univ. of California at San Francisco, USA*

JTuB1, **Post-Coronagraph Wavefront Sensing Using Pupil Imaging and Phase-Diversity**, *Joseph J. Green, Albert F. Niessner, Stuart B. Shaklan; Jet Propulsion Lab, USA*

Publications

Conference Program

The *Conference Program* will be available on the web in May 2005. Authors submitting papers and current committee members will automatically be notified by email when the *Conference Program* is available.

Technical Digest

The AO, COSI, IP and SRS *Technical Digest* on CD-ROM will contain PDFs of paper summaries presented during the meeting as they were submitted by the authors; the *Technical Digest* will be produced only on CD. At the meeting, each registrant will receive a copy of the Technical Digest on CD-ROM. Extra copies can be purchased at the meeting for a special price of US$ 75.

Agenda of Sessions

On This Page:

Sunday, June 05, 2005

Time	Event / Location
3:00 PM - 6:00 PM	Registration Open *Ballroom Foyer*
6:00 PM - 8:00 PM	Welcome Reception *Pool Deck*

Monday, June 06, 2005

Time	Event / Location
7:00 AM - 5:30 PM	Registration Open *Ballroom Foyer*
8:00 AM - 10:00 AM	**CMA**, Information and System Metrics *Poplar*
8:00 AM - 10:00 AM	**SMA**, Scattering and Biological Imaging *Dogwood*
10:00 AM - 10:30 AM	Coffee Break *Cypress*
10:30 AM - 12:30 PM	**JMA**, Joint COSI/SRS Session *Poplar*
12:30 PM - 1:30 PM	Lunch Break (on your own)
1:30 PM - 3:30 PM	**SMB**, Image Reconstruction and Interferometry *Dogwood*
1:30 PM - 3:30 PM	**CMB**, Thin Imaging *Poplar*
3:30 PM - 4:00 PM	Coffee Break *Cypress*
4:00 PM - 6:00 PM	**CMC**, Optical Elements and System Testing *Poplar*
4:00 PM - 6:00 PM	**SMC**, Image and Phase Restoration *Dogwood*
6:00PM - 8:00 PM	COSI/SRS Joint Conference Reception & Poster Session Cypress

Tuesday, June 07, 2005

Time	Event / Location
7:00 AM - 5:30 PM	Registration Open *Ballroom Foyer*
8:00 AM - 10:00 AM	**ITuA**, Coherent Optical Information Processing *Dogwood*
8:00 AM - 10:00 AM	**CTuA**, Defense and Security *Poplar*
10:00 AM - 10:30 AM	Coffee Break *Cypress*
10:30 AM - 12:30 PM	**CTuB**, Microscopy

	Poplar
10:30 AM - 12:30 PM	**ITuB**, Optical Memory *Dogwood*
12:30 PM - 1:30 PM	Lunch Break (on your own)
1:30 PM - 3:30 PM	**ITuC**, Optofluidics *Dogwood*
1:30 PM - 3:30 PM	**CTuC**, Spectroscopy and Novel Sensors *Poplar*
3:30 PM - 4:00 PM	Coffee Break *Cypress*
4:00 PM - 6:00 PM	**JTuA**, Joint COSI/IP Session: Optical Imaging and Information *Poplar*
4:00 PM - 6:00 PM	**JTuB**, Joint AO/SRS Session: Signal Recovering in Adaptive Optics I *Dogwood*
6:00 PM - 7:30 PM	Dinner Break (on your own)
7:30 PM - 9:00 PM	**CTuD**, COSI Panel Discussion: Technology Transfer and Commercialization of Computational Sensors *Poplar*
7:30 PM - 8:50 PM	**JTuC**, Joint AO/SRS Session: Signal Recovering in Adaptive Optics II *Dogwood*

Wednesday, June 08, 2005

Time	Event / Location
7:00 AM - 5:30 PM	Registration Open *Ballroom Foyer*
8:00 AM - 9:40 AM	**AWA**, AO Modeling and Analysis I *Poplar*
8:00 AM - 10:00 AM	**IWA**, Active IP Devices *Dogwood*
10:00 AM - 10:30 AM	Coffee Break *Cypress*
10:30 AM - 11:30 AM	**JWA**, Joint AO/COSI Session: Phase Retrieval and PSF Analysis *Poplar*
10:30 AM - 12:10 PM	**IWB**, Passive IP Devices *Dogwood*
12:10 PM - 1:30 PM	Lunch Break (on your own)
1:30 PM - 3:30 PM	**IWC**, IP Plenary *Dogwood*
1:30 PM - 3:10 PM	**AWB**, Wavefront Sensing I *Poplar*
3:30 PM - 4:00 PM	Coffee Break *Cypress*
4:00 PM - 6:00 PM	**IWD**, Interconnects I *Dogwood*
4:00 PM - 5:40 PM	**AWC**, Wavefront Reconstruction and Control I *Poplar*
6:00 PM - 8:00 PM	**JWB**, Joint AO/IP Poster Session/Conference Reception *Cypress*

Thursday, June 09, 2005

Time	Event / Location
7:00 AM - 5:00 PM	Registration Open *Ballroom Foyer*
8:00 AM - 10:00 AM	**AThA**, Wavefront Reconstruction and Control II *Poplar*
8:00 AM - 10:00 AM	**IThA**, Interconnects II *Dogwood*

10:00 AM - 10:30 AM	Coffee Break *Cypress*
10:30 AM - 12:30 PM	**IThB**, Interconnects III *Dogwood*
10:30 AM - 12:10 PM	**AThB**, AO Modeling and Analysis II *Poplar*
12:30 PM - 1:30 PM	Lunch Break (on your own)
1:30 PM - 3:10 PM	**AThC**, Wavefront Sensing II *Poplar*
1:30 PM - 3:30 PM	**IThC**, Optical Processing for Fiber Communication *Dogwood*
3:30 PM - 4:00 PM	Coffee Break *Cypress*
4:00 PM - 5:40 PM	**IThD**, Mesoscopic Devices *Dogwood*

2005 AO/COSI/IP/SRS Abstracts

SUNDAY, JUNE 5, 2005

Ballroom Foyer
3:00 p.m.–6:00 p.m.
Registration Open

Pool Deck
6:00 p.m.–8:00 p.m.
Welcome Reception

COMPUTATIONAL OPTICAL SENSING AND IMAGING

MONDAY, JUNE 6, 2005

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

Room: Poplar
8:00 a.m.–10:00 a.m.
CMA • Information and System Metrics
Robert Plemmons; Wake Forest Univ., USA, Presider

CMA1 • 8:00 a.m.
Fisher Information of 3D Rotating Point Spread Functions,
Adam Greengard, Rafael Piestun; Univ. of Colorado, USA.
We evaluate the Fisher information of rotating point spread functions with respect to depth and show that it exceeds that of a standard system. These findings are applied to depth estimation from 2-D images.

CMA2 • 8:20 a.m.
Aperture Coding for Three Dimensional Beamforming,
Timothy J. Schulz, Michael Roggemann, Baoyong Liu; Michigan Tech, USA.
The problem of maximizing the weighted-integrated-intensity of a beam over a three-dimensional volume is considered for both homogeneous and inhomogeneous media.

CMA3 • 8:40 a.m. (Invited)
Fisher-Information-Based Performance Bounds of Certain Integrated Imaging Systems,
Sudhakar Prasad; Univ. of New Mexico, USA.
Integrated, computational imaging systems are designed to maximally exploit system trade-offs for improved image quality. Applications of Fisher information to characterize the performance upper bounds of three specific integrated imaging systems will be discussed.

CMA4 • 9:20 a.m.
Information Content of the Near-Field: Three-Dimensional Samples,
David G. Fischer[1], Marius Asipauskas[1], Richard A. Franzin[2], P. Scott Carney[2]; [1]Microgravity Science Div., NASA Glenn Res. Ctr., USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA.
The information content of the near-zone scattered field, for the case of a holographic measurement geometry, is examined using the variance of the least squares estimate of the susceptibility. Several examples will be presented.

CMA5 • 9:40 a.m.

Performance Metric for Multi-Aperture Computational Imaging Sensor,
Vikrant Bhakta, Marc P. Christensen; Southern Methodist Univ., USA.
Determining the effective MTF, SNR and Sensor geometries of multi-aperture computational imaging architectures will allow the National Image Interpretability Rating Scale to be applied to computational imagers. An approach for determining these values is presented.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

10:30 a.m.–12:30 p.m.
JMA • Joint COSI/SRS Session [see Joint section]

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

Room: Poplar
1:30 p.m.–3:30 p.m.
CMB • Thin Imaging
Joseph Mait; ARL, USA, Presider

CMB1 • 1:30 p.m. (Invited)
Imaging Using Alternate Point Spread Functions: Lenslets with Pseudo-Random Phase Diversity,
Mark Allen Neifeld, Amit Ashok; Univ. of Arizona, USA.
An optical imaging system's resolution can often be limited by the detector array instead of the optics. We present alternate non-impulse like optical point spread functions that overcome the distortions introduced by the detector array.

CMB2 • 2:10 p.m.
Ultra-Thin Folded Imager,
Eric J. Tremblay[1], Joel Rutkowski[2], Inga Tamayo[2], Ronald A. Stack[3], Rick L. Morrison[3], Donald Combs[4], John Mader[4], Hyo-Chang Kim[1], Uriel Levy[1], Yeshaiahu Fainman[1], Joseph E. Ford[1]; [1]Univ. of California at San Diego, USA, [2]CDM Optics, Inc., USA, [3]Distant Focus Corp., USA, [4]Fresnel Technologies, Inc., USA.
We present the optical design of a wavefront coded ultra-thin visible-light camera with 35 mm focal length, 0.12 radian field of view, and 0.7 numerical aperture; folded into a 5 mm total physical track.

CMB3 • 2:30 p.m.
Compressive Optical MONTAGE Photography Initiative: Noise and Error Analysis,
David J. Brady[1], Michael A. Fiddy[2], Umer Shahid[2], Thomas J. Suleski[2]; [1]Duke Univ., USA, [2]Univ. of North Carolina, USA.
High resolution images are calculated from sub-Nyquist sampled data. The COMP-I program uses focal plane coding to set sub-bandlimited sampling. An analysis of this approach to noise and alignment errors is presented.

CMB4 • 2:50 p.m.
Form Factor Enhancement of Imaging Systems Using a Cubic Phase Mask,
Manjunath Somayaji, Marc P. Christensen; Southern Methodist Univ., USA.
A wavefront encoding technique for achieving flat form factor imaging sensors is presented. The resultant configuration maintains the light gathering ability of a baseline bulky system and has improved angular resolution over a micro-lens approach.

CMB5 • 3:10 p.m.
Adaptive Flat Micro-Mirror Array-Based Computational Imaging Architecture,
Michael Haney[1], Marc P. Christensen[2], Dinesh Rajan[2], Scott C. Douglas[2], Sally L. Wood[3]; [1]Univ. of Delaware, USA, [2]Southern Methodist Univ., USA, [3]Santa Clara Univ., USA.

A thin, agile, multi-resolution, computational imaging sensor architecture, termed PANOPTES, which utilizes arrays of MEMS micro-mirrors to adaptively redirect the fields-of-view of multiple low-resolution sub-imagers, is described. An information theory-based super-resolution algorithm restores the image.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

Room: Poplar
4:00 p.m.–6:00 p.m.
CMC • Optical Elements and System Testing
Thomas J. Suleski; Univ. of North Carolina at Charlotte, USA, Presider

CMC1 • 4:00 p.m. (Invited)
Phase-Space Representations for Phase-Engineering,
Jorge Ojeda-Casteneda; Univ. of the Americas, Mexico.
We discuss the use of Phase-Space representations for designing annularly distributed phase-only filters, which increase the depth of field and the tolerance to spherical aberration.

CMC2 • 4:40 p.m.
Diffractive Generation of Non-Redundant Images for a Multi-Aperture, Thin, High-Resolution Camera,
Joseph N. Mait[1], Dennis W. Prather[2], David J. Brady[3]; [1]ARL, USA, [2]Univ. of Delaware, USA, [3]Duke Univ., USA.
We designed a diffractive element for generating shift-encoded images in a thin, multiplexed imaging system. We present simulations to validate the element's use for high resolution imaging and preliminary experimental results of diffractive image replication.

CMC3 • 5:00 p.m.
Testbed for Investigating a Distributed Imaging Algorithm,
Rick L. Morrison[1], Ronald A. Stack[1], Mark A. Neifeld[2], William Hasenplaugh[2]; [1]Distant Focus Corp., USA, [2]Univ. of Arizona, USA.
A large imaging sensor array was designed and constructed to investigate a practical implementation of a distributed imaging algorithm. Using a subset of forty sensors, we demonstrated resolution enhancement exceeding that of an individual sensor.

CMC4 • 5:20 p.m. (Invited)
Imaging Properties of Three-Dimensional Pupils,
George Barbastathis; MIT, USA.
Three-dimensional pupils present new opportunities for optical design, including controlled shift variance, depth selectivity, and dispersion. We present analytical and numerical studies of the impulse response of 3-D pupils and discuss implications for computational imaging.

Room: Cypress
6:00 p.m.–8:00 p.m.
COSI/SRS Conference Reception

TUESDAY, JUNE 7, 2005

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

Room: Poplar
8:00 a.m.–10:00 a.m.
CTuA • Defense and Security

Timothy Schulz; Michigan Tech. Univ., USA, Presider

CTuA1 • 8:00 a.m. (Invited)
Military Imaging System Performance Models,
Ronald Driggers; NVL, USA.
Abstract not available.

CTuA2 • 8:40 a.m. (Invited)
Target Detection and Discrimination through Active Multispectral Polarimetric Imaging,
Mehdi Alouini; Thales Res. & Technology, France.
We show how active polarimetric-multispectral-imaging significantly enhances target detection and discrimination capabilities. In this framework, we demonstrate that, the optimal representation of polarimetric images is ruled by the coherency characteristics of the illumination.

CTuA3 • 9:20 a.m. (Invited)
Plenary Speaker,
Ronald Coifman; Yale Univ., USA.
Abstract not available.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

Room: Cypress
10:00 a.m.–4:00 a.m.
Exhibit Open

Room: Poplar
10:30 a.m.–12:30 p.m.
CTuB • Microscopy
Michael A. Fiddy; Univ. of North Carolina, USA, Presider

CTuB1 • 10:30 a.m. (Invited)
Image Reconstruction in Optical Tomography: Beyond the Diffusion Approximation,
John Schotland; Univ. of Pennsylvania, USA.
We review recent progress on the development of inverse scattering methods for the radiative transfer equation. Applications to the image reconstruction problem in optical tomography are described.

CTuB2 • 11:10 a.m.
Computational Hyperspectral Microscopy in Biomedicine: Studies of Brain Function,
Douglas J. Fox, Jr., Thomas A. Woolsey, Chrysanthe Preza, Joseph A. O'Sullivan, Hana Tysver Velde, William H. Smith; Washington Univ., USA.
We use hyperspectral interferometric microscopy to visualize blood vessels and neural functional response in rat brain whisker barrel cortex. We illustrate the interdependence of hyperspectral microscopy sensors and algorithms to detect and visualize biological events.

CTuB3 • 11:30 a.m.
Variable Coherence Scattering Microscopy,
Erwan Baleine, Aristide Dogariu; College of Optics and Photonics: CREOL & FPCE, USA.
We propose and demonstrate a new optical microscopic technique that uses light with variable spatial coherence for determining the structure of a scattering medium. This technique requires recording the intensity scattered in only one direction.

CTuB4 • 11:50 a.m.
Using Near-Field Statistics for Interface Characterization,

Adela M. Apostol[1], Aristide Dogariu[1], Sara Landau[2]; [1]CREOL, Univ. of Central Florida, USA, [2]South Dakota State Univ., USA.
The first- and second-order statistical properties of intensity in the near-field of random media are investigated. It is found that specific experimental configurations are needed to relate intensity statistics to statistical properties of physical interface.

CTuB5 • 12:10 p.m.
Near-Field Inverse Scattering: The Current State of Theory and Experiment,
P. Scott Carney[1], John C. Schotland[2]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Univ. of Pennsylvania, USA.
We will discuss the forward problem and recent progress in the theory of inverse scattering for various modalities of near-field optics. Experimental demonstration will be presented and ongoing efforts in experimental realization will be discussed.

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

Room: Poplar
1:30 p.m.–3:30 p.m.
CTuC • Spectroscopy and Novel Sensors
Mark Allen Neifeld; Univ. of Arizona, USA, Presider

CTuC1 • 1:30 p.m.
Near-Field Scanning Optical Tomography,
Jin Sun[1], Paul Scott Carney[1], John C. Schotland[2]; [1]Univ. of Illinois, USA, [2]Univ. of Pennsylvania, USA.
We present the theoretical foundation for near-field scanning optical tomography. We analyze the forward problem for various experimental modalities and derive unique solution to the inverse problem. This work enables 3D imaging with subwavelength resolution.

CTuC2 • 1:50 p.m.
Multimodal, Multiplex Raman Spectrometer for Weak, Incoherent Sources,
Michael E. Gehm, Scott T. McCain, Yanqia Wang, Nikos P. Pitsianis, David J. Brady; Duke Univ. Fitzpatrick Ctr. for Photonics, USA.
Raman spectroscopy in bio-materials is complicated by fluorescence and scattering. We have developed a multimodal, multiplex spectrometer that overcomes these difficulties. We are currently constructing a second generation prototype for in-vivo Raman spectroscopy of tissue.

CTuC3 • 2:10 p.m.
Multitaper Methods for Spectrum Estimation with a Rotational Shear Interferometer,
Kyle Lepage, Shawn Kraut; Queens Univ., Canada.
Multitaper spectral estimation is used in determining the direction of incident flux and the temporal spectrum of unresolved sources imaged by a rotational shear interferometer. The results are compared to conventional techniques.

CTuC4 • 2:30 p.m.
Multiplex Design for High-Performance Microspectrometers,
Amanda E. Peters, Michael E. Gehm, Bob D. Guenther, David J. Brady; Duke Univ. Fitzpatrick Ctr. for Photonics, USA.
The volume of spectrometers can be drastically reduced through the use of multiplex measurement. Reductions of 3-5 orders of magnitude are possible. This has the potential to drastically effect manufacturing and deployment costs.

CTuC5 • 2:50 p.m.
Compact Spectral Diversity Filters for Diffuse Source Spectroscopy Using Spherical Beam Volume Holograms,

Chaoray Hsieh[1], Omid Momtahan[1], Arash Karbaschi[1], Ali Adibi[1], David J. Brady[2]; [1]Georgia Tech, USA, [2]Duke Univ., USA.
We describe a new class of compact spectral diversity filters implemented using spherical beam volume holograms. Spectral diversity is improved by rotation multiplexing technique. Diffuse source spectroscopy enabled by using Fourier transform architecture is demonstrated.

CTuC6 • 3:10 p.m.
Large Area Pyroelectric Motion Tracking System,
Mohan Shankar, David B. Jones, Russell G. Swagart, John B. Burchett, Bob D. Guenther, Steve D. Feller, David J. Brady; Duke Univ. Fitzpatrick Ctr. for Photonics, USA.
Simple pyroelectric detectors and structured apertures are used to monitor motion in an area and report location and velocity of objects moving through the monitored area.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

4:00 p.m.–6:00 p.m.
JTuA • Joint COSI/IP Session [see Joint section]

6:00 p.m.–7:30 p.m.
Dinner Break (on your own)

Room: Poplar
7:30 p.m.–9:00 p.m.
CTuD • COSI Panel Discussion: Technology Transfer and Commercialization of Computational Sensors
Abhijit Mahalanobis; Lockheed Martin, MFC, USA, Presider

CTuD1 • 7:30 p.m. **(Invited)**
Panel Participant,
Ed Dowski; CDM Optics, USA.

CTuD2 • 7:30 p.m. **(Invited)**
Panel Participant,
Michael Feldman; Digital Optics Corp., USA.

CTuD3 • 7:30 p.m. **(Invited)**
Panel Participant,
Michael Sullivan; Centice Corp., USA.

CTuD4 • 7:30 p.m. **(Invited)**
Panel Participant,
Keith Fife; Stanford Univ., USA.

CTuD5 • 7:30 p.m. **(Invited)**
Panel Participant,
Ron Stack; Distant Focus Corp., USA.

SIGNAL RECOVERY AND SYNTHESIS

MONDAY, JUNE 6, 2005

Ballroom Foyer

7:00 a.m.–5:30 p.m.
Registration Open

Room: Dogwood
8:00 a.m.–10:00 a.m.
SMA • Scattering and Biological Imaging
Peter Doerschuk; Purdue Univ., USA, Presider

SMA1 • 8:00 a.m. (Invited)
Synthesis of Strongly Scattering Structures,
Michael A. Fiddy[1], Andrey Kanaev[1], Umer Shahid[1], Markus Testorf[2]; [1]Univ. of North Carolina, USA, [2]Dartmouth College, USA.
A nonlinear filtering technique for inverse scattering is applied to the structure synthesis problem. The method is used with data from known structures to modify their scattering characteristics.

SMA2 • 8:40 a.m.
Computing the 3-D Structure of Viruses from Electron Microscope Images,
Junghoon Lee[1], Yili Zheng[1], Peter C. Doerschuk[1], Jinghua Tang[2], John E. Johnson[2]; [1]Purdue Univ., USA, [2]Dept. of Molecular Biology, Scripps Res. Inst., USA.
Statistical methods for computing multiple 3-D reconstructions from cryo electron microscope images (noisy 2-D projections in unknown orientations) of mixtures of assembly mutants of Cowpea Chlorotic Mottle virus are described.

SMA3 • 9:00 a.m.
Three-Dimensional Shape-Based Imaging in Diffuse Optical Tomography Using Spherical Harmonics,
Gregory Boverman[1], Eric L. Miller[1], David A. Boas[2]; [1]Northeastern Univ., USA, [2]Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA.
We reconstruct polar three-dimensional shapes in Diffuse Optical Tomography using a basis of spherical harmonics. We also show how to efficiently compute the derivative of our measurement with respect to shape perturbations.

SMA4 • 9:20 a.m.
Recovery of Myosin Filament Positions in Muscle Electron Micrographs,
Rick P. Millane, Chun Hong Yoon, Philip J. Bones; Univ. of Canterbury, New Zealand.
Location of myosin filaments in electron micrographs of muscle cross-sections is difficult because of contrast variations and noise. Two algorithms that incorporate a priori information in the solution in different ways are described and compared.

SMA5 • 9:40 a.m.
Blur Identification Using Image Features,
Philip Bones[1], Rick P. Millane[1], Timo R. Bretschneider[2]; [1]Univ. of Canterbury, New Zealand, [2]Nanyang Technological Univ., Singapore.
Two forms of deconvolution are applied to estimate the line spread function (a projection of the PSF) from image features able to be modelled by a combination of two step functions.

Room: Cypress
10:00 a.m. –10:30 a.m.
Coffee Break

10:30 a.m. –12:30 p.m.
JMA • Joint COSI/SRS Session [see Joint section]

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

Room: Dogwood
1:30 p.m.–3:30 p.m.
SMB • Image Reconstruction and Interferometry
Brian Thelen; General Dynamics, USA, Presider

SMB1 • 1:30 p.m. (Invited)
Resolution and Its Enhancements in Imaging,
Peyman Milanfar; Univ. of California at Santa Cruz, USA.
We present a definition and analysis of the concept of resolution and its enhancement in imaging based on statistical detection and estimation. We also present solutions to the problem of Super-resolution.

SMB2 • 2:10 p.m.
Correcting Color Images for Stray-Light Effects by Computationally Solving an Inverse Problem via Selected-Ordinate Image (SORI) Processing,
Peter A. Jansson[1], Burak Bitlis[2], Jan P. Allebach[2]; [1]Univ. of Arizona, USA, [2]Purdue Univ., USA.
Even small amounts of stray light adversely affect digital-camera color fidelity. We correct camera images by using a particular generalized point-spread function normalization and shift-variant convolution that is much faster than Fourier-based methods.

SMB3 • 2:30 p.m.
Imaging with Aperture Synthesis Radio Telescopes in the Presence of Direction Dependent Effects,
S. Bhatnagar, T. J. Cornwell, K. Golap; Natl. Radio Astronomy Observatory, USA.
We describe in this paper results from our work so far in developing algorithms to solve for and fast application of direction dependent effects while imaging with interferometric radio telescopes.

SMB4 • 2:50 p.m.
A Novel Reconstruction Method for Weak-Phase Optical Interferometry,
Serge Meimon, Laurent M. Mugnier, Guy Le Besnerais; ONERA, France.
Current optical interferometers are affected by unknown turbulent phases. We account for this lack of phase information by introducing aberration parameters, and solve the image reconstruction problem by minimizing an original regularized criterion.

SMB5 • 3:10 p.m.
Complimentary Compensation in the Presence of Fixed Aberrations,
Thomas Zaugg, Richard Paxman; General Dynamics, USA.
Image restoration in a sparse-aperture optical system with fixed aberrations can be improved by actuating between frames so as to eliminate nulls in the original MTF which otherwise cause the noise to become amplified.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

Room: Dogwood
4:00 p.m.–6:00 p.m.
SMC • Image and Phase Restoration
Philip Bones; Univ. of Canterbury, New Zealand, Presider

SMC1 • 4:00 p.m.
Iterative Methods for the Reconstruction of LINC-NIRVANA Images,
Anconelli Barbara[1], Bertero Mario[1], Boccacci Patrizia[1], Carbillet Marcel[2], Lanteri Henri[2]; [1]DISI - Univ. di Genova, Italy, [2]LUAN - Univ. de Nice, France.
The Large Binocular Telescope (LBT) will require routinely the use of multiple-image deconvolution methods.We present the methods and software we have developed for this data reduction problem.

SMC2 • 4:20 p.m.

Regularization, Support Constraints and Noise Reduction in Images—A Cramér-Rao Bound Analysis,
Charles L. Matson, Charles C. Beckner, Jr.; AFRL, USA.
Support constraints can result in noise reduction inside the support of images reconstructed by algorithms that employ deconvolution. The effects of regularization on this noise reduction are analyzed using a Cramér-Rao lower bound approach.

SMC3 • 4:40 p.m.
Artifacts, Bias and Secondary Super-Resolution,
David W. Tyler[1], Charles L. Matson[2]; [1]Univ. of Arizona, USA, [2]AFRL, USA.
We have previously defined "primary" and "secondary" super-resolution phenomena, differing in bias in the resulting image. Here, we demonstrate artifacts resulting from biased super-resolution and discuss its relevance to bandwidth extension by data inversion.

SMC4 • 5:00 p.m.
Nonlinear Reconstruction of Fizeau Fourier Transform Imaging Spectroscopy Data Cubes,
Samuel T. Thurman, James R. Fienup; Inst. of Optics, USA.
Fizeau Fourier transform imaging spectroscopy (FTIS) yields spectral image cubes with missing low spatial frequencies. These spatial frequencies are reconstructed from normal panchromatic imagery, a model for the missing data, and a nonlinear algorithm.

SMC5 • 5:20 p.m.
Iterative Phase Retrieval in Phase-Space,
Markus E. Testorf; Dartmouth College, USA.
Iterative phase retrieval methods are reinterpreted in terms of the Wigner distribution. A deterministic scheme is presented to apply phase retrieval algorithms developed for Fourier data to any first order optical system without change.

SMC6 • 5:40 p.m.
Phase Recovery and the Ambiguity Function,
Markus E. Testorf; Dartmouth College, USA.
Various techniques for determining phase information are interpreted in terms of the ambiguity function. It is shown that this facilitates the comparison of different methods and promotes the development of novel phase retrieval schemes.

Room: Cypress
6:00 p.m.–8:00 p.m.
COSI/SRS Conference Reception

INFORMATION PHOTONICS

TUESDAY, JUNE 7, 2005

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

Room: Dogwood
8:00 a.m.–10:00 a.m.
ITuA • Coherent Optical Information Processing
George Barbastathis; MIT, USA, Presider

ITuA1 • 8:00 a.m. (Invited)
GPC-Based Optical Manipulation,
Jesper Glückstad; Risø Natl. Lab, Denmark.

The Generalized Phase Contrast (GPC) method enables conversion of phase-only modulation to highly photon efficient light distributions. GPC targets a number of applications such as interactive optical manipulation, wavefront sensing, optical encryption and integrated micro-optics.

ITuA2 • 8:40 a.m.
Phase Signal Embedment in Densely Frequency-Multiplexed Coherent Neural Networks,
Amornrat Limmanee, Sotaro Kawata, Akira Hirose; Univ. of Tokyo, Japan.
We propose a coherent neural network whose synaptic weights are embedded densely in volume hologram. Experiments demonstrate that the system learns different output phase values dependently on the carrier frequency.

ITuA3 • 9:00 a.m.
Demonstration of a Broadband Microwave Imager Using Spectral Hole Burning as a Narrowband Image Sieve,
Benjamin Braker, Youzhi Li, Friso Schlottau, Donghua Gu, Kelvin Wagner; Univ. of Colorado, USA.
We present broadband microwave imaging that uses Fourier optical beamforming to project squinted broadband images into a spectral hole burning material from which independent narrowband images are read, de-squinted, and summed into broadband microwave images.

ITuA4 • 9:20 a.m.
Optical Accumulator for Signal Processing,
Aaron Cole[1], Azad Siahmakoun[1], Sergio Granieri[1], Mohammad Sayeh[2]; [1]Rose-Hulman Inst. of Technology, USA, [2]Southern Illinois Univ., USA.
An optical fiber accumulator is designed and experimentally demonstrated for different accumulation rates. The design is based on an optical-fiber loop resonator. Excellent agreement between theory and experiment is obtained for 1.8 MHz sampling rate.

ITuA5 • 9:40 a.m.
Doppler LIDAR Processing in Spatial Spectral Holograms,
Friso Schlottau, Youzhi Li, Kelvin H. Wagner; Univ. of Colorado, USA.
We present a novel technique for range-Doppler LIDAR processing which uses the parallel recording of Doppler-matched, high-bandwidth (>10 GHz), spatial-spectral holographic gratings, which are subsequently read with a chirped laser and post-processed.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

Room: Cypress
10:00 a.m.–4:00 p.m.
Exhibit Open

Room: Dogwood
10:30 a.m.–12:30 p.m.
ITuB • Optical Memory
Sadik C. Esener; ECE Dept., Univ. of California at San Diego, USA, Presider

ITuB1 • 10:30 a.m. (Invited)
High Performance Holographic Data Storage,
Kevin Curtis; InPhase, USA.
Polytopic-angle multiplexing implemented in a phase conjugate architecture enables high-density storage. Using blue media, 100Gb/in2 density, an operational prototype, and a roadmap to 1.6TB per disk are presented.

ITuB2 • 11:10 a.m.
Three-Dimensional Optical Recording in a Human Fingernail,

Akihiro Takita[1], Hirotsugu Yamamoto[1], Yoshio Hayasaki[1], Nobuo Nishida[1], HirPoplari Misawa[2]; [1]Dept. of Optical Science and Technology, Univ. of Tokushima, Japan, [2]Res. Inst. for Electronic Science, Hokkaido Univ., Japan.
Optical storage inside a human fingernail is performed. A bit is recorded by irradiating of a femtosecond laser pulse and the bit is read by use of increased fluorescence at the formed bit.

ITuB3 • 11:30 a.m.
Nanophotonic Memory-Based Computation Using Optical NearField Interactions,
Makoto Naruse[1], Tadashi Kawazoe[2], Suguru Sangu[3], Kiyoshi Kobayashi[4], Motoichi Ohtsu[5]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]Japan Science and Technology Agency, Japan, [3]Ricoh Co. Ltd., Japan, [4]Tokyo Inst. of Technology, Japan, [5]Univ. of Tokyo, Japan.
We propose and demonstrate a memory-based computation architecture combining data summation and broadcast mechanisms using optical near-field interactions between quantum dots, which will allow high-density integration beyond the diffraction-limit of light.

ITuB4 • 11:50 a.m.
Comparison of Least-Square Equalization and Iterative Decision Feedback in Page-Oriented Optical Data Storage,
Tawei Ho, Nopparit Intharasombat, Alexander A. Sawchuk; Univ. of Southern California, USA.
We compare bit-error rate in least square adaptive equalization and iterative decision feedback data detection methods for volumetric (3-D) page-oriented optical data storage (PODS) systems with extreme intersymbol interference (ISI) in novel hexagonal coordinate systems.

ITuB5 • 12:10 a.m.
Improvement on Recording Density in Reflection-Type Holographic Memory with Random Phase Shift Multiplexing,
Osamu Matoba, Yuji Yokohama, Kouichi Nitta, Takeaki Yoshimura; Kobe Univ., Japan.
Recording density of a reflection-type holographic memory system can be improved by use of random phase shift multiplexing. A recording interval of 1.0 μm was achieved in a 0.5mm thick Fe:$LiNbO_3$.

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

Room: Dogwood
1:30 p.m.–3:30 p.m.
ITuC • Optofluidics
Ravindra A. Athale; DARPA, USA, Presider

ITuC1 • 1:30 p.m. (Invited)
Photonic Crystal Biosensors,
Brian Cunningham; Univ. of Illinois at Urbana-Champaign, USA.
Photonic crystals have been used to produce a general-purpose disposable plastic biosensor platform for performing many types of biochemical and cellular assays without the use of fluorescent labels for applications in pharmaceutical research.

ITuC2 • 2:10 p.m.
Optofluidics,
David Erickson, James R. Adleman, Baiyang Li, Ye Pu, Troy Rockwood, Demetri Psaltis; Caltech, USA.
Optofluidics seek to take advantage of recent advancements in micro- and nano-scale fluidics to deliver liquids directly into the optical structures thereby enabling a new class of tunable optical devices.

ITuC3 • 2:30 p.m.
Laser Tweezer Controlled Optical Spatial Filtering,
Aaron L. Birkbeck, Sanja Zlatanovic, Sadik C. Esener; Univ. of California at San Diego, USA.

We present an optical spatial filtering device, integrated into a microfluidic system, and controlled by a laser tweezer. Optical spatial filtering is achieved through automatic aligning in three-dimensions to the focus of the laser beam.

ITuC4 • 2:50 p.m.
Dynamically Adjustable Annular Laser Trapping for Sperm Chemotaxis Study,
Bing Shao, Jaclyn Vinson, Elliot L. Botvinick, Deqiang Song, Sanja Zlatanovic, Sadik C. Esener, Michael W. Berns; Univ. of California at San Diego, USA.
A diameter-adjustable annular laser trapping system based on axicons was designed for sperm chemotactaxis and fertilizability characterization. Experiment on microspheres testified the feasibility and performance of the system and was consistent with theoretical expectation.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

4:00 p.m.–6:00 p.m.
JTuB • Joint AO/SRS Session [see Joint section]

7:30 p.m.–8:50 p.m.
JTuC • Joint AO/SRS Session [see Joint section]

WEDNESDAY, JUNE 8, 2005

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

Room: Dogwood
8:00 a.m.–10:00 a.m.
IWA • Active IP Devices
El-Hang Lee; INHA Univ., Republic of Korea, Presider

IWA1 • 8:00 a.m. (Invited)
Electrically Injected Photonic Crystal Lasers,
Yong Hee Lee, Hong-Gyu Park; KAIST, Republic of Korea.
Experimental characteristics high-Q single-cell photonic crystal laser modes are discussed. Especially the resonant mode with a central node, where the a small electrical wire at the center does not produce appreciable optical losses, is investigated.

IWA2 • 8:40 a.m.
Optical Image Inversion and Edge Detection Based on Vertical Cavity Semiconductor Optical Amplifiers (VCSOAs),
Haijiang Zhang[1], Deqiang Song[1], Pengyue Wen[1], Sadik Esener[1], Anis Husain[2]; [1]Univ. of California at San Diego, USA, [2]Ziva Corp., USA.
We demonstrate optical image inversion and edge detection by employing a VCSOA in the focal plane of a 4-f optical system to manipulate both phase and amplitude of the zero-order spatial frequency component of images

IWA3 • 9:00 a.m.
Wavelength Division Multiplexer Based on Photonic Crystal Filters Integrated into Silicon-on-Insulator Waveguides,
Hui Shen, Siddhartha Banerjee, David Klotzkin; Univ. of Cincinnati, USA.

A photonic crystal filter in silicon-on-insulator is designed and simulated by finite-difference time-domain method, and fabricated. Based on this, a wavelength division demultiplexer occupying only 500 μm^2 based on this filter is designed and simulated.

IWA4 • 9:20 a.m.
High-Bandwidth, Unity Probability-of-Intercept RF Spectrum Analyzer Based on Spectral Hole Burning,
Max Colice, Friso Schlottau, Kelvin Wagner; Univ. of Colorado, USA.
We perform 20-GHz spectrum analysis with unity probability-of-intercept by burning holes into a spectral-hole-burning crystal with an RF-modulated laser and probing the altered absorption profile with a chirped laser.

IWA5 • 9:40 a.m.
Implementation of Quantum Computation Algorithm Based on Spatial Coding,
Naoya Tate, Yusuke Ogura, Jun Tanida; Graduate School of Information Science and Technology, Osaka Univ., Japan.
Spatial coding is studied as an alternative implementation method of quantum computation algorithms. Intensity and phase of the cells represent quantum information. We confirmed correct operation by computer simulation and demonstrated an optical implementation experimentally.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

Room: Cypress
10:00 a.m.–4:00 p.m.
Exhibit Open

Room: Dogwood
10:30 a.m.–12:10 p.m.
IWB • Passive IP Devices
John O'Brien; Univ. of Southern California, USA, Presider

IWB1 • 10:30 a.m. (Invited)
Left-Handed Materials,
David R. Smith, David Schurig; Duke Univ., USA.
We summarize the benefits that negative index materials (NIMs), realizable in artificially constructed metamaterials, can have on both geometrical and wave optics. NIMs may lead to novel or improved future optical devices.

IWB2 • 11:10 a.m.
Novel Slab Lens Based on Artificial Graded Index Medium,
Uriel Levy[1], Yeshaiahu Fainman[1], Ashok Krishnamoorthy[2], John Cunningham[2]; [1]Univ. of California at San Diego, USA, [2]Sun Microsystems, USA.
We present a novel slab lens based on artificial graded index medium. A graded index profile is achieved by gradually modifying the duty cycle of the subwavelength grating that is etched into the slab.

IWB3 • 11:30 a.m.
Reprogrammable Optical Phase Array (ROPA) for Use in an Agile All-Photonic Network,
Madeleine Mony[1], Eric Bisaillon[1], Ehab Shoukry[1], Andrew G. Kirk[1], David V. Plant[1], Keith W. Goossen[2]; [1]McGill Univ., Canada, [2]Univ. of Delaware, USA.
The design and simulation of a 1xN optical switch is presented. Sub-µs switching is achieved through a voltage-controlled optical phase array. Electrode voltages are provided by a high-voltage CMOS chip. Switching angles are within 2°.

IWB4 • 11:50 a.m.

Half-Horn and Parabola Shaped Electro-Optic Beam Deflectors,
Yiying Zuo[1], Babak Bahamin[1], Pierre L. Langlois[2], Vincent Aimez[2], David V. Plant[1]; [1]McGill Univ., Canada, [2]Univ. de Sherbrooke, Canada.
We report the design of two electro-optic deflectors. The half-horn and parabola shaped EO scanners provide deflection angles of 2.5° and 3.22° degrees. These are the largest angles reported to date for bulk effect EO scanners.

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

Room: Dogwood
1:30 p.m.–3:30 p.m.
IWC • IP Plenary
George Barbastathis; MIT, USA, Presider
Sadik C. Esener; ECE Dept., Univ. of California at San Diego, USA, Presider
Ashok Krishnamoorthy; Sun Microsystems Inc., USA, Presider

IWC1 • 1:30 p.m. (Invited)
Unified Theory of Polarization and Coherence and Some of Its Applications,
Emil Wolf; Univ. of Rochester, USA.
Account will be presented of a recently developed unified theory of polarization and coherence. Its usefulness will be illustrated by examples. It will be applied to elucidate effects of turbulent atmosphere on beam propagation.

IWC2 • 2:10 p.m. (Invited)
Limits to Photonics for Information,
David A. Miller; Stanford Univ., USA.
The talk will discuss some of the limits we know, and some we don't, and how these can influence what we can or should do in using photonics to help handle information.

IWC3 • 2:50 p.m. (Invited)
DARPA's Programs on Photonic Technologies and Applications,
Jagdeep Shah; DARPA, USA.
This talk will present an overview of DARPA/MTO's many challenging programs in the area of photonic technologies (e.g. nanophotonics, Silicon photonics and photonic integration) as well as photonic applications in communication, interconnection, switching and routing.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

Room: Dogwood
4:00 p.m.–6:00 p.m.
IWD • Interconnects I
Jurgen Jahns; Fern Univ., Germany, Presider

IWD1 • 4:00 p.m. (Invited)
New-Generation Interconnect,
Helmut Albrecht[1], Axel Beier[2], Peter Demmer[3], Martin Franke[3], Roland Mödinger[4], Karl Pfeiffer[5], Peter Beil[6], Jan Kostelnik[7], Jörg Bauer[8], Frank Ebling[8], Elmar Griese[9]; [1]Infineon Technologies AG, Germany, [2]Infineon Technologies Fiber Optics GmbH, Germany, [3]Siemens AG, Germany, [4]Erni Elektroapparate GmbH, Germany, [5]Micro Resist Technology GmbH, Germany, [6]Ilfa Feinstleitertechnik, Germany, [7]Würth Elektronik GmbH, Germany, [8]Fraunhofer IZM, Germany, [9]Univ. of Siegen, Germany.
A new-generation interconnect for optical backplane systems is presented transmitting data with electro-optical transceivers on processing boards via optical backplane board. All boards are based on printed circuit boards with integrated multimode polymer optical waveguides.

IWD2 • 4:40 p.m.
Optical Interconnect Demonstrator with Embedded Waveguides and Butt-Coupled Optoelectronic Modules,
Christoph Berger[1], René Beyeler[1], Roger Dangel[1], Laurent Dellmann[1], Folkert Horst[1], Tobias Lamprecht[1], Thomas Morf[1], Bert Jan Offrein[1], Fumiaki Yamada[2], Masaki Hasegawa[2], Hidetoshi Numata[2], Yoichi Taira[2]; [1]IBM Zurich Res. Lab, Switzerland, [2]IBM Tokyo Res. Lab, Japan.
Building blocks and experimental results of an optical card-backplane-card link with waveguides embedded into the boards and butt-coupled optoelectronic modules are presented. Important next steps for acceptance of the technology by system developers are listed.

IWD3 • 5:00 p.m.
PAM-4 Signaling over VCSELs Using 0.13µm CMOS,
John E. Cunningham, D. Beckman, D. Huang, T. Sze, K. Cai, A. V. Krishnamoorthy; Sun Microsystems, USA.
We present results for VCSEL links operating PAM-4 signaling using commercial CMOS technology. We perform link analysis of the Bit Error Rate, Q factor, random and deterministic jitter by measuring waterfall curves versus margining.

IWD4 • 5:20 p.m.
Merging Stacked and Planar-Integrated Free-Space Optics to Build a 3-D Optical Multilayer,
Manfred Jarczynski, Jürgen Jahns; Univ. of Hagen, Germany.
Stacked and planar-integrated free-space optics are well-known concepts for building compact free-space optics. Their combination offers additional degrees of freedom for systems design. We discuss possibilities and present a three-dimensional optical interface-module in a memory-bus-interconnect.

IWD5 • 5:40 p.m.
Free Space Adaptive Optical Interconnect, Using a Ferroelectric Liquid Crystal SLM for Beam Steering,
Charley Henderson, T. D. Wilkinson, D. Gil Leyva; Engineering Dept., Cambridge Univ., UK.
A free-space, board-to-board, adaptive optical interconnect demonstrator has been developed. Binary phase gratings displayed on a Ferroelectric Liquid Crystal Spatial Light Modulator are used to maintain data transfer at 1.25Gbps, given varying optical misalignment.

Room: Cypress
6:00 p.m.–8:00 p.m.
JWB • Joint AO/IP Poster Session/Conference Reception [see Joint section]

THURSDAY, JUNE 9, 2005

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

Room: Dogwood
8:00 a.m.–10:00 a.m.
IThA • Interconnects II
Christoph Berger; IBM Res., Switzerland, Presider

IThA1 • 8:00 a.m. (Invited)
2-D Optical Interconnects between CMOS ICs,
Olivier Rits[1], Ronny Bockstaele[1], Michiel De Wilde[1], Wim Meeuws[1], Hendrik Sergeant[1], Johan De Baets[1], Jan Van Campenhout[1], Roel Baets[1], François Dorgeuille[2], Sven Eitel[3], Michaela Klemenc[4], Richard Annen[5], Jan Van Koetsem[6], Jacques Goudeau[7], Baudouin Bareel[8], François Marion[9], Julien Routin[9]; [1]Ghent Univ. - IMEC, Belgium, [2]Alcatel CIT, France, [3]Avalon Photonics Ltd, Switzerland, [4]Albis

Optoelectronics, Switzerland, [5]Helix, Switzerland, [6]FCI, Netherlands, [7]Nexans Res. Ctr., France, [8]Nexans Cabling System, Belgium, [9]CEA-LETI, France.
We describe an optical interconnect demonstrator in which 2-D fiber ribbons directly interconnect digital CMOS ICs with flip-chip mounted VCSEL and detector arrays. Novel approaches are demonstrated for the optical interface to the CMOS package.

IThA2 • 8:40 a.m. (Invited)
Optical Interconnects: Terabus,
Jean Trewhella; IBM, USA.
Abstract not available.

IThA3 • 9:20 a.m.
Scaling VCSEL Reliability up to 250 Terabits/s of System Bandwidth,
John E. Cunningham[1], D. Beckman[1], D. McElfresh[1], C. Forrest[2], D. Cohen[2], A. V. Krishnamoorthy[1]; [1]Sun Microsystems, USA, [2]Sun HPCS, USA.
We evaluate VCSEL reliability for next-generation High Productivity Computers in which several hundreds of terabits of bandwidth are envisioned. VSCEL sparing, water-cooling and redundancy though percentage of link failures are analyzed.

IThA4 • 9:40 a.m.
Performance Analysis for a Waveguide Based Optical Interconnect System,
Deqiang Song, Matthias Gross, Christopher Marki, Sadik Esener; Univ. of California at San Diego, USA.
An analytical model for inter-channel crosstalk in a waveguide based optical interconnect system is established. The results show the dependence of the performance on the loss of the link and the dominant noise.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

Room: Cypress
10:00 a.m.–4:00 p.m.
Exhibit Open

Room: Dogwood
10:30 a.m.–12:30 p.m.
IThB • Interconnects III
Ashok Krishnamoorthy; Sun Microsystems Inc., USA, Presider

IThB1 • 10:30 a.m. (Invited)
CMOS-Compatible Photonics,
Barham Jalali, Prakash Koonath, Ozdal Boyraz, Dimitri Dimitropoulos, Varun Raghunathan, Teja Indukuri; Univ. of California at Los Angeles, USA.
CMOS boasts a combination of technological sophistication and mass production that is unparalled in the industrial age. This talk will review recent breakthroughs in silicon photonics that promise CMOS compatible lasers, optical amplifiers and wavelength converters.

IThB2 • 11:10 a.m. (Invited)
Modulating and Switching Light on a Silicon Chip,
Michal Lipson; Cornell Univ., USA.
We demonstrate electro-optic switching and modulation of light on a silicon chip. The modulators are microns in size and present 1.5 Gbit/sec modulation speed with 15dB modulation depth.

IThB3 • 11:50 a.m.
Scalable Optical Interconnection Network for Parallel and Distributed Computing,
Avinash K. Kodi, Ahmed Louri; Univ. of Arizona, USA.

In this paper, a high-performance, scalable, parallel computing system called RAPID is designed using switchless, passive optical interconnect technology. RAPID outperforms current electrical multiprocessor systems by significantly decreasing the remote memory access latency.

IThB4 • 12:10 p.m.
Architectural Limits on Optical Highway Interconnected Parallel Processing,
Gordon A. Russell, Andrew Nicholson, Keith J. Symington, John F. Snowdon; Heriot-Watt Univ., UK.
Optics are often suggested for interconnecting parallel processors. The minimum size of such a computer was found to be sixteen for a reducing sum and six for a fast Fourier transform due to architectural limits.

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

Room: Dogwood
1:30 p.m.–3:30 p.m.
IThC • Optical Processing for Fiber Communication
Frederick McCormick; Sandia Natl. Labs, USA, Presider

IThC1 • 1:30 p.m. (Invited)
All-Optical CDMA and Switching,
S. J. Ben Yoo; Univ. of California at Davis, USA.
Abstract not available.

IThC2 • 2:10 p.m.
Dispersion-Managed (3+1)-D Optical Solitons for Ultrafast Switching and Wavelength Conversion,
Lu Gao, Robert McLeod, Kelvin Wagner; Univ. of Colorado at Boulder, USA.
Dispersion management of bulk nonlinear materials for generating (3+1)-D optical solitons is achieved by use of negative dispersive mirrors. Ultrafast switching and wavelength conversion based on these dispersion managed solitons are proposed and demonstrated numerically.

IThC3 • 2:30 p.m.
Demonstration of All-Photonic Code Conversion in a Semiconductor Fiber Ring Laser for OCDMA Networks,
Reuven E. Gordon, Lawrence R. Chen; McGill Univ., Canada.
We demonstrate all-photonic code conversion for OCDMA network applications based on cross-gain modulation in a semiconductor fiber ring laser. The code converter translates weight four spectral sequences and is capable of providing 2R regeneration.

IThC4 • 2:50 p.m.
A Broadband PLL Solution for Burst-Mode Clock and Data Recovery in All-Optical Networks,
Alan B. Li, David V. Plant; McGill Univ., Canada.
Fast phase-locking PLLs are proposed as a new solution for recovery of burst-mode data. Modeling and circuit implementation have demonstrated phase-lock times on the order of tens of bits for data recovery at OC-48 rates.

IThC5 • 3:10 p.m.
On the Suitability of Fiber Optical Parametric Amplifiers for Agile Photonic Networks,
Nikolaos Gryspolakis, Lawrence R. Chen; Photonic Systems Group, McGill Univ., Canada.
We study the gain tilt and gain transients of fiber optical parametric amplifiers to determine their suitability and potential use in reconfigurable multi-wavelength WDM photonic networks.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

Room: Dogwood
4:00 p.m.–5:40 p.m.
IThD • Mesoscopic Devices
Joseph Mait; ARL, USA, Presider

IThD1 • 4:00 p.m. (Invited)
Nonlinear Optical and Opto-Mechanical Oscillators Based on Ultra-High-Q Microtoroids,
Kerry Vahala; Caltech, USA.
Micro-resonators on silicon having Q factors as high as 500 million are described, and then are used to demonstrate micro-Raman and parametric sources with sub-100 microWatt thresholds, as well as a novel radiation-pressure driven micro-mechanical oscillator.

IThD2 • 4:40 p.m.
Optical Delay Lines Formed by Circuits of Spherical Cavities with Coupled Whispering Gallery Modes,
Vasily N. Astratov, Andrey V. Kanaev, Shashanka P. Ashili, Jason P. Franchak, Wei Cai; Univ. of North Carolina at Charlotte, USA.
We propose a novel concept of optical delay lines where the tunable delay can be achieved by controlling the inter-resonator gap sizes in circuits of optically coupled microspheres.

IThD3 • 5:00 p.m.
Encapsulated Microsphere Arrays for Applications in Photonic Circuits,
Charles E. Sykes, Shashanka P. Ashili, Andrey V. Kanaev, Vasily N. Astratov; Ctr. for Optoelectronic and Optical Communications, USA.
This paper describes the fabrication, characterization and spectroscopic properties of novel structures made from prearranged circuits of optically coupled polystyrene microspheres in a robust elastomeric polymer.

IThD4 • 5:20 p.m.
Dynamic Optical Memory Based on Light Trapping in a Ring Resonator Using Asymmetric Grating Assisted Codirectional Couplers,
Mykola Kuloshov[1,2], Jacques M. Laniel[2], Nicolas Bélanger[2], David V. Plant[2]; [1]Adtek Photomask Inc., Canada, [2]McGill Univ., Canada.
We present a systematic study of an asymmetric switchable grating enabling the coupling between a waveguide and a ring resonator. The ring can act as an optical memory or as a pulse retiming device.

Room: Cypress
6:00 p.m.–8:00 p.m.
JWB • Joint AO/IP Poster Session/Conference Reception [see Joint section]

ADAPTIVE OPTICS: ANALYSIS AND METHODS

WEDNESDAY, JUNE 8, 2005

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

Room: Poplar
8:00 a.m.–9:40 a.m.
AWA • AO Modeling and Analysis I
Curt Vogel; Montana State Univ., USA, Presider

AWA1 • 8:00 a.m. (Invited)
Solving Propagation Problems in Turbulence Using Filter Functions and Mellin Transforms,

Richard Sasiela; MIT, USA.
Finding the solution to propagation problems through turbulence requires one to develop and evaluate an expression representing the quantity of interest for particular parameter ranges. Techniques to develop and evaluate the expression are described.

AWA2 • 8:40 a.m.
Analytical Modelling of Open-Loop and Closed-Loop Shack-Hartmann Based Adaptive Optics,
Rodolphe Conan, Jean-Marc Conan, Thierry Fusco; ONERA, France.
New AO modelling tools are required for next generation AO. The analytical model for Shack-Hartmann based AO is revisited and extended to the closed-loop case. It is then applied to Extreme AO and coronagraphy.

AWA3 • 9:00 a.m.
Disk Harmonic Functions for Adaptive Optics Simulations,
Norman Mark Milton, Michael Lloyd-Hart; Ctr. for Astronomical Adaptive Optics, USA.
We investigate the disk harmonic basis functions as an alternative to the Zernike basis functions and their application to fast, analytic adaptive optics simulations which require a large number of degrees of freedom.

AWA4 • 9:20 a.m.
Off-Axis Adaptive Optics with Optimal Control: Laboratory Validation,
Cyril Petit[1], Jean Marc Conan[1], Caroline Kulcsar[2], Henri-Francois Raynaud[2], Thierry Fusco[1], Joseph Montri[1]; [1]ONERA, France, [2]L2TI, Inst. Galilée, France.
We present a laboratory demonstration of open loop Off-Axis Adaptive Optics with optimal control. The control based on a Minimum Mean Square Error Estimator brings a significant performance improvement.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

Room: Cypress
10:00 a.m.–4:00 p.m.
Exhibit Open

10:30 a.m.–12:30 p.m.
JWA • Joint AO/COSI Session [see Joint section]

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

Room: Poplar
1:30 p.m.–3:10 p.m.
AWB • Wavefront Sensing I
Richard Lane; Univ. of Canterbury, New Zealand, Presider

AWB1 • 1:30 p.m. (Invited)
Wavefront Sensing in Strong Scintillation with a Self-Referencing Interferometer Wavefront Sensor,
Troy Rhoadarmer; AFRL, USA.
Recently the Starfire Optical Range has been developing a self-referencing interferometer wavefront sensor for applications requiring laser propagation in strong scintillation. This presentation describes the status of the development effort.

AWB2 • 2:10 p.m.
Optimization of the Pre-Compensation of Non-Common Path Aberrations for Adaptive Optics Systems,

Thierry Fusco[1], Cyril Petit[1], Gerard Rousset[1], Jean Francois Sauvage[1], Amandine Blanc[2], Jean Marc Conan[1], Jean Luc Beuzit[2]; [1]ONERA, France, [2]LAOG, France.
We present experiental results of a new procedure of measurement and pre-compensation of the AO non-common path aberrations. A significant Strehl ratio increase (from 70 to 90 % in R band) is demonstrated.

AWB3 • 2:30 p.m.
Aberrations Induced by Laser Guide Stars in Adaptive Optics,
Marcos A. van Dam, Antonin H. Bouchez, David Le Mignant; Keck Observatory, USA.
Laser guide stars are used to measure the wave-front in adaptive optics for astronomy. The wave front measured in this way differs from the true wave-front and the induced aberrations must be measured and compensated.

AWB4 • 2:50 p.m.
Scintillation and Phase Anisoplanatism in Shack-Hartmann Wavefront Sensing,
Clélia L. Robert, Jean-Marc Conan, Vincent Michau, Thierry Fusco, Nicolas Vedrenne; ONERA, France.
Turbulence phase and scintillation anisoplanatism limit the wave-front sensing precision on extended sources. An analytical expression of the error induced is given in the Rytov regime. The formalism is applied to a solar case observation.

Room: Cypress
3:30 p.m.–4:00 p.m.
Coffee Break

Room: Poplar
4:00 p.m.–5:40 p.m.
AWC • Wavefront Reconstruction and Control I
Glenn Tyler; Optical Sciences Co., USA, Presider

AWC1 • 4:00 p.m. (Invited)
Optimality, Observers and Controllers in Adaptive Optics,
Caroline Kulcsar; L2TI, Inst. Galilée, Univ. Paris 13, France.
Standard results from control theory provide a constructive solution to the residual phase variance minimization in classical or multiconjugate adaptive optics. A link is made between this state-space approach and classical linear controllers.

AWC2 • 4:40 p.m.
AO System Design for Direct Exo-Planet Detection on the VLT,
Thierry Fusco[1], Gerard Rousset[1], Jean Luc Beuzit[2], Rodolphe Conan[2], David Mouillet[2]; [1]ONERA, France, [2]LAOG, France.
In the frame of the VLT Planet-Finder project a global system study has demonstrated the feasability of an AO system for the direct detection of exoplanets. The main results of this design study are presented.

AWC3 • 5:00 p.m.
Optimal Control Law in State-Space Formalism for eXtreme Adaptive Optics,
Brice Le Roux[1], Marcel Carbillet[2]; [1]INAF, Italy, [2]LUAN, Nice Univ., France.
We apply a Kalman filter based control to XAO. We discuss the minimization of temporal errors, show the evolution of prediction errors with the order of the model and present simulations that quantify the gain.

AWC4 • 5:20 p.m.
Fourier Domain Preconditioned Conjugate Gradient Algorithm for Atmospheric Tomography,
Qiang Yang[1], Cutris R. Vogel[1], Brent L. Ellerbroek[2]; [1]Montana State Univ., USA, [2]Caltech, USA.
In this paper we introduce a new Fourier domain preconditioned conjugate gradient (FDPCG) algorithm for atmospheric tomography.We also compare FD-PCG performance with that of an existing multigrid preconditioned conjugate gradient algorithm.

Room: Cypress

6:00 p.m.–8:00 p.m.
JWB • Joint AO/IP Poster Session/Conference Reception [see Joint section]

THURSDAY, JUNE 9, 2005

Room: Poplar
8:00 a.m.–10:00 a.m.
AThA • Wavefront Reconstruction and Control II
Richard Sasiela; MIT, USA, Presider

AThA1 • 8:00 a.m. (Invited)
Control Theory and Adaptive Optics,
John Burns; Virginia Tech, USA.
Abstract not available.

AThA2 • 8:40 a.m.
Efficient, Adaptive Wave-Front Control for High-Order Adaptive Optics,
Lisa A. Poyneer[1], Jean-Pierre Veran[2]; [1]Lawrence Livermore Natl. Lab, USA, [2]Herzberg Inst. of Astrophysics, Canada.
Our wave-front control scheme for high-order Adaptive Optics involves efficient wave-front reconstruction, real-time optimization of the control system and control of multiple wave-front correctors.

AThA3 • 9:00 a.m.
Ground Layer Wavefront Reconstruction Using Dynamically Refocused Rayleigh Laser Beacons,
Christoph J. Baranec, Michael Lloyd-Hart, Mark Milton, Thomas Stalcup, Miguel Snyder, Nicole Putnam, Roger Angel; Ctr. for Astronomical Adaptive Optics, USA.
Experiments have been carried out at the MMT telescope to validate ground layer wavefront reconstruction using five dynamically refocused Rayleigh laser beacons. Here we quantify the wavefront improvement expected from ground layer adaptive optics correction.

AThA4 • 9:20 a.m.
Development of Multi-Laser Guide Star Adaptive Optics Techniques for Extremely Large Telescopes,
Michael Lloyd-Hart, Roger Angel, Christoph Baranec, Thomas Stalcup, Mark Milton, Miguel Snyder, Nicole Putnam; Steward Observatory, USA.
We outline ongoing work at the MMT telescope to develop altitude-conjugated adaptive optics using a constellation of laser guide stars. We describe how the new techniques will be applied to the planned Giant Magellan Telescope.

AThA5 • 9:40 a.m.
Stability of Closed-Loop Tomography Algorithms for Adaptive Optics,
Donald Gavel; Univ. of California at Santa Cruz, USA.
We present a class of algorithms for multi-conjugate (tomographic) adaptive optics wavefront controllers that are proven asymptotically stable in closed loop operation.

Room: Cypress
10:00 a.m.–10:30 a.m.
Coffee Break

Room: Poplar
10:30 a.m.–12:10 p.m.
AThB • AO Modeling and Analysis II
Michael Lloyd Hart; USA, Presider

AThB1 • 10:30 a.m. (Invited)

Assessment of Issues for Propagation through Strong Turbulence,
Glenn Tyler; Optical Sciences Co., USA.
The issues associated with propagation through strong turbulence are assessed in detail and techniques for ameliorating the degradation associated with these effects are identified.

AThB2 • 11:10 a.m.
Linear Systems Modeling and Evaluation of Adaptive Optics in the Spatial Frequency Domain,
Brent L. Ellerbroek; CELT Development Corp., USA.
We extend a recent paper on spatial frequency domain modeling of adaptive optics by describing how to evaluate a broader range of performance metrics at one or several field points in the AO system's field-of-view.

AThB3 • 11:30 a.m.
Simulation of SCAO and MOAO for an Extremely Large Telescope,
Miska Le Louarn, Christophe Verinaud, Visa Korkiakoski, Norbert Hubin; ESO, Germany.
We present results for two NGS AO systems for ELTs. We compare the performance of a single conjugate AO system on three telescope diameters (30,60,100m) and analyzed the performance of a Multi-object (or falcon-like) AO.

AThB4 • 11:50 a.m.
A Software Framework for Fast Adaptive Optics Control with Atmospheric Tomography,
Aron J. Ahmadia[1], Brent L. Ellerbroek[2]; [1]Illinois Inst. of Technology, USA, [2]CELT Development Corp., USA.
We have developed a software framework for the control of astronomical adaptive optics systems that employ tomographic wavefront reconstruction. The framework binds efficient parallel wavefront reconstructors to a generalized interface for simulations and algorithm analysis.

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

Room: Poplar
1:30 p.m.–3:10 p.m.
AThC • Wavefront Sensing II
Miska LeLouarn; ESO, France, Presider

AThC1 • 1:30 p.m. (Invited)
Curvature and Pyramid Sensing,
Richard Lane; Applied Res. Associates NZ Ltd., New Zealand.
This paper describes the common limitations imposed on all wavefront sensors which rely on a geometric optics model of wavefront propagation. The differences between open and closed loop operation are also discussed.

AThC2 • 2:10 p.m.
Characterization of PSF Reconstruction on a Shack-Hartmann Based System,
Damien Gratadour, Laurent M. Mugnier, Jean-Marc Conan; DOTA ONERA, France.
We present tests on simulations of the PSF reconstruction method on a Shack-Hartmann based system. We used an end-to-end AO simulation to test the approximations made and validate the method for available instruments.

AThC3 • 2:30 p.m.
Long Exposure Point Spread Function Estimation from Adaptive Optics Loop Data,
Jose Marino[1], Thomas Rimmele[2]; [1]New Jersey Inst. of Technology, USA, [2]Natl. Solar Observatory, USA.
We present a method to estimate the Long Exposure Point Spread Function of an AO corrected solar image using AO loop data. With this LEPSF image quality can be brought closer to diffraction limit level.

AThC4 • 2:50 p.m.

Polarization Effects in Coherence-Gated Wave-Front Sensing,
Markus Rueckel, Winfried Denk; Max-Planck Inst. for Medical Res., Germany.
Wave-front measurements by coherence-gated wave-front sensing depend on the polarization for scattering particles comparable to the wavelength. Due to polarization-dependent scattering spurious astigmatism appears for linearly polarized light but not for circularly polarized light.

JOINT SESSIONS

MONDAY, JUNE 6, 2005

Room: Poplar
10:30 a.m.–12:30 p.m.
JMA • Joint COSI/SRS Session
P. Scott Carney; Univ. of Illinois at Urbana-Champaign, USA, Presider

JMA1 • 10:30 a.m. (Invited)
Lensless Coherent Imaging with Shaped Illumination and Phase-Retrieval Image Reconstruction,
James R. Fienup; Inst. of Optics, Univ. of Rochester, USA.
One can decrease the complexity of imaging optics by increasing the demands on the illumination system or on post-detection computations. A lens-less coherent imaging system employing a shaped illumination pattern and phase retrieval is described.

JMA2 • 11:10 a.m. (Invited)
Extended-Resolution Reconstruction of Structured Illumination Microscopy Data,
Mats Gustafsson; Univ. of California at San Francisco, USA.
Microscope resolution can be extended through structured illumination followed by linear data processing. The possible resolution increase, determined by the highest spatial frequency of the effective illumination pattern, can be made theoretically infinite through nonlinearities.

JMA3 • 11:50 a.m.
Probing Random Media with Singular Beams,
Chaim Schwartz, Aristide Dogariu; College of Optics and Photonics: CREOL & FPCE, USA.
Optical fields containing phase singularities provide additional capabilities in studying random media. Coherent backscattering of such fields will be thoroughly discussed for the case of both double-pass geometries and volume scattering random media.

JMA4 • 12:10 p.m.
The Quantized Cosine Transform for Sensor-Layer Image Compression,
Nikos P. Pitsianis[1], David J. Brady[1], Xiaobai Sun[2]; [1]Duke Univ. Fitzpatrick Ctr., USA, [2]Dept. of Computer Science, Duke Univ., USA.
We introduce a compressive encoding at the sensor layer based on the quantized cosine transform. Compression at the physical layer of integrated imaging systems reduces the measurements-to-pixels ratio, the data volume and accelerates image estimation.

TUESDAY, JUNE 7, 2005

Room: Poplar
4:00 p.m.–6:00 p.m.
JTuA • Joint COSI/IP Session: Optical Imaging and Information
Kelvin Wagner; Univ. of Colorado, USA, Presider

JTuA1 • 4:00 p.m.
Feasible Light Fields in Three-Dimensional Space,
Rafael Piestun; Univ. of Colorado, USA.

I investigate the synthesis of light fields in 3D domains by means of a singular value decomposition of the objective signal. The number of effective 3D degrees of freedom determines the feasible fields.

JTuA2 • 4:20 p.m.
Rigorous Analysis of Strong Spherical Wave Gratings Using a Slice-and-Cascade Approach,
Zao Xu[1], Kehan Tian[1], Wenyang Sun[1,2], George Barbastathis[1], Mark A. Neifeld[2]; [1]MIT, USA, [2]Univ. of Arizona, USA.
We present a numerical approach to computing diffraction from strong holograms of arbitrary fringe shape, e.g. plane-to-spherical. We compute the angular, shift and wavelength Bragg selectivities and compare with coupled wave and weak diffraction approaches.

JTuA3 • 4:40 p.m.
Asynchronous Stream Cipher System Using Digital Smart Pixel Arrays,
Hiroshi Setoguchi, Rui Shogenji, Yusuke Ogura, Jun Tanida; Graduate School of Information Science and Technology, Osaka Univ., Japan.
An optoelectronic parallel processing system for asynchronous stream cipher has been constructed to demonstrate potential capability of free-space optical interconnections. Two digital smart pixel arrays are employed for generation of pseudorandom patterns and encryption.

JTuA4 • 5:00 p.m.
Numercal Simulation of Hyper-Spectral Volume Holographic Imaging Using Slice-and-Cascade Method,
Zao Xu, Wenyang Sun, Kehan Tian, George Barbastathis; MIT, USA.
We present the analysis of rainbow-illumination volume holographic hyper-spectral imaging using a slice-and-cascade numerical method. The experiments are in good agreement with the simulations.

JTuA5 • 5:20 p.m.
Diffraction-Limited Impulse Response Image Reconstruction with a Single Imaging Pixel,
Junpeng Guo, Andrew Portnoy, David J. Brady; Duke Univ., USA.
In this paper, we will discuss two techniques to reconstruct diffraction-limited impulse response images by sub-pixel shifting the photodetector array and measuring the signal from a specific large area photodetector pixel.

JTuA6 • 5:40 p.m.
Computer Generated Volume Holograms: Design and Fabrication,
Wenjian Cai, Rafael Piestun; Univ. of Colorado, USA.
We discuss coding techniques for computer-generated volume holograms and present experimental results of holograms embedded in glass fabricated with a femtosecond laser.

Room: Dogwood
4:00 p.m.–6:00 p.m.
JTuB • Joint AO/SRS Session: Signal Recovering in Adaptive Optics I
Julian Christou; Univ. of California at Santa Cruz, USA, Presider

JTuB1 • 4:00 p.m. (Invited)
Post-Coronagraph Wavefront Sensing Using Pupil Imaging and Phase-Diversity,
Joseph J. Green, Albert F. Niessner, Stuart B. Shaklan; Jet Propulsion Lab, USA.
We present an efficient wavefront sensing approach for coronagraphic imaging systems. By measuring the pupil intensity after a coronagraph while known phase errors are injected, the phase in the exit-pupil may be derived.

JTuB2 • 4:40 p.m. (Invited)
Fast, Robust Algorithms for Wavefront Reconstruction under Weak Turbulence Conditions,
Curt Vogel; Montana State Univ., USA.
We review preconditioned conjugate gradient approaches for the robust, efficient solution of large linear systems of equations that arise in wavefront reconstruction for extremely large telescopes.

JTuB3 • 5:20 p.m.
Wavefront Amplitude and Phase Correction for High Contrast Imaging Using Fourier Decomposition,
Amir Give'on, Jeremy N. Kasdin, Robert J. Vanderbei; Princeton Univ., USA.
Phase conjugation does not achieve the dark nulls needed for high-contrast imaging. We present an alternative optimized solution for the shaping of the deformable mirror based on the Fourier decomposition of the overall aberration.

JTuB4 • 5:40 p.m.
Joint Estimation of Amplitude and Phase from Phase-Diversity Data,
John H. Seldin, Richard G. Paxman; General Dynamics, USA.
We present the problem of jointly estimating wavefront amplitude and phase from phase-diversity data and provide simulation examples.

Room: Dogwood
7:30 p.m.–8:50 p.m.
JTuC • Joint AO/SRS Session: Signal Recovering in Adaptive Optics II
Brent Ellerbroek; CELT Development Corp., USA, Presider

JTuC1 • 7:30 p.m.
The Application of Deconvolution to Adaptive Optics Retinal Images,
Julian C. Christou; Univ. of California at Santa Cruz, USA.
Adaptive optics images of the human retina can be improved using wavefront derived point spread functions (PSF). Errors in these PSFs call for wavefront sensing constraints to be applied to a blind-deconvolution algorithm.

JTuC2 • 7:50 p.m.
Retinal Motion Tracking in Adaptive Optics Scanning Laser Ophthalmoscopy,
Curt Vogel[1], David Arathorn[1], Albert Parker[1], Austin Roorda[2]; [1]Montana State Univ., USA, [2]Univ. of California at Berkeley, USA.
We apply a novel computational technique known as the map-seeking circuit algorithm to track retinal motion from a sequence of frames of data from a scanning laser opthalmoscope.

JTuC3 • 8:10 p.m.
A New Technique to Study Anisoplanatic AO Images of Crowded Fields,
Giovanna Pugliese[1], Domenico Bonaccini Calia[1], Guido De Marchi[2], Francesco Paresce[1]; [1]European Southern Observatory, Germany, [2]European Space Agency, Netherlands.
We address the problem of astrometry and photometry in presence of anisoplanatism in very crowded fields with adaptive optics data. We present a data reduction technique that produces reliable results overcoming the AO anisoplanatism problem.

JTuC4 • 8:30 p.m.
Block-Processing Method for Post-Detection Correction of Anisoplanatic Adaptive Optics Images,
Mathieu Aubailly, Michael C. Roggemann; Michigan Technological Univ., USA.
AO systems are effective for narrow field of view. We propose a post-processing method to reduce the effects of anisoplanatism in wide FOV AO images. The off-axis point-spread function is predicted by use of simulations.

WEDNESDAY, JUNE 8, 2005

Room: Poplar
10:30 a.m.–11:30 a.m.
JWA • Joint AO/COSI Session: Phase Retrieval and PSF Analysis
Brent Ellerbroek; CELT Development Corp., USA, Presider

JWA1 • 10:30 a.m. (Invited)
Real-Time Aberration Compensation without a Wavefront Sensor,
Christopher Dainty; Natl. Univ. of Ireland, Ireland.
In conventional adaptive optics, the wavefront sensor is often claimed to be an essential component. In this talk, we shall discuss the case where there is no wavefront sensor, and so-called "image-sharpening" techniques are used.

JWA2 • 11:10 a.m.
Information-Theoretic Metrics for Quantifying PSF Quality,
Brian J. Thelen, Richard G. Paxman; General Dynamics, USA.

Room: Cypress
6:00 p.m.–8:00 p.m.
JWB • Joint AO/IP Poster Session/Conference Reception

JWB1 • 6:00 p.m. (Invited)
Optoelectronic Foundry: The CoOP Experience,
Ravindra A. Athale; DARPA/MTO, USA.
The Consortium for Optical and Optoelectronic Technology for Computing (CO-OP) was launched in 1992 under DARPA sponsorship to enhance access to latest device technology by systems researchers. I will review its evolution through multiple programs and summarize its accomplishments.

JWB2 • 6:00 p.m.
Solutions to Optoelectronic Interconnect Problems,
Srinivasarao Kumpatla, Josh Casswell, John Snowdon; Heriot-Watt Univ., UK.
Optoelectronic bonding has been performed onto sample MCMs, which are to be used for optical testing on HOLMS demonstrator. The photodiodes and VCSELs were successfully bonded, but we experienced problems attaching the Mixed Signal chips.

JWB3 • 6:00 p.m.
Analysis of a WDM Packet Switch with a Reduced Set of Limited-Range Wavelength Converters,
Reuven E. Gordon, Lawrence R. Chen, Mark Coates; McGill Univ., Canada.
We analyze the performance of a packet switch in a wavelength division multiplexed network employing reduced sets of limited-range wavelength converters. Optimal operation is achieved by trading off conversion range and number of converters.

JWB4 • 6:00 p.m.
Parallel Three-Step-Phase-Shifting Digital Holography,
Yasuhiro Awatsuji[1], Atsushi Fujii[1], Takumi Onchi[1], Toshihiro Kubota[1], Osamu Matoba[2]; [1]Kyoto Inst. of Technology, Japan, [2]Kobe Univ., Japan.
Parallel phase-shifting digital holography using three-step-phase-shifting for three-dimensional measurement and recognition is proposed. The recording optical system and the image reconstruction scheme of the technique are presented. Validity of the technique is numerically verified.

JWB5 • 6:00 p.m.
Laser Writing of Tapers in Polymer,
Craig J. Moir, Aongus McCarthy, John F. Snowdon; Heriot-Watt Univ., UK.
A fabrication method for laser writing a polymer taper by accelerating the laser beam across the polymer is described. This taper gradually varies in the horizontal and vertical dimensions and is similar to fibre tapers.

JWB6 • 6:00 p.m.
Spatial Position Detection of Three-Dimensional Object Using Complex Amplitude Derived from Fourier Transform Profilometry,
Nobukazu Yoshikawa; Saitama Univ., Japan.

The spatial position detection by the 3D object recognition method based on the Fourier transform profilometry is discussed. The exact displacement in the depth direction can be derived from the phase of the correlation output.

JWB7 • 6:00 p.m.
Optical Image Processing by Use of an Optoelectronic Feedback System with an Electronic Distortion Correction,
Yoshio Hayasaki, Ei-ichiro Hikosaka, Hirotsugu Yamamoto, Nobuo Nishida; Univ. of Tokushima, Japan.
We demonstrate that optical image processing based on a spontaneous optical pattern formation from an initial seed optical pattern in an optoelectronic feedback system with electronic distortion correction.

JWB8 • 6:00 p.m.
A Simulation Method for Quantum Algorithm Using Optical Array Logic,
Kouichi Nitta, Yasunori Tado, Osamu Matoba, Takeaki Yoshimura; Kobe Univ., Japan.
A simulator for exponential function in Shor's quantum algorithm is presented. It is based on optical array logic (OAL) which is one of paradigm for digital optical computing.

JWB9 • 6:00 p.m.
Board Integrated Micro-Optics for Divergence Management in Opto-Electronic Interconnect Systems,
Josh J. Casswell[1], Srinu Kumpatla[1], John F. Snowdon[1], Manfred Jarczynski[2], Marco Wirz[3]; [1]Heriot Watt Univ., UK, [2]Fern Univ. Hagen, Germany, [3]Swiss Federal Inst. of Technology (ETH), Switzerland.
In order to reduce the divergence of high power VCSELs for the High-speed Opto-electronic Memory System optical interconnect project, the integration of refractive micro-lenses into a Multi-Chip Module base board is examined.

JWB10 • 6:00 p.m.
Parallel Fabrication of Photonic Crystals (PC) Using Interference Lithography for Integrated Waveguide-PC Devices,
Ashwin Chincholi[1], Siddhartha Banerjee[1], Jia-Sheng Huang[2], David Klotzkin[1]; [1]Univ. of Cincinnati, USA, [2]Emcore, USA.
Multiple exposure interference lithography is a promising way to fabricate areas of photonic crystals areas lithographically mapped for easy integration with conventional waveguides or optical devices. Preliminary results on fabrication of square PCs are reported.

JWB11 • 6:00 p.m.
Application of Magneto-Rheological Finishing (MRF®) to the Figuring of Adaptive Optics Systems,
Aric Shorey, Michael DeMarco; QED Technologies Inc., USA.
The advancement of adaptive optics requires improved processes for manufacturing the facesheet and the facesheet/actuator assembly as a whole. Magnetorheological Finishing (MRF®) is a deterministic, subaperture, shear-based removal process that solves both of these issues.

JWB12 • 6:00 p.m.
Atmospheric Turbulence Outer Scale Profile for MCAO Specifications,
Aziz Ziad, Julien Borgnino, Jérôme Maire; Lab Univ. d'Astrophysique de Nice, France.
The Extremely Large Telescopes will be certainly equipped with MCAO systems. The profile of the outer scale L0(h) is a key parameter for these MCAO systems optimization. We present here new techniques for L0(h) extraction.

JWB13 • 6:00 p.m.
Ferrofluid Based Deformable Mirrors for Adaptive Optics,
Denis Brousseau[1], Ermanno F. Borra[1], Myriam Rioux[2], Simon Thibault[2]; [1]Dept. of Physics, Univ. Laval, Canada, [2]INO, Canada.
The performance of a ferrofluid deformable mirror is studied in order to characterize its usefulness as a low-cost and high-stroke alternative to conventionnal deformable mirrors. The control procedure is examined and mathematically modelled.