Hyperspectral Imaging and Sounding of the Environment (HISE)

10 July - 14 July 2011, The Westin Harbour Castle, Toronto, Ontario, Canada

HISE: Seeking innovation using hyperspectral instrumentation to study land, ocean, polar, and atmospheric phenomena, including developing strategies for providing rapid response to quickly changing conditions.

The scope of HISE continues to expand as active, polarimetric, and hyperspectral measurement systems provide unprecedented opportunities to monitor and understand our planetary system. These new observations are challenging scientists in all disciplinary areas to develop new approaches for managing and processing the data in addition to working with users of the data products. Additionally, synthesis of hyperspectral observations with those from other measurement platforms shows great scientific potential. Hyperspectral remote sensing over scales ranging from regional to global, and event-oriented to climatological are of interest. All relevant passive, active, imaging, and sounding hyperspectral remote sensing programs, missions, field campaigns, data processing, applications, validation approaches, basic research, educational outreach and user feedback are welcomed. Additionally, research is solicited that addresses the use of current and future measurements for providing products useful for rapid response efforts to phenomena such as volcanos, floods, changes in land cover, snow/ice cover, and atmospheric events such as biomass burning, tropical storms, trace gases, and heavy aerosol events.

The conference chairs invite you to share your latest work with colleagues and network with leaders in the field including invited speakers and the program committee.

Check out the Housing and Travel Page to find out how to Experience Toronto from the Water and get discounts on Toronto Bus and Walking Tours!

View the conference program and plan your itinerary for the conference

- Browse speakers and the agenda of sessions
- Browse sessions by type or day.
- Search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference

This event is part of the Imaging and Applied Optics Congress, allowing attendees to access all meetings within the Congress for the price of one and to collaborate on topics of mutual interest.

Imaging and Applied Optics

- Adaptive Optics: Methods, Analysis and Applications (AO)
- Application of Lasers for Sensing & Free Space Communication (LS&C)
- Applied Industrial Optics: Spectroscopy, Imaging, & Metrology (AIO)
- Computational Optical Sensing and Imaging (COSI)
- Fourier Transform Spectroscopy (FTS)
- Hyperspectral Imaging and Sounding of the Environment (HISE)
- Imaging Systems Applications (IS)
- Signal Recovery & Synthesis (SRS)

Chairs:

Bryan Baum, Space Science and Engineering Ctr., Univ. of Wisconsin-Madison, USA, General Chair
Ping Yang, Texas A&M Univ., USA, General Chair

Sponsor:
Imaging and Applied Optics: OSA Optics and Photonics Congress

July 10-14, 2011, The Westin Harbour Castle, Toronto, Canada

The Imaging and Applied Optics Congress – exploring the growing need for optical imaging technologies.

Optical imaging technologies and its wide adaption for commercial, military and medical applications are progressing rapidly. Additionally, optical techniques applied to sensing, process control, metrology, and laser remote sensing are impacting and enabling many applications. This Optics and Photonics Congress explores the latest advances in imaging technologies as well as the development and use of other optical sensing and data transfer techniques and reports on new implementations that exploit these advances. Numerous advances in optical technologies have enabled new applications and these too will be presented at this Congress. Novel computational and conventional imaging theory, component developments, and demonstrations will be discussed in five of the meetings (AO, COSI, FTS, IS, SRS) while the application of imaging techniques will represent the important themes in three of the meetings (HISE, IS, AIO). Optical measurement and sensing applications also form an important component to this Congress and are covered in IS, AIO, LS&C, and HISE.

- Adaptive Optics: Methods, Analysis and Applications (AO)
- Application of Lasers for Sensing & Free Space Communication (LS&C)
- Applied Industrial Optics: Spectroscopy, Imaging, & Metrology (AIO)
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- Hyperspectral Imaging and Sounding of the Environment (HISE)
- Imaging Systems Applications (IS)
- Signal Recovery & Synthesis (SRS)

OSA Congresses are intimate, medium sized meetings where 300-500 industry experts and top researchers and developers share their latest research and collaborate on new and future applications. Exhibiting at The OSA Imaging and Applied Optics Congress offers you an extremely targeted opportunity to display your company’s products. Previous exhibitors include representatives from companies involved in nanotechnology. Precision optics, optical thin film coatings, optoelectronics and imaging, fabrication and testing and scientific instruments.

Reserve exhibit space today by calling +1 202.416.1474 or email rpickett@osa.org. Several sponsorship options, ranging from coffee breaks to lanyards, are also available – call 1-202-416-1474 or email rpickett@osa.org to learn more. Sign up early to receive the best location.

NEW!

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- Browse sessions by type or day.
- Search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference

Special Events
AIO Plenary Session
Monday, 11 July, 08:00-10:00
Pier 3
Atle Honne
Senior Research Scientist, SINTEF, Oslo, Norway
Atle Honne is the project manager for ANITA at SINTEF, the largest independent research organization in Scandinavia. His responsibilities include calibration, measurement, testing and data evaluation for ANITA with special interests in FTIR-based multi-gas analyses, optical measurements, and measurement technology in general. He holds a Master of Science in Applied Physics, and has recently been awarded the 2009 Wright Brothers Award for one of his background research papers on this subject.

Networking for Lunch
Tuesday, 12 July 12:30 – 14:00
Sponsored by the OSA Information Acquisition, Processing and Display Technical Division
David Brady, Division Chair, and Chris Dainty, OSA President, invite you to join them over lunch for some lively networking with your colleagues. OSA is pleased to offer complimentary sandwiches and beverages to all who attend.

Joint Conference Reception
Tuesday, 11 July, 19:00-20:30
Metro West Ballroom, 2nd Floor Conference Room
The reception will feature light fare and is open to all registrants

Poster Presentations
Poster presentations offer an effective way to communicate new research findings and provide an opportunity for lively and detailed discussion between presenters and interested viewers.

Joint IS/AIO/LS&C Poster Session
Tuesday, 12 July, 10:30-12:30
Salon B

Joint FTS/HISE/AO/COSI Poster Session
Wednesday, 13 July, 10:30-12:30
Salon B

Postdeadline Paper Presentations
The program committees of AO/COSI/FTS/HISE accepted postdeadline papers for presentation. The purpose of postdeadline sessions is to give participants the opportunity to hear new and significant materials in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timelines were accepted.

For more information, including the schedule and locations see the Postdeadline papers appended to the back of the program book.

AO Postdeadline Paper Session
Tuesday, 12 July 16:30-18:30
Pier 5

COSI Postdeadline Paper Session
Wednesday, 13 July 10:30-12:30
Salon C

Joint FTS/HISE Postdeadline Paper Session
Wednesday, 13 July 16:30-18:30
Pier 7/8

Sponsors:
Hyperspectral Imaging and Sounding of the Environment (HISE)

10 July - 14 July 2011, The Westin Harbour Castle, Toronto, Ontario, Canada

Program

HISE: Seeking innovation using hyperspectral instrumentation to study land, ocean, polar, and atmospheric phenomena, including developing strategies for providing rapid response to quickly changing conditions. If you would like to be considered as a presenter, please review the topic categories below and the author/presenter information for submission guidelines.

A number of distinguished invited speakers have been invited to present at the meeting. In addition, the organizers have planned a number of special events to make your meeting experience more enjoyable!

View the conference program and plan your itinerary for the conference

- Browse speakers and the agenda of sessions
- Browse sessions by type or day.
- Search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference

Meeting-at-a-Glance

A tentative general schedule of the meeting (as well as all meetings in the Congress) is listed below. Please check back frequently for updates.

<table>
<thead>
<tr>
<th>11 July</th>
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<tr>
<td>AIO Technical Sessions</td>
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<td>AO Technical Sessions</td>
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<td>16:30–18:30 (joint with LS&amp;C)</td>
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<td>COSI Technical Sessions</td>
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<td>11:30–12:30 (Postdeadline Papers)</td>
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<td>FTS Technical Sessions</td>
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### HISE Technical Sessions
- **8:00–10:00:**
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- **10:30–12:30:**
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### IS Technical Sessions
- **8:00–10:00:**
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  - 14:00–16:00
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- **10:30–12:30:**
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### LS&C Technical Sessions
- **8:00–10:00:**
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  - 16:00–18:00
  - 16:30–18:30

### SRS Technical Sessions
- **8:00–10:00:**
  - 8:00–10:00
  - 10:30–12:30
  - 14:00–16:00
  - 10:30–10:50

- **10:30–12:30:**
  - 10:30–12:30
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- **14:00–16:00:**
  - 14:00–16:00
  - 10:30–10:50
16:30–18:30 (joint with AO)
14:00–16:00 (joint with AO)

Poster Sessions

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<tr>
<td>10:30–12:30</td>
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Coffee Breaks

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<td>16:00–16:30</td>
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Exhibit Time

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<th>Description</th>
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Conference Reception

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Call for Papers

View the Hyperspectral Imaging and Sounding of the Environment (HISE) Call for Papers PDF in December 2010.
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OSA would like to give a special Thank You to our Platinum Sponsor!
Adaptive Optics: Methods, Analysis and Applications (AO)
Application of Lasers for Sensing & Free Space Communication (LS&C)
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Hyperspectral Imaging and Sounding of the Environment (HISE)
Imaging Systems Applications (IS)
Signal Recovery & Synthesis (SRS)

10-14 July 2011
The Westin Harbour Castle, Toronto, Ontario, Canada

OSA continues the tradition of outstanding conferences and focused meetings with the 2011 Optics and Photonics Congress on Imaging and Applied Optics in beautiful Toronto, Ontario. Like last year's meeting in Tucson, this year's meeting promises to be very exciting. The Congress has co-located eight topical meetings (listed above) in order for attendees to benefit from exposure to a diverse collection of optical technologies. The Program includes scientific leaders from around the globe in each topical area which should facilitate networking and the cross-pollination of ideas between attendees. Please join us on Tuesday evening for the joint Welcome Reception on the 2nd floor of the conference center in the Metro West Ballroom.

The Applied Industrial Optics (AIO) meeting was an unprecedented success last year, and promises to be very exciting this year. The conference begins on the International Space Station thanks to our plenary speaker Atle Honne. The remaining 28 invited speakers, spanning the full three days of the conference cover a wide range of applied optical technologies and a very diverse set of application areas including security, forensics, environmental monitoring, and Smart Grid technology. In addition, our invited speakers and contributors include industrial, governmental, and academic scientist at the forefront of applied optics from around the globe. Join us for an exciting meeting and volunteer to join the team to help make next year's meeting even better.

The Adaptive Optics meeting brings together technologies which have enabled significant performance improvements in different applications of adaptive optics such as astronomy, free space communications, optometry/ophthalmology, microscopy, laser microfabrication, lithography, laser fusion, fiber optics, and x-ray optics. This meeting represents a forum in which many of the latest advances and challenges will be presented by well-known experts in this discipline. The topics to be presented include discussions of various systems that use adaptive optics techniques, control systems, wavefront sensing and correcting, system and component modeling, imaging techniques through distorting or scattering media, and achievable performance improvements.

This meeting will also include two special joint sessions. The first is with the Signal Recovery and Analysis meeting and the second with the Application of Lasers for Sensing & Free Space Communication meeting covering common topics. Invited speakers will present talks on the application of complex Adaptive Optic systems for two very different applications in the fields of ophthalmology and astronomy.

The Computational Optical Sensing and Imaging (COSI) meeting covers subject matter in fundamental physics, numerical methods and physical hardware that has led to significant improvements in the fields of imaging and sensing including applications in medical, defense, homeland security, inspection, testing, etc. Topics in this meeting include wave-front coding, light field sensing, compressive optical sensing, tomographic imaging, structured illumination imaging, digital holography, SAR, lensless imaging, point spread function engineering, digital/optical super-resolution, unusual form-factor cameras, synthetic aperture optical systems, etc. Computational Optical Sensing and Imaging is an important discipline being applied to solve numerous problems in modern optics and the techniques developed in this field have been incorporated in to numerous commercial products.

Benefiting from innovative techniques and mature instrumentation, Fourier-transform spectrometers push forward the limits of sensing in a growing number of fields. Inheriting from its predecessors, the 2011 Fourier Transform Spectroscopy (FTS) meeting welcomes you to inspiring and stimulating conferences. In-depth invited talks and up-to-date contributions will cover the vast FTS field. Attendees will hear about atmospheric science, astronomy, planetary science, and advanced laboratory spectroscopy. The meeting will exhibit expanding applications of imaging, static, and spatial heterodyne spectrometers. Novel developments like polarimetric and comb techniques will also be highlighted.
The Hyperspectral Imaging and Sounding of the Environment (HISE) meeting will cover many important research results in cloud monitoring, surface and atmospheric research, advances in sensors and measurement approaches, atmospheric profiling and gas sensing, radiometric and spectral remote sensing, and new applications arising from merged imager and sounder data. Invited papers delivered by widely recognized experts in this area will present a picture of the state of the art in environmental sensing. Remote sensing data from passive and active measurement technologies provide unprecedented monitoring capabilities and are leading to a more refined understanding of our planet. The uniqueness of the data obtained from these hyperspectral sensors requires new approaches for managing, processing and using the data, including the integration of observations from different sensor constellations to better assess the information that these new measurements provide.

The Imaging Systems (IS) meeting is an “all-encompassing” conference on imaging that covers topics in imaging optics, sensors, computational imaging and 3-D imaging. Invited speakers from the military, academic, and commercial imaging sectors will address the current status and future of imaging in their organizations. The conference includes 16 invited, 17 contributed oral presentations, and 6 poster presentations that describe recent developments in lens design (including aperture masks and wavefront coding), pixel optics, novel imaging sensors (including curved focal plane arrays, superresolution systems, and MEMs deformable mirrors), compressive sensing, image processing, computational photography and human vision.

The Application of Lasers for Sensing & Free Space Communication meeting (LS&C) is designed to report on many of the important advances realized in the last few years to make FSO more robust, increase data rate capabilities, and demonstrate its usefulness in numerous field applications. Adaptive optics (AO) is an important component to addressing the limiting effects encountered when propagating in the atmospheric and in water. To be reported at this meeting will be diversity techniques including MIMO as well as AO are used to combat fading channels, coherent communications, hybrid laser/RF technologies, and networking with FSO. The latest research results on information assurance in quantum communications will be discussed along with advances in LADAR system and technology development. Important applications in standoff bio-detection, uses of lasers in Naval environments involving blue-green communications, and lunar laser communications will be described. Also included in the meeting is a joint session with the Adaptive Optics topical meeting on the latest advances in wave front control and turbulence. Laser systems are being used in numerous free space communications and remote sensing applications. Free space optical (FSO) communications has become a viable competitor to RF systems for many special applications; however, there still are several issues that need to be addressed to make FSO more robust relative to propagation impairments.

The Signal Recovery & Synthesis (SRS) meeting consists of topics that range from theoretical to experimental, but all with a common theme of signal processing to achieve desired ends. You will hear the latest research results in the areas of ghost imaging, blind deconvolution, optical turbulence characterization, optical signal processing, and more. In addition, the SRS meeting has two joint sessions with the AO meeting, with topics that involve signal processing and adaptive optics. There are 6 invited and 22 contributed presentations as part of this exciting meeting.

AIO
Sean Christian, Optrology, Inc., USA, General Chair
Jess Ford, Weatherford Intl., USA, General Chair
Joe Dallas, Avo Photonics Inc., USA, Program Chair
Bertrand Lanher, Process Analytical Chemistry Services, USA, Program Chair

AO
Julian Christou, Gemini Observatory, USA, Chair
Donald T. Miller, Indiana Univ., USA, Chair

COSI
Michael Gehm, Univ. of Arizona, USA, Chair
Rafael Piestun, Univ. of Colorado at Boulder, USA, Chair

FTS
Pierre Tremblay, Univ. Laval, Canada, General Chair
Felix Friedl-Vallon, Karlsruhe Inst. of Technology, Germany, Program Chair

HISE
Bryan Baum, Space Science and Engineering Ctr., Univ. of Wisconsin-Madison, USA, General Chair
Ping Yang, Texas A&M Univ., USA, General Chair

IS
Gisele Bennett, Georgia Tech, USA, General Chair
Joyce Farrell, Stanford Univ., USA, General Chair
Boyd Fowler, Fairchild Imaging, USA, General Chair
Peter Catrysse, Stanford Univ., USA, Program Chair
Joseph N. Mait, ARL, USA, Program Chair

LS&C
Paul McManamon, Exciting Technology, LLC, USA, Chair
Larry Stotts, DARPA/STO, USA, Co-Chair
Ed Watson, US Air Force, USA, Co-Chair

SRS
Charles Matson, Air Force Res. Lab, USA, General Chair
Chris Dainty, Natl. Univ. of Ireland Galway, Ireland, Program Chair
Edmund Lam, Univ. of Hong Kong, Hong Kong, Program Chair
Imaging and Applied Optics Program Committee

Adaptive Optics: Methods, Analysis and Applications (AO)

Chairs
Julian Christou, Gemini Observatory, USA
Donald T. Miller, Indiana Univ., USA

Committee Members
Matthew Britton, The Optical Sciences Company (tOSC), USA
Chris Dainty, National Univ. of Ireland Galway, Ireland, liaison with SRS
Nathan Doble, New England College of Optometry, USA
Brent Ellerbroek, Thirty Meter Telescope Project, USA
Simone Esposito, INAF - Osservatorio Astrofisico di Arcetri, Italy
Robert Johnson, AFRL, USA
Caroline Kulcsar, Univ. Paris 13, France
Gordon Love, Univ. of Durham, UK
Lisa Poyneer, LLNL, USA
Sergio Restaino, NRL, USA
Erez Ribak, Technion Israel Inst. of Technology, Israel
Michael Vorontsov, Univ. of Maryland, USA
Tony Wilson, Univ. of Oxford, UK

Application of Lasers for Sensing & Free Space Communication (LS&C)

General Chairs
Paul McManamon, Exciting Technology, LLC, USA, Chair
Larry Stotts, DARPA/STO, USA, Co-Chair
Ed Watson, US Air Force, USA, Co-Chair

Committee Members
Larry Andrews, CREOL, Univ. of Central Florida, USA
Tim Carriag, Lockheed Martin Coherent Technologies, USA
Rick Heinrich, MIT Lincoln Lab, USA
Sammy Henderson, Lockheed Martin Coherent Technologies, USA
David Hughes, Air Force Research Lab
Juan Juarez, Johns Hopkins APL, USA
Mike Lovern, SPAWAR, USA
Brian Miles, FastMetrix, Inc., USA
Malcom Northcott, Aoptix Technologies, Inc., USA
Ron Phillips, Univ. of Central Florida, USA
Pete Poirier, SPAWAR, USA
Troy Rhoadarmer, SAIC, USA
Jason Schmidt, Air Force Inst. of Technology, USA
Brian Stadler, US Air Force Res. Lab, USA
Linda Thomas, Office of Naval Res., USA
Bob Tyson, Univ. of North Carolina at Charlotte, USA

Applied Industrial Optics: Spectroscopy, Imaging, & Metrology (AIO)

General Chairs
Sean Christian, Optrology, Inc., USA
Jess Ford, Weatherford Intl., USA

Program Chairs
Joe Dallas, Avo Photonics Inc., USA
Bertrand Lanher, Process Analytical Chemistry Services, USA

Committee Members
Haji-saeed Bahareh, Air Force Res. Lab, USA, Young Professional
Steve Buckley, Photon Machines, Inc., USA
Chun-Hung (Frank) Kuo, Newport Corp., USA, Young Professional
Bin (Bill) Li, Coherix, Inc., USA, Young Professional
Fred Long, Spectroscopic Solutions, USA
Marion O’Farrell, SINTEF ICT, Norway
Prasanna Pavani, Ricoh Innovations, USA, Young Professional
Dominick Polizzi, Optics Technology Inc., USA
Milan Poudel, US Southwestern Medical School, USA, Young Professional
Arel Weisberg, Energy Research Co., USA

Computational Optical Sensing and Imaging (COSI)

Program Chairs
Michael Gehm, Univ. of Arizona, USA
Rafael Piestun, Univ. of Colorado at Boulder, USA

Committee Members
Saeed Bagheri, IBM TJ Watson Res. Ctr., USA
George Barbastathis, MIT, USA
Scott A Basinger, JPL, USA
David Brady, Duke Univ., USA
Jose Mait, USA
Wolfgang Osten, Inst. für Technische Optik, Univ. Stuttgart, Germany
Kenny Kubala, FiveFocal, USA
Kyros Kutulakos, Univ. of Toronto, Canada
Abhijit Mahalanobis, Lockheed Martin Corp., USA
Joseph Mait, US ARL, USA
Wolfgang Osten, Inst. für Technische Optik, Univ. Stuttgart, Germany
Joseph O’Sullivan, Washington Univ. in St Louis, USA
Chrysanthe Preza, Univ. of Memphis, USA
Demetri Psaltis, EPFL, Switzerland
Ramesh Raskar, MIT, USA
Joseph Rosen, Ben Gurion Univ., of the Negev, Israel
Michael Stenner, MITRE Corp., USA
Jun Tanida, Osaka Univ., Japan
Peter Török, Imperial College London, UK

Fourier Transform Spectroscopy (FTS)
General Chair
Pierre Tremblay, Univ. Laval, Canada
Program Chair
Felix Friedl-Vallon, Karlsruhe Inst. of Technology, Germany
Committee Members
Peter F. Bernath, Univ. of York, UK
Jérôme Genest, Univ. Laval, Canada
John Harlander, St. Cloud State Univ., USA
Donald E. Jennings, NASA/Goddard Space Flight Ctr., USA
Akihiko Kuze, Japan Aerospace Exploration Agency, Japan
Jean-Pierre Maillard, Inst. d’Astrophysique de Paris, France
Johannes Orphal, Karlsruhe Inst. of Technology, Germany
Luca Palchetti, Istituto di Fisica Applicata “Nello Carrara” IFAC-CNR, Italy
Juliette Pickering, Imperial College London, UK
Nathalie Picqué, Max-Planck-Inst. fuer Quantenoptik, Germany
Joe Taylor, Space Science and Engineering Ctr., Univ. of Wisconsin-Madison, USA
Geoffrey C. Toon, Jet Propulsion Lab, USA

Hyperspectral Imaging and Sounding of the Environment (HISE)
General Chairs
Bryan Baum, Space Science and Engineering Ctr., Univ. of Wisconsin-Madison, USA
Ping Yang, Texas A&M Univ., USA
Committee Members
Chris Barnet, NOAA, USA
Caroline Cox, Rutherford Appleton Lab, UK
John Dykema, Harvard Univ., USA
Joanna Joiner, NASA Goddard Space Flight Ctr., USA
Margaret Kalacska, McGill Univ., Canada
Jhoon Kim, Yonsei Univ., Republic of Korea
Allen M. Larar, NASA Langley Res. Ctr., USA
Betsy Middleton, NASA Goddard Space Flight Ctr., USA
Marty Mlynczak, NASA Langley Res. Ctr., USA
Shaima Nasiri, Texas A&M Univ., USA
Peter Pilewskie, Lab for Atmospheric and Space Physics (LASP), University of Colorado-Boulder, USA
Heli Wei, Lab of Atmospheric Composition and Optical Radiation, Chinese Acad. of Sciences, China
Elisabeth Weisz, Space Science and Engineering Ctr., Univ. of Wisconsin-Madison, USA

Imaging Systems and Applications (IS)
General Chairs
Gisele Bennett, Georgia Tech, USA
Joyce Farrell, Stanford Univ., USA
Boyd Fowler, Fairchild Imaging, USA
Program Chairs
Peter Catrysse, Stanford Univ., USA
Joseph N. Mait, ARL, USA
Committee Members
Ken Barnard, AFRL, USA
Glenn Boreman, Univ. of Central Florida, USA
David Brady, Duke Univ., USA
Ed Dowski, Ascent Imaging, USA
Ronald Driggers, NRL, USA
Michael Eismann, AFRL, USA
Michael Fiddy, Univ. of North Carolina at Charlotte, USA
Jim Fienup, Univ. of Rochester, USA
Patti Gillespie, ARL, USA
Francisco Imai, Canon USA, Inc., USA
Eddie Jacobs, Univ. of Memphis, USA
Keith Krapels, Army Night Vision Lab, USA
Michael Kriss, MAK Consultants, USA
Matt Kupinski, Univ. of Arizona, USA
Dale Linne von Berg, NRL, USA
Pierre Magnan, Supérieur de l’Aéronautique et de l’Espace, France
Ricardo Motta, Attom Res., USA
David Pope, Aptina, USA
Dennis Prather, Univ. of Delaware, USA
Jennifer Ricklin, Lockheed Martin, USA
John Sheridan, Univ. College Dublin, Ireland

Signal Recovery & Synthesis (SRS)
General Chair
Charles Matson, Air Force Res. Lab, USA
Program Chairs
Chris Dainty, Natl. Univ. of Ireland Galway, Ireland
Edmund Lam, Univ. of Hong Kong, Hong Kong
Program Committee
Philip Bones, Univ. of Canterbury, New Zealand
Jun Cheng, Shenzhen Inst. of Advanced Technology, Chinese Acad. of Sciences, China
Christy Fernandez Call, MIT Lincoln Lab, USA
David Gerwe, Boeing Corp., USA
Andrew Lambert, Australian Defense Force Acad., Univ. of New South Wales, Australia
Vincent Michau, ONERA, France
Rick Millane, Univ. of Canterbury, New Zealand
Jannick Rolland, Inst. of Optics, Univ. of Rochester, USA
Markus Testorf, Dartmouth College, USA
Peter Tsang, City Univ. of Hong Kong, Hong Kong
Special Events

AIO Plenary Session
Monday, 11 July, 08:00-10:00
Pier 3

Atle Honne
Senior Research Scientist, SINTEF, Oslo, Norway

Atle Honne is the project manager for ANITA at SINTEF, the largest independent research organization in Scandinavia. His responsibilities include calibration, measurement, testing and data evaluation for ANITA with special interests in FTIR-based multi-gas analyses, optical measurements, and measurement technology in general. He holds a Master of Science in Applied Physics, and has recently been awarded the 2009 Wright Brothers Award for one of his background research papers on this subject.

Joint Conference Reception
Tuesday, 11 July, 19:00-20:30
Metro West Ballroom, 2nd Floor Conference Room

The reception will feature light fare and is open to all registrants

Poster Presentations
Poster presentations offer an effective way to communicate new research findings and provide an opportunity for lively and detailed discussion between presenters and interested viewers.

Joint IS/AIO/LS&C Poster Session
Tuesday, 12 July, 10:30-12:30
Salon B

Joint FTS/HISE/AO/COSI Poster Session
Wednesday, 13 July, 10:30-12:30
Salon B

Postdeadline Paper Presentations
The program committees of AO/COSI/FTS/HISE accepted postdeadline papers for presentation. The purpose of postdeadline sessions is to give participants the opportunity to hear new and significant materials in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timelines were accepted.

For more information, including the schedule and locations see the Postdeadline papers appended to the back of this program book.

AO Postdeadline Paper Session
Tuesday, 12 July 16:30-18:30
Pier 5

COSI Postdeadline Paper Session
Wednesday, 13 July 10:30-12:30
Salon C

Joint FTS/HISE Postdeadline Paper Session
Wednesday, 13 July 16:30-18:30
Pier 7/8
## Agenda of Sessions — Sunday, 10 July

15:00–18:00
Registration Open, Ballroom Foyer, Convention Level

## Agenda of Sessions — Monday, 11 July

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<tr>
<td>07:00–18:00</td>
<td>LS&amp;C</td>
<td>IS</td>
<td>AIO</td>
<td>SRS</td>
<td>FTS</td>
<td>HISE</td>
<td>AO</td>
<td>COSI</td>
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<td>07:45–08:00</td>
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<tr>
<td>08:00–10:00</td>
<td>Opening Remarks (8:20)</td>
<td>IMA • Image Sensors (Ends at 09:40)</td>
<td>AIMA • Space Applications (Ends at 09:40)</td>
<td>SMA • Optical System Design, Analysis &amp; Optimization</td>
<td>JMA • Joint FTS/HISE Session, Salon A</td>
<td>AMA • Systems I</td>
<td>CMA • Seeing the Future: A Symposium in Memory of Dennis Healy I</td>
<td></td>
</tr>
<tr>
<td>10:00–10:30</td>
<td>Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level</td>
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<tr>
<td>10:30–12:30</td>
<td>LMB • Adaptive Optics I (Ends at 12:10)</td>
<td>IMB • Emerging Technologies for Imaging Systems</td>
<td>AIMB • Fiber Optic Sensors (Ends at 13:10)</td>
<td>SMB • Ghost Imaging, Superresolution &amp; Blind Deconvolution</td>
<td>FMA • Atmospheric Science from Space I (Ends at 12:10)</td>
<td>HMA • Upcoming Missions</td>
<td>AMB • Control Systems</td>
<td>CMB • Seeing the Future: A Symposium in Memory of Dennis Healy II (Begins at 11:10)</td>
</tr>
<tr>
<td>12:30–14:00</td>
<td>Lunch (On Your Own)</td>
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<tr>
<td>14:00–16:00</td>
<td>LMC • Adaptive Optics II</td>
<td>IMC • Image Processing</td>
<td>AIMC • Industrial Monitoring (Ends at 15:20)</td>
<td>SMC • Information Theory &amp; Processing Time Considerations</td>
<td>FMB • Atmospheric Science from Space II</td>
<td>HMB • Advances in Sensors and Measurements</td>
<td>AMC • Wavefront Control</td>
<td>CMC • Phase-based Techniques</td>
</tr>
<tr>
<td>16:00–16:30</td>
<td>Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level</td>
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<tr>
<td>16:30–18:30</td>
<td>See Joint AO/LS&amp;C session in Pier 5</td>
<td>IMD • Human Vision and Imaging Systems</td>
<td>AIMD • Healthcare and Pharma</td>
<td>SMD • Optical Processing &amp; Algorithms (Ends at 17:30)</td>
<td>FMC • Atmospheric Science with Ground Based Instrumentation</td>
<td>HMC • Radiative Transfer</td>
<td>JMB • Joint AO/LS&amp;C Session: Waterfront Control Turbulence (Begins at 17:10)</td>
<td>CMD • Computational Spectroscopy and Spectral Imaging (Ends at 18:10)</td>
</tr>
</tbody>
</table>

### Key to Conference Abbreviations
- **AIO**: Applied Industrial Optics: Spectroscopy, Imaging, & Metrology
- **AO**: Adaptive Optics: Methods, Analysis and Applications
- **COSI**: Computational Optical Sensing and Imaging
- **FTS**: Fourier Transform Spectroscopy
- **IS**: Imaging Systems and Applications
- **HISE**: Hyperspectral Imaging and Sounding of the Environment
- **LS&C**: Application of Lasers for Sensing & Free Space Communication
- **SRS**: Signal Recovery & Synthesis
## Agenda of Sessions — Tuesday, 12 July

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<tr>
<th>Pier 4</th>
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<tbody>
<tr>
<td>LS&amp;C</td>
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<td>FTS</td>
<td>HISE</td>
<td>AO/SRS</td>
<td>COSI</td>
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</table>

**07:00–18:00**

**Registration Open, Ballroom Foyer, Convention Level**

<table>
<thead>
<tr>
<th>08:00–10:00</th>
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<tbody>
<tr>
<td>LTuA • Information Assurance in Quantum Communications I</td>
</tr>
<tr>
<td>ITuA • Coded Optical Imaging</td>
</tr>
<tr>
<td>ATuA • LIBS (08:40–9:20)</td>
</tr>
<tr>
<td>FTuA • Astronomy and Planetary Science</td>
</tr>
<tr>
<td>HtuA • Merged Imager and Sounder</td>
</tr>
<tr>
<td>JTuA • Joint AO/SRS Session I: Atmospheric Turbulence; Adaptive Optics Systems; Image Analysis</td>
</tr>
<tr>
<td>CtTuA • Imaging with Scattering and Aberrations (Begins at 08:20)</td>
</tr>
</tbody>
</table>

**10:00–10:30**

**Coffee Break/ Exhibits Open, Ballroom Foyer, Convention Level**

<table>
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<tr>
<th>10:30–12:30</th>
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</thead>
<tbody>
<tr>
<td>LTuB • Network Technologies (Ends at 12:10)</td>
</tr>
<tr>
<td>JTuB • Joint IS/AIO/LS&amp;C Poster Session, Salon B</td>
</tr>
<tr>
<td>FTuB • IFTS in Astronomy (Ends at 12:10)</td>
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<tr>
<td>HtuB • MODIS</td>
</tr>
<tr>
<td>ATuA • Wavefront Sensing (Begins at 10:50)</td>
</tr>
<tr>
<td>CtTuB • PSF Engineering and Pupil Encoding</td>
</tr>
</tbody>
</table>

**12:30–14:00**

**Lunch (On Your Own)**

<table>
<thead>
<tr>
<th>14:00–16:00</th>
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</thead>
<tbody>
<tr>
<td>LTuC • Information Assurance in Quantum Communications II (Ends at 16:20)</td>
</tr>
<tr>
<td>See Joint COSI/IS session in Salon C</td>
</tr>
<tr>
<td>ATuB • Optical Metrology</td>
</tr>
<tr>
<td>FTuC • IFTS in Atmospheric Research and Air Quality Control</td>
</tr>
<tr>
<td>HtuC • Surface and Atmosphere</td>
</tr>
<tr>
<td>JTuC • Joint AO/SRS Session II: Wavefront Estimation and Image Analysis</td>
</tr>
<tr>
<td>JTuD • Joint COSI/IS Session I: Computational Photography</td>
</tr>
</tbody>
</table>

**16:00–16:30**

**Coffee Break/ Exhibits Open, Ballroom Foyer, Convention Level**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>LTuD • Laser Propagation</td>
</tr>
<tr>
<td>See Joint COSI/IS session in Salon C</td>
</tr>
<tr>
<td>ATuC • Semiconductor Applications</td>
</tr>
<tr>
<td>FtuD • IFTS for Other Applications</td>
</tr>
<tr>
<td>HtuD • Atmospheric Profiles and Trace Gases (Ends at 18:10)</td>
</tr>
<tr>
<td>AO Post deadline Session</td>
</tr>
<tr>
<td>JTuD • Joint COSI/IS Session II: Wide Field of View and Large Format Imaging</td>
</tr>
</tbody>
</table>

**18:30–19:00**

**30 Minute Break**

**19:00–20:30**

**Welcome Reception, Metro West Ballroom, Conference Center, 2nd floor**

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**Key to Conference Abbreviations**

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- COSI: Computational Optical Sensing and Imaging
- FTS: Fourier Transform Spectroscopy
- IS: Imaging Systems and Applications
- HISE: Hyperspectral Imaging and Sounding of the Environment
- LS&C: Application of Lasers for Sensing & Free Space Communication
- SRS: Signal Recovery & Synthesis
## Agenda of Sessions — Wednesday, 13 July

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<th>Pier 4</th>
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<td>FTS</td>
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<td>AO</td>
<td>COSI</td>
</tr>
</tbody>
</table>

07:30–18:00 | **Registration Open, Ballroom Foyer, Convention Level** |

| 08:00–10:00 | LWA • Naval Applications I | IWA • Military Applications I | AIWA • Spectroscopy | FWA • Static Spectrometers and New Developments I | HWA • Clouds | AWA • Systems II (Ends at 9:40) | CWA • Superresolution |
| 08:00–10:00 | LWB • Naval Applications II | IWB • Military Applications II | AIWB • Laser Applications | JWA • Joint FTS/HISE/AO/COSI Poster Session, Salon B | COSI Postdeadline Session |

Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level

10:00–10:30

10:30–12:30 | LWB • Naval Applications II | IWB • Military Applications II | AIWB • Laser Applications | JWA • Joint FTS/HISE/AO/COSI Poster Session, Salon B | COSI Postdeadline Session |

Lunch (On Your Own)

14:00–16:00 | LWC • Laser Communication/Atmosphere I (Ends at 15:40) | JWB • Joint AIO/IS Session I: Biophotonics, Pier 2 (Ends at 15:40) | FWB • Static Spectrometers and New Developments II | HWB • Spectral Analyses | CBW • Computational Holography |

Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level

16:00–16:30

16:30–18:30 | LWD • Laser Communication/Atmosphere II | JWC • Joint AIO/IS Session II: 3D Imaging, Pier 2 | Joint FTS/HISE Postdeadline Session, Salon A | CBW • Other Sensing Modalities (Ends at 18:10) |

——— Thursday, 14 July ———

<table>
<thead>
<tr>
<th>Pier 4</th>
<th>Salon A</th>
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</thead>
<tbody>
<tr>
<td>LS&amp;C</td>
<td>FTS</td>
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</tbody>
</table>

07:30–12:00 | **Registration Open, Ballroom Foyer, Convention Level** |

| 08:00–10:00 | LThA • Ladar I | FThA • Laboratory Spectroscopy ( Begins at 08:20) |
| 10:00–10:30 | Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level |

| 10:30–12:30 | LThB • Ladar II (Ends at 12:15) | FThB • Comb Techniques |

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These concurrent sessions are grouped across two pages. Please review both pages for complete session information.
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<tr>
<th>Time</th>
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<tr>
<td>10:30-12:10</td>
<td>LMB • Adaptive Optics I</td>
<td>Malcolm Northcott; Aoptix Technologies, Inc., United States; Troy Rhoadarmer; Science Applications International Corporation, United States, Presiders</td>
</tr>
<tr>
<td>10:30-12:30</td>
<td>IMB • Emerging Technologies for Imaging Systems</td>
<td>Peter Catrysse; Stanford University, United States, Presider</td>
</tr>
<tr>
<td>10:30-13:10</td>
<td>AIMB • Fiber Optic Sensors</td>
<td>Sean Christian; Optrology, Inc., United States, Presider</td>
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<td>AIMB • Fiber Optic Sensors</td>
<td>Sean Christian; Optrology, Inc., United States, Presider</td>
</tr>
</tbody>
</table>

**LMB1 • 10:30**
**Invited**
Self-Reference Interferometer Adaptive Optics for Improving Free Space Laser Communications, Troy A. Rhoadarmer; Lasers & Imaging Technology Laboratory, Science Applications International Corporation, USA. Self-reference interferometer adaptive optics (SRI AO) provides innovative technologies for improving performance of free-space laser communications. We provide an overview of the next generation SRI AO system and results from system testing.

**IMB1 • 10:30**
**Invited**
High Efficiency and High Resolution Plasmonic Color Filters for Display Applications, L. Jay Guo, Ting Xu, Alex F. Kaplan, Yi-Kuei Wu; University of Michigan, USA. Selective conversion between the free-space waves and spatially confined modes in plasmonic nanostructures, frequency-selective transmission and reflection spectra can be engineered and can be used to develop filters for display and imaging applications.

**AIMB1 • 10:30**
**Invited**
Fiber Optic Strain Sensors for Chemical and Acoustic Measurements, Hans Peter Lock; Queen’s Univ. College, USA. Single FBGs and FBG Fabry-Pérot cavities were used to measure the strain on a fiber optic waveguide. Chemical concentration measurements and audio recordings of an acoustic guitar were obtained from shifts of the transducer spectra.

**LMB2 • 11:10**
Withdrawn

**IMB2 • 11:10**
**Invited**
Some Recent Progress on Curvilinear Imagers and Eyeball Cameras, John Rogers; Univ. of Illinois at Urbana-Champaign, USA. We present curvilinear imagers using photodetector arrays on elastomeric membranes, capable of reversible deformation into hemispherical shapes via hydraulics. Combining with tunable, fluidic plano-convex lenses yields hemispherical cameras of adjustable zoom and excellent imaging characteristics.

**AIMB2 • 11:10**
**Invited**
Shape Sensing of Multiple Core Optical Fiber, Mark Froggatt; Luna Technologies, USA. The shape of a fused silica fiber having four guiding cores that are configured in a helix is reconstructed using a measurement of the phase shift in the Rayleigh scatter patterns of the four cores.

**SMB1 • 10:30**
**Invited**
Promises and Challenges of Ghost Imaging, Robert Boyd; Department of Physics, University of Ottawa, Ontario, ON K1N 6N5 Canada and The Institute of Optics and Department of Physics and Astronomy, University of Rochester, NY, USA. In this contribution we review research on the imaging protocol known as ghost (or coincidence) imaging. We also describe some current research directions within this topical area.

**SMB2 • 11:10**
**Invited**
High Precision Object Segmentation and Tracking for use in Super-Resolution Video Reconstruction, Terrell N. Mundhenk; Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong. By formulating a general light field acquisition model and incorporating the prior knowledge existing in the observations, we propose a resolution enhancement scheme for the captured light field. Meanwhile, the depth map can be obtained.

**SMB3 • 11:30**
**Invited**
Light Field Superresolution Reconstruction in Computational Photography, Zhimin Xu; Edmund Lam; David R. Gersh; ‘Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong. By formulating a general light field acquisition model and incorporating the prior knowledge existing in the observations, we propose a resolution enhancement scheme for the captured light field. Meanwhile, the depth map can be obtained.
FMA1 • 10:30  
**Science, Measurement, and Technology Requirements for Infrared Climate Benchmark Missions**, David G. Johnson, Martin Mylneczak, NASA Langley Research Center, USA. Quantifying climate change in the presence of natural variability requires highly accurate global measurements covering more than a decade. Instrument design considerations for trending terrestrial emitted radiances are described.

FMA2 • 11:10  
The University of Wisconsin Space Science and Engineering Center Absolute Radiance Interferometer (ARI), Joe Taylor, Henry Bevercomb, Henry Busby, Federico Grandmont, Jonathan Gera, Fred Best, David Tobin, Robert Knuteson, Daniel Lallier, Richard Clune, Mark Schwarz, Jeff Wong, Space Science and Engineering Center, University of Wisconsin-Madison, USA; ABB-Bøhm Inc, Canada; Université Laval, Canada. A summary of the development of the Absolute Radiance Interferometer (ARI) at the University of Wisconsin Space Science and Engineering Center (UW-SSEC) is presented. This effort is funded under the NASA Instrument Incubator Program (IIP).

FMA3 • 11:10  
**On-orbit Absolute Blackbody Emissivity Determination Using the Heated Halo Method**, Jonathan Gera, Joe Taylor, Fred Best, Henry Bevercomb, Robert Knuteson, David Tobin, Douglas P. Adler, Nick Ciganowski, Steven Dutcher, Ray Garcia, Space Science and Engineering Center, University of Wisconsin, USA. The Heated Halo method can be used to accurately measure the spectral emissivity of a blackbody, on-orbit, using a broadband thermal source.

FMA4 • 11:30  
**A Cross-Comparison of The NOAA/NESDIS AIRS, IASI and CrIS Operational Channel Selections: Methodology and Information Content**, Antonia Gambacorta, Christopher Barnett, Eugenio Dardi, Walter Wolf, Tim King, Henry Busby, Mitchell D. Goldberg, Dell Inc., USA; NOAA/NESDIS/STAR, NOAA, USA; INSPI, USA. We present a cross-comparison of the NOAA/NESDIS operational channel selection for AIRS, IASI and CrIS. The focus of this study is on the channel selection methodology and the final information content in the three systems.

FMA1 • 10:30  
**NOAA’s Joint Polar Satellite System and the NPP Satellite Delivering the Next Generation of Environmental Earth Observations**, Mitchell D. Goldberg, James Glassow, Robert Murphy, Carl Hoffman, John Ferguson, Satellite Meteorology Division, NOAA/NESDIS, USA. The current status and plans for the Joint Polar Satellite System and its predecessor mission, the NPOESS Preparatory Project (NPP), are discussed with more detail provided for the five sensors scheduled to be flown on NPP.

FMA2 • 11:10  
**Pre-Launch Evaluation of NPP-CIMSS EDR Algorithm Products with Matched ECMWF Analysis, RAOB Measurements, and IASI Retirevals**, Marty G. Diskin, Mitchell D. Goldberg, Christopher Barnett, Dugan Gu, Xia Liu, William Blackwell, Guanggui, Susan Kizer, Eric Maddy, Antonia Gambacorta, Nick Nalli, Kexin Zhang, ML Systems Group, Inc., USA; STAR, NOAA/NESDIS, USA; NGAI, USA; NASA/LARC, USA; MIT Lincoln Laboratories, USA; DELL, USA. Atmospheric vertical temperature and moisture profiles retrieved by the Cross-track Infrared Sounder and Advanced Technolgy Microwave Sounder (CrTMS) algorithm were evaluated with radiosonde measurements, ECMWF analysis, and IASI retrievals.

FMA3 • 11:30  
**Fast Off-Line Kalman Filter Gain Computation for Astronomical Adaptive Optics Systems**, Paola Massioni, Caroline Kilicar, Henri-François Raynaud, Jean-Marc Coutur, Institut Galilée, L2T, Université Paris I, France; DOD, ONERA, France. We introduce a new procedure for quickly approximating the Kalman gain for the optimal control of large astronomical adaptive optics systems. A computational simplification is obtained in Fourier domain by working on infinite-size phase screens.

FMA1 • 10:30  
**The Durham AO Real-Time Controller and the CANARY Implementation**, Alastair Basden, Physics, Durham University, United Kingdom. A new real-time control system (the Durham Adaptive optics Real-time controller, DARC) was used with the MÔA0 demonstrator instrument CANARY. Available as an open-source release, the major features are described and the CANARY implementation.

FMA2 • 11:10  
**Gemini Planet Imager Minimum-Variance Tip-Tilt Controllers**, Carlos Correia, Jean-Pierre Véran, Lisa Poyner, Herzberg Institute of Astrophysics, Canada; Lawrence Livermore National Lab, USA. Minimum-variance controllers for tip/tilt modes are investigated and compared to optimized-gain integrators through time- and frequency-domain simulations, using common and non-common path disturbances.

FMA3 • 11:30  
**Using Split-tomography, Fast Off-Line Kalman Filter Gain Computation for Astronomical Adaptive Optics Systems**, Paolo Massioni, Caroline Kilicar, Henri-François Raynaud, Jean-Marc Coutur, Institut Galilée, L2T, Université Paris I, France; DOD, ONERA, France. We introduce a new procedure for quickly approximating the Kalman gain for the optimal control of large astronomical adaptive optics systems. A computational simplification is obtained in Fourier domain by working on infinite-size phase screens.

FMA4 • 11:30  
**Advanced NGS-Mode Control In NFIRAOS Using Split-tomography**, Carlos Correia, Jean-Pierre Véran, Glen Herrard Herrard, Brent Ellerbroek, Liang Wang, Luc Gillet, Carina Boyer, Herzberg Institute of Astrophysics, Canada; Thirty-Meter Telescope Observatory Corporation, USA. Controllers based on simple and double integrators are compared to Linear-Quadratic-Gaussian controllers for the Natural-Guide Star loop of NFIRAOS, the 1st light multi-conjugate Adaptive Optics facility for the Thirty-Meters Telescope.

FMA5 • 11:10  
**Experimental Demonstration of Compresive Target Tracking**, Tareq Osman, Philip K. Pont, Dan Townsend, Scott Whelton, Adrian Mariano, Michael Stenner, Michael E. Gehm, Electrical and Computer Engineering, University of Arizona, USA; College of Optical Science, University of Arizona, USA; MITRE Corp., USA. We present an experimental demonstration of compressive target tracking—detection of mover locations with a spatial resolution finer than that provided by the detector pixel dimensions. The tracking performance is evaluated with a customized metric.
### Monday, 11 July

#### These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

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#### LMB • Adaptive Optics I—Continued

**LMB3 • 11:50**

**Compact Integrated Wavefront Corrector for Lasercom Applications**

Alias Werk1, Thomas Price2, ‘Kinetics, Inc., USA. The design and test results for a compact optic that combines the functionality of a fast steering mirror and a deformable mirror in a single component are presented.

#### LMB • Adaptive Optics II

**LMB4 • 12:10**

**Picoscend Camera for Time-of-Flight Imaging**

Andrea Veltiu1, Ramech Raskar1, Hounigu Bawend1, MIT Media Lab, USA; ‘Department of Chemistry, MIT, USA. We present an ultrafast imaging system capable of capturing images with picosecond time resolution or movies with a frame rate of 3x10^11 frames per second.

#### AIMB • Fiber Optic Sensors—Continued

**AIMB4 • 12:30**

**Optical Fiber Gas Sensors using UV and MidIR Spectroscopy for Exhaust Gas Monitoring**

Efud Lowar1, University of Limerick, Ireland. Results are presented for on-board and on-line sensing of vehicle exhaust gases. The sensor was located downstream of the Diesel Particle Filter of a Fiat Croma and data were simultaneously recorded from reference gas analysis instrumentation.

### 14:00–16:00

#### LMC • Adaptive Optics II

Malcolm Northcott1, Aoptix Technologies, Inc., United States; Troy Rhoadarmer2, Science Applications International Corporation, United States, Presider

**LMC1 • 14:00**

**Invited**

**Strategies for Enhancing the Reliability and Availability of Lasercom**

Malcolm Northcott1, ‘Kinetics, Inc., USA. Free space laser communications offers large improvements in data bandwidth. Lasercom also has some implementation difficulties, we will describe the difficulties and approaches to their mitigation. Examples are drawn from AOptix lasercom product performance.

#### IMB • Emerging Technologies for Imaging Systems—Continued

**IMB3 • 11:50**

**High Color Accuracy Image Acquisition in Single Capture**

Giacomo Langiformi1, Cesare Bufo1, Antonio Longoni2, Federica Zanaga2, ‘Politecnico di Milano, Italy. A tunable sensor enables image acquisition with high color accuracy. A different tuning of alternate rows implements a quasi-colorimetric six-color sensor. Tuning all the pixels identically gives higher resolution with usual color errors.

#### AIMB • Fiber Optic Sensors—Continued

**AIMB3 • 11:50**

**Invited**

**Strain Measurements Using Embedded Fiber Bragg Sensors**

Ron V. Guttman1, City Univ. London, United Kingdom. Abstract Not Available

#### SMB • Ghost Imaging, Superresolution & Blind Deconvolution—Continued

**SMB4 • 11:30**

**An Iterative Blind Deconvolution Algorithm as an Attempt to Search the Global Minimum**

Tobru Takahashi1, ‘Oita National College of Technology, Japan. We propose an iterative blind deconvolution algorithm which is an attempt to search the global minimum of a cost function. This algorithm works for small sized images although it needs a lot of iterations.

### 12:30–14:00 Lunch (On Your Own)

#### LMC • Adaptive Optics II

**Invited**

**High-Order Statistics for Point Prediction in Natural Images**

William S. Geisler1, Jeffrey S. Perry1, ‘Psychology, Univ. of Texas at Austin, USA. Results are presented for a simple conditional-moments method that directly measures high-order statistics of natural images. In four estimation tasks significant increases in performance are obtained in comparison to traditional methods.

#### AIMC • Image Processing

**AIMC1 • 14:00**

**Invited**

**In-Situ Near- and Mid-Infrared Laser Spectrometers: From Lab to Industry**

Peter Kaspersen1, Axel Bohman1, Dang Du Dang1, ‘Norsk Elektro Optikk AS, Norway. Two new near-and mid-infrared spectrometers for in-situ measurements in harsh environments are presented in this paper including their development from an idea through a laboratory prototype to an industrial instrument.

#### SMC • Information Theory & Processing Time Considerations

Andrew Lambert; University of New South Wales, Australia, Presider

**SMC1 • 14:00**

**Invited**

**Applications of Shannon Information and Statistical Estimation Theory to Inverse Problems in Imaging**

Sudhakar Prasad1, Srikanth Narasimul1, ‘Physics and Astronomy, University of New Mexico, USA. We apply statistical information and estimation theories to derive fundamental Bayesian bounds on image recovery from noisy data for two highly simplified imaging problems, namely single-pixel source localization and a two-pixel correlated image.
FMA • Atmospheric Science from Space I—Continued

FMA4 • 11:50 Wideband Far Infrared FTS For The FORUM Explorer Mission, Luca Pulchetti; "Istituto di Fisica Applicata ‘Nello Carrara’ - IFAC-CNRL, Italy. The FTS designed for the FORUM space mission is presented. The instrument covers 100 to 1800 cm⁻¹ spectral range of the Earth emission to space with spatial resolution optimized for the characterization of the atmospheric processes affecting the ERB.

FMA4 • 14:00 Panchromatic Fourier Transform Spectrometer (Pan-FTS) for Geostationary Measurements of Atmospheric Composition, Stanley P. Sander; NASA/JPL, Caltech, USA. The Panchromatic Fourier Transform Spectrometer (PanFTS) instrument is being developed to meet the science demands of measuring a wide range of trace gases with unprecedented vertical resolution, by sensing the UV, visible, and IR in one instrument.

HMA • Upcoming Missions—Continued

HMA4 • 11:50 Invited NASA’s Aerosol-Cloud-Ecosystems (ACE) Mission, David O’C Starr; NASA Goddard Space Flight Center, USA. Plans for NASA’s Aerosol-Cloud-Ecosystem (ACE) mission is described. Recommended by Earth Science Decadal Survey in 2007, ACE is nominally planned for a 2021 launch. ACE is comprised of passive and active sensors (tadar and lidar).

AMB • Control Systems—Continued

AMB5 • 12:00 Discrete-Time Model for Adaptive Optics with Discrete-Time Atmospheric Model, Douglas Looze; ECE, U. Massachusetts, USA. This paper models the incident wavefront of an AO system as being constant within each frame. It has shown that the performance degradation is almost insignificant for astronomical AO applications.

HMB • Advances in Sensors and Measurements

HMB1 • 14:00 Invited Scientific Results from the FIRST Instrument Deployment to Cerro Toco, Chile and from the Flight of the INFLAME Instrument, Martin Mlynczak; David G. Johnson1, Richard P. Cageao1; NASA Langley Res. Ctr., USA. Transform Spectrometers are presented. These are comprehensive measurements of the far-IR spectrum (FIRST) and the net infrared fluxes within the atmosphere (INFLAME).

AMC • Wavefront Control

AMC1 • 14:00 Invited Adaptive Grazing Incidence X-Ray Optics, Alan Wirth1, David Pearson1; Xinetics, Inc., USA. Active figure control will be necessary to meet the challenging requirements of the Gen-X optics. In this paper we present our adaptive grazing incidence mirror design and the results from laboratory tests of a prototype mirror.

HMB1 • 14:00 Invited Panchromatic Fourier Transform Spectrometer (Pan-FTS) for Geostationary Measurements of Atmospheric Composition, Stanley P. Sander; NASA/JPL, Caltech, USA. The Panchromatic Fourier Transform Spectrometer (PanFTS) instrument is being developed, to meet the science demands of measuring a wide range of trace gases with unprecedented vertical resolution, by sensing the UV, visible, and IR in one instrument.

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CMC • Phase-based Techniques

CMC1 • 14:00 Invited Compressive Phase Retrieval, George Barbastathis1, Justin W. Lee1, Lei Tian1, Se Baek Oh1; MIT, USA. We discuss and provide experimental results on the application of compressive sampling to the problem of quantitative tomographic phase reconstruction.
**LMC • Adaptive Optics II—Continued**

*Monday, 11 July*

**LMC2 • Withdrawn**

See the full session information in the next page.

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**AIMC • Image Processing—Continued**

**AIMC2 • 14:40 Invited**

Optimal Image-based Defocus Estimates from Individual Natural Images, Johannes Burge1, Wilson S. Geisler1; 1Department of Psychology, University of Rochester, USA. We present a general method for estimating defocus blur from first principles, given a set of natural scenes and properties of the vision system. Local, high-precision, signed estimates are obtained for a model human visual system.

**AIMC3 • 15:00**

Local Linear Learned Image Processing Pipeline, Steven Lancel1, Brian Wandell1; 1Stanford Univ., USA. The local linear learned (L3) algorithm is presented that simultaneously performs the deconvolution, denoising, and color transform calculations of an image processing pipeline for a digital camera with any color filter array.

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**SMC • Information Theory & Processing Time Considerations—Continued**

**SMC2 • 14:40**

Achievability of Multi-Frame Blind Deconvolution Cramer-Rao Lower Bounds, Charles Matson1, Charles C. Becker1, Michael Flanagan1; 1Air Force Res. Lab, USA; 2USAF, USA. The achievable of MFBD CRBs for both object and blurring functions using Fourier-domain metrics depend upon signal-to-noise ratios and the quality of the prior knowledge included in the reconstruction process.

**SMC3 • 15:00**

A Fast Approximation Method for Broadband Phase Retrieval, Aiden S. Harling1, James Fienup2; 1Institute of Optics, University of Rochester, USA. We introduce a new approximation method for broadband phase retrieval. We show that it yields results of comparable quality to the traditional broadband phase retrieval algorithm with a large improvement in speed.

**SMC4 • 15:20**

Fast PSF Reconstruction using the Frozen Flow Hypothesis, James Nagy1, Qiong Chu1, Sarah Kepfer1; 1Math and CS, Emory University, USA; 2Institute for Astronomy, University of Hawaii, USA. Using a Taylor frozen flow hypothesis, correlations in multiple wavefront sensor measurements are exploited to obtain accurate PSF estimates. The approach requires solving a large and sparse least squares problem.

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**IMC • Image Processing—Continued**

**IMC2 • 14:40**

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**IMC4 • 15:20**

Towards Experimental Validation of Full-Wave Precompensation for Laser Telecommunications, Ronald Barentsz1, Marie-Theeine Vallier2, Vincent Michau1, Nicolas Vidline1, Laurent M. Magnier1; 1DOTA/HRA, ONERA, France. We designed an optical bench to demonstrate full-wave precompensation for laser telecommunications. This technique requires a device performing time reversed waves. We propose and characterize a precompensation for laser telecommunications.

**IMC5 • 15:40**

Generating Function and Diffractive Optics Approach for MIMO Free Space Optical Communications, Shamsul Ghani1, Michael A. Gold1, Silvano Ruschi1; 1Electrical Engineering, Tel Aviv University, Israel. Several channels in optical complex spatial filters for multimodal communication systems have design freedom in choice of modal phases. We show that analytical generating functions of orthogonal polynomials provide optimization of required phases.

**IMC5 • 15:40**

OTF Estimation Using a Siemens Star Target, Samuel T. Thurman1; 1Lockheed Martin Coherent Technologies, USA. Some practical aspects of estimating the optical transfer function of an imaging system with a Siemens star target are described.

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**SMC • Information Theory & Processing Time Considerations—Continued**

**SMC2 • 14:40**

Achievability of Multi-Frame Blind Deconvolution Cramer-Rao Lower Bounds, Charles Matson1, Charles C. Becker1, Michael Flanagan1; 1Air Force Res. Lab, USA; 2USAF, USA. The achievable of MFBD CRBs for both object and blurring functions using Fourier-domain metrics depend upon signal-to-noise ratios and the quality of the prior knowledge included in the reconstruction process.

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Against Other Satellite Instrument Datasets, Validation of the ACE-FTS Version 3.0 Dataset

Detecting Trace Organic Compounds from Orbit, University of York, United Kingdom.

Spectrally resolved airborne and ground-based measurements of shortwave radiation have advanced cloud and aerosol remote sensing. They provide new insights into the radiative energy budget. We illustrate this with results from recent experiments.

FMB2 • 14:40 Atmospheric Chemistry Experiment (ACE): Latest Results, Peter Bernath1; Chemistry, University of York, United Kingdom. An overview of some of the latest results from the ACE satellite Fourier transform spectrometer will be presented.

FMB3 • 15:00 Atmospheric Chemistry Experiment (ACE): Advanced Sounder Measurement Information Dependence on System Characteristics, Allen M. Larson1, Daniel Zhao2, Xu Liu1, William Smith2; NASA Langley Res. Ctr., USA; Hampton University, USA; University of Wisconsin, USA. Improved observations of Earth system are needed for enhancing weather prediction, climate monitoring capability, and environmental change detection. This study addresses impact on system characteristics of advanced sounder information content.

FMB4 • 15:20 Validation of the ACE FTS Version 3.0 Dataset Against Other Satellite Instrument Datasets, Claude Maynard1, Kaley Walker1, Chris Boone2, Eric Dupuy1; Department of Physics, University of Toronto, Canada; Department of Chemistry, University of Waterloo, Canada; National Institute of Information and Communications Technology, Japan; Department of Chemistry, University of York, United Kingdom. The ACE-FTS version 3.0 dataset is being validated against the previous (well validated) data version 2.2 as well as other satellite instruments such as HALOE.

FMB5 • 15:40 Developments for Future Atmospheric Composition Measurements Using Space-based Solar Occultation Fourier Transform Spectrometry, Kaley Walker1, Stella Mile1, Guatem Ferrer2; Physics, University of Toronto, Canada; Chemistry, University of Waterloo, Canada; Canadian Space Agency, Canada; ABB-Bomem, Canada. This paper will discuss CSA-funded studies that have been undertaken in Canada to develop new satellite missions and instruments using solar occultation Fourier Transform spectrometry to build on heritage from the Atmospheric Chemistry Experiment.

FMB6 • 14:40 Measurements of Shortwave Radiation: The Value of Spectral Resolution for Cloud and Aerosol Remote Sensing, Sebastian Schmidt1, Peter Filipiak2; Laboratory for Atmospheric and Space Physics, University of Colorado, USA. Spectrally resolved airborne and ground-based measurements of shortwave radiation have advanced cloud and aerosol remote sensing. They provide new insights into the radiative energy budget. We illustrate this with results from recent experiments.

HMB2 • 14:40 Invited Measurements of Shortwave Radiation: The Value of Spectral Resolution for Cloud and Aerosol Remote Sensing, Sebastian Schmidt1, Peter Filipiak2; Laboratory for Atmospheric and Space Physics, University of Colorado, USA. Spectrally resolved airborne and ground-based measurements of shortwave radiation have advanced cloud and aerosol remote sensing. They provide new insights into the radiative energy budget. We illustrate this with results from recent experiments.

HMB3 • 15:20 Advanced Sounder Measurement Information Dependence on System Characteristics, Allen M. Larson1, Daniel Zhao2, Xu Liu1, William Smith2; NASA Langley Res. Ctr., USA; Hampton University, USA; University of Wisconsin, USA. Improved observations of Earth system are needed for enhancing weather prediction, climate monitoring capability, and environmental change detection. This study addresses impact on system characteristics of advanced sounder information content.

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HMB5 • 15:40 Developments for Future Atmospheric Composition Measurements Using Space-based Solar Occultation Fourier Transform Spectrometry, Kaley Walker2, Stella Mile1, Guatem Ferrer2; Physics, University of Toronto, Canada; Chemistry, University of Waterloo, Canada; Canadian Space Agency, Canada; ABB-Bomem, Canada. This paper will discuss CSA-funded studies that have been undertaken in Canada to develop new satellite missions and instruments using solar occultation Fourier Transform spectrometry to build on heritage from the Atmospheric Chemistry Experiment.

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AMC2 • 14:20 Advances In The Analysis And Design Of Adaptive Optics, Gregory Michels1, Victor Gentberg; Signature, Inc., USA. Opto-mechanical analysis and design techniques for development of adaptive optics are presented. Topics include actuator stroke limits, actuator failures, optimum placement of actuators, and optimum structural design.

AMC3 • 14:40 Novel Beacon Creation in an Adaptive Optics System, Elizabeth Daly1, Andrew J. Lambert2, Chris Dainty3; Applied Optics Group, National University of Ireland Galway, Ireland; School of Engineering and IT, UNSW@ADFA, Australia. We describe the use of supplementary active optics for beacon shaping in an adaptive optics system for the human eye. We determine the effects of such shaping on system performance for model and real eyes.

AMC4 • 15:00 Controlling Spatial Coherence in Multimode Fibers, Fasting Kong1, Nicholas V. Prociuc2, Kotik K. Lee3, Ying-Chih Chen4; Physics and Astronomy, Hunter College of the City University of New York, USA. We demonstrate that the randomized output field of multimode fibers can be focused in the near field or collimated in the far field by waveform shaping in the input or the output fields.

AMC5 • 15:20 Laser Microlithography Using Adaptive Optics: Parallelization and Aberration Correction, Patrick S. Salter1, Alexander Jesacher2, Hassan Al-Wakeel1, Martin Booth1; Engineering Science, University of New York, USA. We use of photoacoustic signals originating from an optically absorptive target as feedback for shaping the incident wavefront to increase optical energy density at the absorptive target delivered through a diffusive medium.

AMC6 • 15:40 Phase-Space Imaging of Partially Coherent Beam Propagation Using a Spatial Light Modulator, Laura Waller1, Guohai Situ1, Jason W. Fleischer2; Electrical Engineering, Princeton University, USA. We measure the phase-space of coherent and partially coherent light beams as they propagate. The 4D distributions are captured by scanning and Fourier transforming an aperture created by a spatial light modulator (SLM).

CMC2 • 14:20 Novel Beam Creation in an Adaptive Optics System, Elizabeth Daly1, Andrew J. Lambert2, Chris Dainty3; Applied Optics Group, National University of Ireland Galway, Ireland; School of Engineering and IT, UNSW@ADFA, Australia. We describe the use of supplementary active optics for beacon shaping in an adaptive optics system for the human eye. We determine the effects of such shaping on system performance for model and real eyes.

CMC3 • 15:20 Schulz-Snyder Phase Retrieval Algorithm as an Alternating Minimization Algorithm, Figen S. Oktay1, Richard E. Blahut1; Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, USA. We derive the Schulz-Snyder phase retrieval algorithm as an alternating minimization method, and discuss its advantages and drawbacks. An annealing-type Schulz-Snyder algorithm is proposed to avoid convergence to nonglobal solutions.

CMC4 • 15:40 Phase-Space Imaging of Partially Coherent Beam Propagation Using a Spatial Light Modulator, Laura Waller1, Guohai Situ1, Jason W. Fleischer2; Electrical Engineering, Princeton University, USA. We measure the phase-space of coherent and partially coherent light beams as they propagate. The 4D distributions are captured by scanning and Fourier transforming an aperture created by a spatial light modulator (SLM).
Monday, 11 July

16:30–18:30
IMD • Human Vision and Imaging Systems
Joyce Farrell; Stanford University, United States, Presider

16:30–18:30
AIMD • Healthcare and Pharma
Jess Ford; Weatherford Intl., United States, Presider

16:30–17:50
SMD • Optical Processing & Algorithms
Julia Sakamoto; University of Arizona, United States, Presider

IMD1 • 16:30
Invited
Learning the Mosaic: Unsupervised Identification of Sensor Spectral Types,
David Brainard1; 1Univ. of Pennsylvania, USA.

Accurate processing of color information requires knowledge of the spectral class of each light-sensitive receptor. Unsupervised learning algorithms can identify the class of individual sensors in a mosaic from the sensor responses to natural images.

AIMD1 • 16:30
Invited
Process Analytical Technology: Bringing Solutions to the Plant Floor,
Katherine A. Bakeev1; 1CAMO Software Inc., USA.

Process analytical technology using spectroscopic tools for real-time monitoring will be presented. PAT provides fuller process understanding and contributes to process control. Challenges in implementation of PAT in manufacturing will be discussed.

SMD1 • 16:30
Invited
Optical Signal Processing: Holography, Speckle and Algorithms,
John Sheridan1; 1Univ. of Pennsylvania, USA.

Modeling the propagation of light through free space and simple paraxial systems continues to be enduring, and practically important topics in optics. Is there anything new or interesting that remains to be said? Given the pervasive use of digital cameras and numerical algorithms, examples are given indicating that the answer is yes. Satisfactory modeling requires the interactions of the whole optical information processing system (optics, optoelectronics and software) be included.

IMD2 • 17:10
Invited
Simulating Imaging Systems: Photons, Parts and People,
Brian Wandell1; 1Stanford Univ., USA.

The interest in the spatial statistics of the signal encoded by the eye motivated us to assemble and distribute software for calculating the retinal irradiance and cone absorptions of scene radiance. We hope that this simulation will provide a more realistic approximation of the statistical properties encoded by the nervous system. The statistics of the retinal irradiance image is significantly different from the scene radiance, and the cone absorption properties add further complexity. By making it simple to account for optical and retinal factors, we hope to enable new experimentation and insights.

AIMD2 • 17:10
Invited
How To Measure The Size of Tumors: The RECIST Standard vs. Volumetrics,
Zachary H. Levine 1; 1Optical Technology Division, NIST, USA.

Response Evaluation Criteria for Solid Tumours (RECIST) proposed 1D criteria for determining if 3D tumors are growing malignantly. Here, the error introduced is quantified using physical ellipsoids and fitting to clinical data on liver malignoma.

SMD2 • 17:10
Optical Signal Processing: Holography, Speckle and Algorithms,
Jun Ke1, Rui Zhu1, Edmund Y. Lam1; 1Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong.

We cast the signal reconstruction in spectral domain optical coherence tomography as a minimization problem with total variation regularization. A cross-sectional image in SD-OCT is estimated directly from non-uniformly spaced frequency samples.
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.
Monday, 11 July

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IMD • Human Vision and Imaging Systems—Continued

AIMD • Healthcare and Pharma—Continued

SMD • Optical Processing & Algorithms—Continued

IMD3 • 17:50 Invited
Video Acuity: A Metric to Quantify the Effective Performance of Video Systems, Andrew Watson1; 1NASA Ames Res. Ctr., USA. There is a widely acknowledged need for metrics to quantify the performance of video systems.

AIMD3 • 17:50 Invited
Glucose and Other Measurements, Joe Chaiken1,3, Bin Deng2, Jerry Goodisman1, George Shakhov1, Rebecca Busig2; 1Chemistry, Syracuse University, USA; 2Biomedical Engineering, Syracuse University, USA; 3600 East Genesee Street, LightTouch Medical, Inc., USA. Simultaneous measurement of elastic and inelastic remitted light from tissues being irradiated with a single near infrared laser wavelength can be used to calculate the plasma and red blood cell volumes of the included blood.

SMD3 • 17:30
Three-dimensional Surface Recovery with a Regularized Multi-frame Phase Shift Algorithm, Fuqin Deng1, Edmund Y. Lam1; 1University of Hong Kong, Hong Kong. We develop a modified four-frame phase shift algorithm that incorporates a smoothness constraint. This is applied to a high-precision full-profile reconstruction and measurement for integrated circuit packages.

NOTES
Science with Ground Based Instrumentation—Continued

FMC3 • 17:30
University of Wisconsin Calibration Performance Certification of Atmospheric Emitted Radiance Interferometer (AERI) Systems, Robert Knuteson1, Joe Taylor1, Fred Beer1, Henry Revercomb1, Danny Hackel1, Ray Garcia1; Space Science & Engineering Center, Uni. of Wisconsin-Madison, USA. The University of Wisconsin-Madison Space Science and Engineering Center (UW-SSEC) is certifying the calibration performance of a new generation of instruments for the measurement of the downwelling atmospheric infrared spectrum at the surface.

FMC4 • 17:50
The REFIR-PAD far-infrared Fourier transform spectroradiometer, Giovanni Bianchini1, Luca Palchetti1; Istituto di Fisica Applicata ‘Nello Carrara’ - IFAC-CNR, Italy. The REFIR-PAD spectroradiometer is based on a misalignment-compensated Strehl-Zeuner design with Ge-coated Mylar beamsplitters and uncooled pyroelectric detectors for broadband, room-temperature operation in the mid/far-infrared range.

FMC5 • 18:10
Ground-Based FTIR Spectrometer Observation of Nitrous Oxide And Its Validation Over Addis Ababa, Ethiopia, Samuel T. Kenea1; Physics, Addis Ababa University, Ethiopia. Since May 2009 high-resolution Fourier transform infrared (FTIR) absorption spectra are recorded at Addis Ababa, Ethiopia. The vertical distribution of nitrous oxide (N2O) was deduced from the spectra by the code PROFFIT (V9.5).

HMC3 • 17:30
A Combined Atmospheric Radiative Transfer Model (CART) and Its Applications, Hui Wei2; Key Laboratory of Atmospheric Composition and Optical Radiation, Anhui Institute of Optics and Fine Mechanics, the Chinese Academy of Sciences, China. A Combined Atmospheric Radiative Transfer model (CART) has been developed to rapidly calculate atmospheric spectral transmittance and background radiance. The algorithms and the applications of CART are presented in the paper.

HMC4 • 17:50
Satellite Retrieval of Percent Liquid Water in Tropical Clouds Between 20° and 38°C, David L. Mitchell1, Robert F. entrenmont1; Atmospheric Sciences, Desert Research Institute, USA; Atmospheric and Environmental Research, Inc., USA. A method for estimating the fraction of liquid water using the 11 and 12 micron MODIS channels is described. The mean liquid fraction at 20°C was ~10%, strongly affecting cloud optical properties.

HMC5 • 18:10
Retrieving Atmospheric Profiles Data in the Presence of Clouds from Hyperspectral Remote Sensing Data, Xia Liu1, Allen M. Larson2, Daniel Zhou1, Susan Kizer1, Hui Wei1, Christopher Barnet1, Marty G. Dovukante1, Guang Guo1, William Blackwood1, William L. Smith4; NASA Langley Research Center, USA; NASA Ames Research Center, USA; NASA Laboratory, USA; Harvard University, USA; Texas A&M University, USA; Northrop Grumman Aerospace Systems, USA; Different methods for retrieving atmospheric profiles in the presence of clouds will be described. We will present results from the JPSS cloud-clearing algorithm and NASA Langley cloud retrieval algorithm.

JMC3 • 17:30
Grid Size Optimization for Atmospheric Turbulence Phase Screen Simulations, Ramesh M. V1, Vyas Akondi2, Raghavendra Prasad Budhiraja1; NASA Langley Research Center, USA; Department of Physics, Indian Institute of Science, India. Atmospheric phase screens are used for numerical evaluation of large telescope systems. In this paper, we optimized the grid size of the simulated phase screens in terms of the error in the structure function assuming a Kolmogorov turbulence model.

JMC4 • 17:50
Beam Wavefront Control of TIL for ICF Application, Wanjun Dai1; Research Center of Laser Fusion, China Academy of Engineering Physics, CAEP, China. A novel scheme to correct aberration of each beam from the front-end to target point in TIL is presented.

JMC5 • 18:10
Towards Low Cost Turbulence Generator for AO Testing, Utility, control and stability, M. B. R. Raoophara1, Akoni Vyas1; S. Anurda Krishnan1, B. R. Ram2, S. Siva Shankar Suri2; Raghavendra Prasad1; Indian Institute of Astrophysics, Karnataka, India; Indian Institute of Science, Karnataka, India; S. Siva Suri1; Institute of Higher Learning, Andhra Pradesh, India. We demonstrate and characterize an effective, statistically repeatable atmospheric turbulence generator with the aim of testing a 2m class telescope adaptive optics system in a cost effective manner.
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

<table>
<thead>
<tr>
<th>Pier 4</th>
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<th>08:00–10:00</th>
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<th>08:40–09:20</th>
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<tr>
<td>LTuA • Information Assurance in Quantum Communications I</td>
<td>LTuA • Coded Optical Imaging</td>
<td>AITuA • LIBS</td>
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<tr>
<td>David Hughes; Air Force Research Lab, United States, Presider</td>
<td>Gisele Bennett; Georgia Tech, United States, Presider</td>
<td>Arel Weisberg; Energy Research Co., United States, Presider</td>
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<tr>
<th>LTuA1 • 08:00</th>
<th>LTuA2 • 08:40</th>
<th>AITuA1 • 08:00</th>
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<tbody>
<tr>
<td>Addressing Security Issues in Quantum Key Distribution using Seed Keys and Entangled Sources, Dog Kantor; Yu-Ping Huang; Prem Kumar; NuCrypt LLC, USA; Center for Photonic Communication and Computing, Northwestern University, USA.</td>
<td>Novel Protocols for Free-Space Quantum Key Distribution, Ulvi Yurtsever; MathSense Analytics, USA.</td>
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<th>LTuA3 • 09:20</th>
<th>ITuA1 • 08:00</th>
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<tbody>
<tr>
<td>Stochastic Electromagnetic Beams for Sensing and Free Space Communications, Olga Korotkova; University of Miami, USA.</td>
<td>Recent Advances in Diffraction and Geometry Related Super Resolution Approaches, Zee Zalevsky; Ohad Fixler; Aviram Gur; Dear Fiser; Vicente Mico; Javier Garcia; School of engineering, Bar-Ilan Univ., Israel; Departamento de Optica, Univ. Valencia, Spain.</td>
<td>Laser-Induced Breakdown Spectroscopy (LIBS) for On-line Control in Mining Industry, Michael Gaft; Laser Distance Spectrometry, Israel.</td>
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<th>LTuA3 • 09:20</th>
<th>ITuA1 • 08:00</th>
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<tbody>
<tr>
<td>Spatially Selective Mask for Single Pixel Video Rate Imaging, Orges Furxhi; Eddie Jacobs; Electrical and Computer Engineering, University of Memphis, USA.</td>
<td>What Would You Do With Precision in Optics If You Had It?, Edward Dowski; Ascentia Imaging, Inc, USA.</td>
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- With increasing precision a number of important changes in imaging could become possible and practical, such as new configurations, separating design from manufacture and seamless merging of optics and electronics.
- We discuss alternative technologies to the decoy-state protocol based on the use of entangled light randomly mixed with weak laser pulses.
- Stochastic and vectorial (electromagnetic) nature of the optical beams can improve communication links and can be effectively used for sensing of objects when the propagation channels involve atmospheric turbulence.
- We present a spatially selective mask that is used with a single pixel detector to reconstruct images in real-time. Reconstructed image sizes are variable, the mask works in multiple electromagnetic regimes. Experimental results are shown.
- We manufacture industrial on-line analyzers based on LIBS. The main installations are: (a) phosphate industry in USA and Russia; (b) metallurgical plant in Russia; (c) successful test for ash analysis of coal in South Africa.
Tuesday, 12 July

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

Pier 2
Imaging Systems and Applications

Pier 3
Applied Industrial Optics: Spectroscopy, Imaging, & Metrology

Pier 4
Application of Lasers for Sensing & Free Space Communication

LTuA * Coded Optical Imaging—Continued

ITuA4 • 09:40
Code Aperture Agile Spectral Imaging (CAASI), Henry Arguello*, Gonzalo Arce*, Electrical and Computer Engineering, University of Delaware, USA. This paper shows the mathematical framework for a new architecture, the Code Aperture Agile Spectral Imaging (CAASI), which extends the capabilities of the Code Aperture Spectral Imaging (CASSI) to allow multiple measurements.

10:00–10:30 Coffee Break/ Exhibits Open, Ballroom Foyer, Convention Level

NOTES
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

**FTuA • Astronomy and Planetary Science—Continued**

**FTuA5 • 09:40**
Pre-Commissioning Status of FTS-2, the SCUBA-2 Imaging Fourier Transform Spectrometer, Brad Gom1, David A. Naylor1, Coskun Oba2; 1Physics, University of Lethbridge, Canada. We present the installation and pre-commissioning status of FTS-2, the imaging Fourier transform spectrometer for use with SCUBA-2 at the James Clerk Maxwell Telescope, and discuss synergies with the HERSCHEL/SPIRE and SPICA/SAFARI instruments.

**HTuA • Merged Imager and Sounder—Continued**

**HTuA5 • 09:40**
Sensitivity of Monthly Cloud Statistics to Space and Time Considerations, Nadia Smith1, W. Paul Menzel2, Elisabeth Weisz3, Bryan Baum4; 1Space Science and Engineering Center, University of Wisconsin-Madison, USA. A monthly mean is calculated for MODIS high cloud top pressures (CTP≥440 hPa) at 1.0 degree spatial grid. Results indicate sensitivity to sample size, a function of both time and space. Three threshold methods are compared.

**JTuA • Joint AO/SRS Session I: Atmospheric Turbulence; Adaptive Optics Systems; Image Analysis—Continued**

**JTuA5 • 09:40**
Correct Normalization Of Scintillation Autocovariance for Generalized SCIDAR: Theory and Application, Remy Arola1,2; 1Centre de Física Aplicada y Tecnología Avanzada, Universidad Nacional Autonoma de Mexico, Mexico; 2Centre de Radioastronomía y Astrofísica, Universidad Nacional Autonoma de Mexico, Mexico. I present the theory for the correct normalization of scintillation autocovariance for the generalized SCIDAR and the application to turbulence profile measurements at San Pedro Martir Astronomical Observatory.

**CTuA • Imaging with Scattering and Aberrations—Continued**

**CTuA4 • 09:40**
Mitigation of Optical Aberrations Using Binary-Amplitude Masks and Digital Image Processing, Gonzalo Muyo1, Tom Vettenburg2, Andy R. Harvey3; 1Electrical Engineering, Heriot-Watt University, United Kingdom. We report the design of binary-amplitude masks that in conjunction with digital restoration enable mitigation of optical aberrations. Essentially, the design process aims to reduce destructive interferences in the optical transfer function.

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**10:00–10:30 Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level**
Frequent Fade Communications Channels, Diversity Rateless Round Robin for Networked FSO Communications, Roger A. Hammond, Frederic Davidson, APE, John Hopkins University, USA. In this paper, we show how the Rateless Round Robin protocol can be applied in a free space optical communications network. We discuss explicit code designs for the Rateless Round Robin packet-level coding and show how the Rateless Round Robin can be extended to make integrated use of diversity to further enhance performance.

The cBERT has BER estimation that provides stats for faded channels. The cBERT includes a specific (patented) technique of assembling monolithic scintillating crystals.

Explicit Code Designs for the Rateless Round Robin protocol can be applied in a free space optical communications network. We discuss explicit code designs for the Rateless Round Robin packet-level coding and show how the Rateless Round Robin can be extended to make integrated use of diversity to further enhance performance.

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The cBERT includes a specific (patented) technique of assembling monolithic scintillating crystals.
Recent improvements are detailed regarding the development of ice cloud scattering models based on a comprehensive set of microphysical in situ measurements and a set of modeled ice particles used for light scattering calculations.
### Session 1

**14:00–18:20**

**LTuC • Information Assurance in Quantum Communications II**

- David Hughes; Air Force Research Labs, United States, President

**LTuC1 • 14:00**

**Invited**

Authentication of Quantum Messages

Patrick Hayden\(^1\), Debbie Leung\(^1\), Dominic Mayers\(^1\); McGill University, Canada; \(^1\)University of Waterloo, Canada; \(^3\)Caltech, USA. We show that the protocols is universal composable secure, and most of the required key can be reused with universal composable security.

**LTuC2 • 14:40**

**Invited**

Defeating Eavesdropping with Quantum Illumination

Jeffrey Shapiro\(^1\), \(^2\)Research Laboratory of Electronics, Massachusetts Institute of Technology, USA. Theory has shown that quantum illumination can defeat passive eavesdropping on a two-way communication protocol. We report a preliminary experiment to demonstrate that immunity, and extend the analysis to minimizing vulnerability to active attacks.

**LTuC3 • 15:20**

**Invited**

MIMO FSO Communications in Cloud and Turbulence

Mohsen Kavehrad\(^1\), Jarir Fadlullah\(^1\), Zeinab Hajjarian\(^1\); \(^1\)Pennsylvania State University, USA. FSO communications can facilitate secure broadband airborne communications with enormous rates. However, atmospheric phenomena drastically degrade performance. Here, improvements achievable with MIMO FSO systems are presented.

**LTuC4 • 15:40**

**Invited**

Special Beam Arrays for Scintillation Reduction

Greg Cherney; \(^1\)Univ. of North Carolina at Charlotte, USA. A number of spatial coherence-related strategies are considered for the reduction of optical beam scintillation in turbulence. Among these are Bessel beam arrays, Airy beam arrays, and nonuniform polarization.

**16:00–16:30**

**Coffee Break/ Exhibits Open, Ballroom Foyer, Convention Level**

### Session 2

**14:00–16:00**

**AITuB • Optical Metrology**

- Sean Christian; Optometry, Inc., United States, President

**AITuB1 • 14:00**

**Invited**

Optical Current Sensing

Paul Dunn; \(^1\)8544 Electric Ave, USA. Abstract Not Available

**AITuB2 • 14:40**

**Invited**

Evolution of a Planar Waveguide Interferometric Sensor

Daniel Campbell, GTRI, USA. Planar waveguides interferometers provide a commercially viable sensor technology for the detection of an array of chemical and biological species. This presentation will follow the progress of one interferometric sensor from its inception to its current status.

**AITuB3 • 15:20**

**Invited**

Optical Methods for Sensing Temperature

Rami Reddy Bommaridi; \(^1\)AirForce Research Labs, USA. Initial performance assessment of the spectrometer is discussed.

**AITuB4 • 15:40**

**Invited**

Surface Metrology using an Elastometric Sensor

Mirah K. Jirzane; \(^1\)CSAIL, MIT, USA. We describe a method for measuring microscopic surface topography using an elastometric sensor combined with machine vision. The system is fast, low-cost, and offers micron-scale resolution.

### Session 3

**14:00–16:00**

**FTuC • IFTS in Atmospheric Research and Air Quality Control**

- Akiko Kuze; Japan Aerospace Exploration Agency, Japan, President

**FTuC1 • 14:00**

**Invited**

PREMIER - A Candidate ESA Mission For UTLS Research

Johannes Orphal\(^1\), Karlsruhe Institute of Technology (KIT), Germany. PREMIER is one of three candidate ESA Earth Explorer mission concepts currently undergoing feasibility studies and related science activities. The objective of the mission is to make global high resolution observations of mid / upper tropospheric and lower stratospheric composition.

**FTuC2 • 14:40**

**Invited**

Progress with GLORIA, Felix Friedl-Vallon; \(^1\)IMK, KIT, Germany. The hardware status of the airborne GLORIA imaging FTS is outlined. A summary of characterization and performance tests with the first flight model of the instrument and the campaign planning is presented.

**FTuC3 • 15:00**

**Invited**

Remote Sensing of Gases and Liquids by Imaging Infrared Fourier-Transform Spectroscopy

Roland Harig; \(^1\)Fachhochschule für Technologie, Germany. Methods and systems for remote sensing of gases in the atmosphere as well as for analysis of liquids have been developed. Analysis methods include a quantification algorithm based on nonlinear modelling of spectra and a parametric model for the instrument line shape. This paper provides an overview of methods, systems, and applications.

**FTuC4 • 15:20**

**Invited**

Initial performance assessment of the spectrometer is presented.
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<td>14:00–16:00</td>
<td><strong>HTuC • Surface and Atmosphere</strong></td>
<td><strong>Pier 7/8</strong></td>
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<td><strong>Daniel Zhou, NASA Langley Research Center, United States, Presider</strong></td>
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<td><strong>HTuC1 • 14:00</strong> Invited</td>
<td>Hyperspectral Detection of Clandestine Graves, Margaret Kalacska; ‘McGill Univ., Canada. Abstract Not Available’</td>
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<td><strong>HTuC2 • 14:40</strong> Full-Scene Surface Reflectance Retrievals, Jean-Claude Thelen, Stephan Havemann, Jonathan B. Taylor; ‘UK Met Office, United Kingdom. We demonstrate the feasibility of retrieving the reflectance spectra from hyperspectral imagery at speeds comparable to AE schemes by using a fast scattering radiative transfer code in conjunction with a 1D-Var scheme’</td>
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<td><strong>HTuC3 • 15:00</strong> Invited</td>
<td>The Eyjafjallajökull Volcanic Ash Plume Over Central Europe: Lidar Observations of Aerosol Composition and Ash-Induced Cloud Modification, Andreas Macke, Albert Ansmann; ‘Leibniz-Institute for Tropospheric Research, Germany. The optically thickest volcanic ash plume ever measured over Germany was monitored with a midwavelength Raman lidar. Polarized lidar signals reveal occurrence, type, concentration as well as freezing of supercooled droplets by entrainment of ash particles’</td>
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<td><strong>HTuC4 • 15:40</strong> Ultra-Spectral Measurements of Surface Emissivity with an Imaging Interferometer Spectrometer, William Smith, Leanne West, Gary Gimmestad, Sarah E. Lane; ‘Hampton University/U. of Wisconsin, USA; ‘Georgia Tech Research Institute, USA. Surface emissivity and skin temperature measurements were conducted with the Telops Hyper-Cam imaging spectrometer for a scene consisting of wet, dry, and ice covered concrete and a wet, dry, and ice covered non-skid surfaces’</td>
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<td>14:00–16:00</td>
<td><strong>JTuC • Joint AO/SRS Session II: Wavefront Estimation and Image Analysis</strong></td>
<td><strong>Pier 7/8</strong></td>
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<td><strong>Chris Dainty, National Univ. of Ireland Galway, Ireland, Presider</strong></td>
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<td><strong>JTuC1 • 14:00</strong> Invited</td>
<td>Image Reconstruction in Optical Interferometry, Eric Thévenaz; ‘Aixi, Centre de Recherche Astrophysique de Lyon, France. Inverse problem approach is a suitable framework to analyze the issues in image reconstruction from interferometric data. It can be exploited to describe and formally compare the new methods specifically developed for optical interferometry’</td>
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<td><strong>JTuC2 • 14:40</strong> Improving Retinal Resolution by Multiple Oversampling, Nizan Matar, Erez N. Ribak; ‘Physics, Technion, Israel. We take advantage of ocular sacades to average out some of the high order aberrations. Combining a long sequence of oversampled retinal images we were able to resolve single cells outside the fovea’</td>
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<td><strong>JTuC3 • 15:00</strong> Measurement of Packing and Spacing of Photoreceptors, Nizan Matar, Erez N. Ribak; ‘Physics, Technion, Israel. We developed two automated methods for measuring the hexagon size and the fraction of hexagonally packed cones. Density is mostly set by adjacent cones, decreasing with eccentricity. High frequencies are also being sampled in the periphery’</td>
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<td><strong>JTuC4 • 15:20</strong> Adaptive Optics Enabled Wavefront Diversity Sensing, Allan Wirth, Robert Gonsalves, Andrew Jankavicius; ‘Xinetics, Inc., USA; ‘Tjufts University, USA. Phase diversity has proven a viable technique for wavefront sensing but converges too slowly for real-time applications. The small wavefront changes in a closed loop system allow much more rapid convergence’</td>
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<td><strong>JTuC5 • 15:40</strong> Joint-Optimization of Phase-Diversity and Adaptive Optics, Visa Korkiakoski, Christoph Keller, Nick Dedman, Radu Frangos, Michel Verhaegen; ‘Utrecht University, Netherlands; ‘TNO Science and Industry, TNO, Netherlands; ‘Delft Center for Systems and Control, Delft TU, Netherlands. We demonstrate the potential of joint-optimization of adaptive optics (AO) and phase-diversity (PD). The wavefront sensor information reduces computational costs by a factor of 20, and PD can reconstruct much better the AO corrected images’</td>
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<td>14:00–16:00</td>
<td><strong>JTuD • Joint COSI/SIS Session I: Computational Photography</strong></td>
<td><strong>Pier 5</strong></td>
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<td><strong>Rafael Piestun; University of Colorado, United States; Edward H. Adelson; MIT, United States, Presiders</strong></td>
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<td><strong>JTuD1 • 14:00</strong> Invited</td>
<td>A Frequency Analysis of Light Transport, Frédé Durand; ‘MIT Cambridge, USA. The simulation of light in complex 3D scenes is challenging because of the number of rays that must be simulated. We use a Fourier analysis of the 4D set of rays for insights and acceleration’</td>
</tr>
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<td><strong>JTuD2 • 14:40</strong> Invited</td>
<td>Visualizing and Measuring Detailed Shape And Texture with an Elastomeric Sensor, Edward H. Adelson, Micah K. Johnson; ‘MIT, USA. We have developed a sensor made of clear elastomer which converts distortion due to a contact with a surface into visual images. Using machine vision techniques, we can quantify the surface properties with great detail’</td>
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<td><strong>JTuD3 • 15:20</strong> Plenoptic Principal Planes, Todor Georgiev, Andrew Lumsdaine, Sergio Goma; ‘Digital Imaging, Adobe, USA; ‘Computer Science, Indiana University, USA; ‘QCT mmedia R&amp;D and standards, Qualcomm, USA. We show that the plenoptic camera is optically equivalent to an array of cameras. We compute the parameters that establish that equivalence and show where the plenoptic camera is more useful than the camera array’</td>
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<td><strong>JTuD4 • 15:40</strong> 3D Image Design through Multiple Aperture Optimization, Sri Rama Prasanna Pavani, Jorge Monedero, David G. Stork, Kathrin Berker; ‘Rohm Innovations Inc., USA. 3D imagers exhibit a tradeoff between device size and accuracy. We design compact and accurate 3D imagers by optimizing subsystem parameters using a multiple-aperture image simulator and an accuracy estimator operating on distorted views’</td>
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16:00–16:30 Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level
is rooted in capacity analysis. The approach supports rapid design approach to analyzing receiver sensitivity in a fading channel that through turbulent atmosphere will be discussed.

Bi-directional scintillation fading measurements have shown near-field demonstrations of high-bandwidth optical free-space links.

Using a controlled Gaussian-Schell Model beam to mitigate turbulence effects has been shown in simulation that by using this transmission method it is possible to decrease the scintillation index in the far-field, regardless of turbulence strength, when compared to the intensity of a fully coherent source in turbulence.

We present an approach to analyzing receiver sensitivity in a fading channel that is rooted in capacity analysis. The approach supports rapid design trades during the early stages of system design.

A New Imaging FTIR Instrument Optimized for Spectral Polarization Sensing. Laboratory results demonstrate the capability of the instrument for the remote detection of surface contamination and its potential for probing fluctuating scenes.

Defining the Specifications of an Imaging Fourier Transform Spectrometer Working in the Far-UV (IFTSUV), Claudia Ruiz de Galaretta Fanjul\textsuperscript{1}, Anne Philippe\textsuperscript{1}, Jean-Claude Vial\textsuperscript{1}, Jean-Pierre Maillard\textsuperscript{1}, Thierry Augier\textsuperscript{1}, \textit{Institut d'Astrophysique Spatiale (IAS)}, France; \textit{Institut d'Astrophysique de Paris (IAP)}, France. We present the advancements on the specification and the performance requirements of an imaging Fourier transform spectrometer working in the Ly-α domain (λ=121,567 nm).

A New Imaging FTS for LWIR Polarization Sensing: Principle and Application, \textit{Jean-Marc Thériault}\textsuperscript{1}, \textit{Gilles Fortin}\textsuperscript{2}, \textit{Hugo Lavio\textsuperscript{1}}, \textit{Francesco Boujard}\textsuperscript{1}, \textit{Paul Lacaze}\textsuperscript{1}, \textit{Yann Montenbruck}\textsuperscript{2}, \textit{Alexandre Vallier\textsuperscript{1}}, \textit{Vincent Frel\textsuperscript{1}}, \textit{Martin Chamberland}\textsuperscript{2}, \textit{National Defence}, \textit{DRDC Valcartier}, Canada; \textit{AEREX Atronis Inc}, Canada; \textit{Telepor Inc}, Canada. We discuss a new imaging FTS optimized for spectral polarisation sensing. Laboratory results demonstrate the capability of the instrument for the remote detection of surface contamination and its potential for probing fluctuating scenes.

We present the advancements on the specification and the performance requirements of an imaging Fourier transform spectrometer working in the Far-UV (IFTSUV), Claudia Ruiz de Galaretta Fanjul\textsuperscript{1}, Anne Philippe\textsuperscript{1}, Jean-Claude Vial\textsuperscript{1}, Jean-Pierre Maillard\textsuperscript{1}, Thierry Augier\textsuperscript{1}, \textit{Institut d'Astrophysique Spatiale (IAS)}, France; \textit{Institut d'Astrophysique de Paris (IAP)}, France. We present the advancements on the specification and the performance requirements of an imaging Fourier transform spectrometer working in the Ly-α domain (λ=121,567 nm).
Pier 7/8
Hyperspectral Imaging and Sounding of the Environment

Pier 5
Adaptive Optics: Methods, Analysis and Applications

Salon C
Joint COSI / SIS

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

16:30–18:10
HTuD • Atmospheric Profiles and Trace Gases
Xu Liu; NASA Langley Research Center, United States, Presider

HTuD1 • 16:30
PanFTS: Panchromatic Measurements for Unprecedented Vertical Sensitivity and Temporal Resolution of Trace Gases, Annmarie Elder1, Liusha Sander1, Reinhard Bör1, Jean-François Blavier1, Richard Key1, David Rider1, John Wöden1, Kevin Bowman1, Jessica New1, Vijay Nath1, Dejuan Fu1, Geoffrey C. Toon1, Wesley A. Brand1; JPL/California Inst Tech, USA. The Panchromatic Fourier Transform Spectrometer (PanFTS) instrument is being developed, to meet the science demands of measuring a wide range of trace gases with unprecedented vertical resolution, by sensing the UV, visible, and IR in one instrument.

HTuD2 • 17:10
NASA ESTO IIP Tropospheric Infrared Mapping Spectrometers (TIMS) Demonstration First Deployment on an Airship: Preliminary Results, John B. Kumer1, Richard Rainard1, Aidan Rocha1, Robert Chattfield1; ADEO, Lockheed Martin Tech, USA; 2NASA Ames, USA. We compare preliminary retrieval from data acquired in airship deployment with ground based data acquired in our IIP demonstration campaign.

HTuD3 • 17:30
Hyperspectral Detection of Aircraft Exhaust, Leanne Wert1, Sarah E. Lane1, Gary Gimmestad1, William L. Smith1, Edward Burdette1; Electro-Optical Systems Laboratory, Georgia Tech Research Institute, USA; 2Hampton University, USA. Hyperspectral datacubes of passing aircraft are investigated. Of particular interest is the feasibility of detecting aviation hazards in these data. Sub-pixel processing algorithms are implemented, and aircraft exhaust gases have been identified.

HTuD4 • 17:50
Geologically Emitted Gas Identification Using Hyperspectral Data Processing Algorithms, Edward Burdette1, Leanne Wert1, Sarah E. Lane1, Kevin Caravati1; Georgia Tech Research Institute, USA. Applying gas plume detection algorithms to LWIR hyperspectral data of a mixed gas cloud emitted continuously from thermal features at Yellowstone National Park, the positive identification of carbon disulfide from among the mixture is reported.

16:30–18:30
A0 Postdeadline Session

16:30–18:30
JTuE • Joint COSI/IS Session II: Wide Field of View and Large Format Imaging
Rafael Pietzsch; University of Colorado, United States; William Rhodes; Florida Atlantic Univ., United States, Presiders

JTuE1 • 16:30
The Quanta Image Sensor (QIS): Concepts and Challenges, Eric Fossum1; Dartmouth Univ., USA. New type image sensing paradigm proposed. Based around binary, nano-scale active pixels, called jets, a Quanta Image Sensor (QIS) architecture allows high spatial (>109/sensor) and temporal resolution (>102-103 Hz) of photon strikes on image plane.

JTuE2 • 17:10
A Multiscale, Wide Field, Gigapixel Camera, Hui Sun1, Daniel L. Marks1, Eric J. Tremblay1, Joseph Ford1, Joonku Hahn1, Ronald Stock1, Adam Johnson1, Paul McLoughlin1, Jeffrey Show1, Junsung Kim1, David J. Brady1; Electrical and Computer Engineering, Duke University, USA; 2Electrical and Computer Engineering, UC San Diego, USA; 3Distant Focus Corporation, USA; 4RPC Photonics, Inc., USA. Recent investigations into high pixel count imaging using multiscale optics have led to a novel optical design for a wide field, gigapixel camera. We review the mechanical design and optical performance of this imager.

JTuE3 • 17:30
Optimizing Microcamera Aperture in Gigapixel Mono-centric Multiscale Cameras, Daniel L. Marks1, David J. Brady1, Michael E. Gehm1,2; Electrical and Computer Engineering, University of Arizona, USA; College of Optical Science, University of Arizona, USA; Electrical and Computer Engineering, Duke University, USA. We present image formation (IF) strategies developed for multiscale imaging systems. In this context, IF takes advantage of significant prior knowledge of array geometry and relies on parallelizable algorithms to handle the high data bandwidth.

JTuE4 • 17:50
Image Formation in Multiscale Optical Systems, Dathon Gohle1, Esteban Vera1, Kevin Kely1, Qian Gong1, David J. Brady1, Michael E. Gehm1,2; Electrical and Computer Engineering, University of Arizona, USA; College of Optical Science, University of Arizona, USA; Electrical and Computer Engineering, Duke University, USA. We present image formation (IF) strategies developed for multiscale imaging systems. In this context, IF takes advantage of significant prior knowledge of array geometry and relies on parallelizable algorithms to handle the high data bandwidth.

JTuE5 • 18:10
Space-Bandwidth Scaling for Wide Field-of-View Imaging, Predrag Milojkovic1, Joseph Matt1; U.S. Army Research Laboratory, USA. To examine how the space-bandwidth of imaging systems scale as a function of field-of-view, we extend the analysis for flat focal plane detectors to curved focal plane detectors.
An Optical Filter for Underwater Laser Communications, Fred Leventon1; 1NovaHraphics, USA. A free space laser communications system operating underwater in the blue-green portion of the electromagnetic spectrum requires a narrow bandwidth, high throughput filter to transmit the laser light and block unwanted background light.

Adaptive Imaging for ISR Applications, David V. Wick1; 2Brett E. Bugeleff1, 2Grant H. Soehnle1; 2Sandia National Labs, USA. Imaging intelligence is hindered by the diurnally opposite needs of high resolution and wide area surveillance. Multi-Gigapixel focal plane arrays are one solution, but we have successfully demonstrated adaptive imaging systems as an alternative.

A Quantitative UV Chemometric Model for the Determination of Zeaxanthin Cis and Trans Isomers, Jim Barren1; 1Kalsec Corp., USA. A free space laser communications system operating underwater in the blue-green portion of the electromagnetic spectrum requires a narrow bandwidth, high throughput filter to transmit the laser light and block unwanted background light.

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Hyperspectral Imaging and Sounding of the atmosphere. This static interferometer is designed to provide high spectral resolution and SNR spectra TAS-F. This static interferometer is designed to provide high spectral resolution and SNR spectra.

**Presider**
John Harlander; St. Cloud State University, United States, Presider

**08:00-10:00**

**FWA • Static Spectrometers and New Developments I**
John Harlander; St. Cloud State University, United States, Presider

**FWA1 • 08:00**
**Invited**
Results of SIFTI phase A study: design, budget and performances of a static FT interferometer, Philippe Hubert1, E. Canuti1, C. Piazzo1, C. Buil, F. Bernard2; CNES, France. We present the phase A study of SIFTI (Static Infrared Fourier Transform Interferometer) led by CNES with TAS-F. This static interferometer is designed to provide high spectral resolution and SNR spectra of the atmosphere.

**HWA • Clouds**
Shaima Nasiri; Texas A&M University, United States, Presider

**HWA1 • 08:00**
**Invited**
Fast Simulator for Cloud Optical Centroid Pressure, Joana Sanner1, NASA Goddard Space Flight Ctr, USA. Here, we describe a fast simulator for satellite-derived cloud optical centroid pressure, a parameter commonly used in trace-gas retrieval algorithms to describe the mean photon pathlength for backscattered sunlight in a cloud.

**HWA2 • 08:40**
Towards a Handheld Cryogenic FTIR Spectrometer, Frédéric Gillard1, Sylvain Roumier1, Florence de la Barrière1, Gaëlle Faure1, Nicolas Guerini1, Yann Ferre1, Sandrine Lejevre1, Émilie Benoit1, Manuel Fédor1, Jean Tournier1; ONERA, France; Laboratoire Charles Fabry, Institut de physique du Globe de Paris, France, A new concept of Fourier transform interferometer integrated in the focal plane array has been developed. Properties of this element, compact optical design and experimental results obtained with a prototype will be detailed.

**HWA3 • 09:00**
Applications of Airborne Hyperspectral Remote Sensing for Retrievals of Cloud Properties, Manfred Wendisch, Leipzig inst. for Meteorology, Germany. Hyperspectral measurement techniques in the visible to near infrared wavelength region offer unique possibilities for the remote sensing of clouds from aircraft or satellite. In this presentation two specific fields of cloud observations using hyperspectral reflectivity data are covered.

**HWA4 • 09:20**
Low Cost “Laserless” FTIR Spectrometer with Resolution Better than 0.5 cm-1, Karl Henrik Andersen1, Jenny Aasland1, Karin Anne Bakk1, Jon Tschudi1, Atle Hønne2; Olav Storstrom1; ICT, SINTEF, Norway. The traditional He-Ne reference laser is replaced by a low-cost linear encoder in a new FTIR instrument. By oversampling interferogram and encoder signal and then resample, using a correction table, we achieve an RMS sampling error of less than 50nm.

**AWA • Systems II**
Robert Johnson; Air Force Research Lab, United States, Presider

**AWA1 • 08:00**
**Invited**
Progress Toward Wide-Field Adaptive Optics for Future Extremely Large Telescopes, Brent Ellerbroek1; Instrumentation Department, TMT Observatory Corporation, USA. We describe recent progress in system design, hardware component development, performance modeling, and lab- and field testing of concepts for ground layer, multi-conjugate, and multi-object adaptive optics for future extremely large telescopes.

**AWA2 • 08:40**
Robo-AO: An Autonomous Laser Adaptive Optics and Science System, Christoph Baranne1, Reed Kidd1, A. Ramaparakash1, Nicholas Law1, Shriram Tendulkar1, Shrinivas Kulkarni1, Richard Dolan1, Khun Bui1, Jack Davis1, Jeff Zolkower1, Jason Falc1, Mahesh Burs1, Hilol De1, Pravin Cherdol1, Mann Kajiwala1, Evan Ojik1, Timothy Martens1, John Johnson2; Caltech Optical Observatories, California Institute of Technology, USA; Jet Propulsion Laboratory, United States, Presider

**AWA3 • 09:00**
Improving LGS Sky Coverage at Gemini North, Julian C. Christou1; Hilo Base Facility, Gemini Observatory, USA. We report on work being done to operate the GN Altair LGS AO system using PWFS2 to track (i.e. TT correction) with a guide star at 6". From the LGS target as opposed to an NGS TT star within the Altair FoV (25"").

**AWA4 • 09:20**
NFIRAOS —TMT Early Light Adaptive Optics System, Glen Harvett Harvett1, David R. Anderson2, Jenny Aasland1, Carlos Correia1, Peter Byrne1, Corinne Boyer1, R. Kaufman2, Jennifer Dunn1, Brent Ellerbroek1, Jeffy Fitzsimmons1, Luc Gillet1, Paul Hickman1, Alexis HRP1, John Pucher1, Vid Raston2, Scott Roberts1, Malcolm Smith2, Jean-Pierre Veran3, Lianqi Wang1, Ivan Wevers1; Gemini Observatory, California Institute of Technology, USA. The early-light facility Adaptive Optics System of the Thirty Meter Telescope. We present the specifications, novel architecture and design of NFIRAOS.

**CWA • Superresolution**
Joseph Mait; US Army Research Laboratory, United States, Presider

**CWA1 • 08:00**
Model-Based Metrology of Resist Patterns in Lithography, Arie J. den Boef1, Hugo Cramer1, Paul Hommer2, Henry Wagner3, Michael Kahel1, Maurice van der Schaar1, Kustutis Bhatuacharyia1, Nicole Wright1; Research, ASML, Netherlands. A metrology concept is presented that is used for measuring the shape and position of resist patterns in the production of semiconductor devices. Some application examples are presented that demonstrate the capabilities of this concept.

**CWA2 • 08:40**
Multiplexed Agile Fourier Sampling for Doppler Excluded Excitation Pattern (DEEP) 3D Microscopy, Daniel Feldkamp1, Kehin H. Wagner1, JCEE, University of Colorado at Boulder, USA. A deep microscope synthesizes images from Fourier data measured using dynamic structured light and a single-element detector. We describe acousto-optic multiplexed pattern generation and Fourier sampling strategies for tomographic DEEP 3D imaging.

**CWA3 • 09:00**
Super-resolution via Nonlinearity in Computational Optics, Christopher Burz1, Jason W. Fleischer1; Electrical Engineering, Princeton University, USA. All computational methods suffer from resolution limits due to finite-aperture effects. Using digital holography, we show that nonlinearity surpasses linear limits, as formulated by Abbe, as high-frequency spatial modes mix with low-frequency ones.
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

10:00–10:30 Coffee Break/Exhibits Open, Ballroom Foyer, Convention Level

10:30–12:30 LWB • Naval Applications II
Peter Poitier, SPAWAR Systems Center – Pacific, United States; Mike Lorenz, SPAWAR, United States, Presiders

10:30–12:30 IWB • Military Applications II
Gisele Bennett; Georgia Tech, United States, Presider

10:30–12:30 AIWB • Laser Applications
Joseph Dallas; Avo Photonics Inc., United States, Presider

10:30–12:30 LWB1 • 10:30 Invited
Blue Green Laser Communications in Support of Undersea Dominance: Connecting with the Undersea Network, Greg Mooradian; 1QNA TSG, USA. Considerable progress has been made in Submarine Laser Communications. As Network-Centric operations expand, however, the Navy needs to be a fully integrated part of the Joint Force and communications must be improved to ensure Undersea Dominance.

10:30–12:30 IWB1 • 10:30 Invited
Distributed Aperture Millimeter Wave Imaging, Christopher A. Schuetz, Richard D. Martin, Thomas E. Dillon; Phase Sensitive Innovations, Inc., USA; Electrical Engineering, University of Delaware, USA. We present advancements of a distributed aperture technique for the realization of a passive millimeter-wave imager based on optical upconversion. Specific advancements realized by the implementation of aperiodic aperture distribution are discussed.

10:30–12:30 AIWB1 • 10:30 Invited
New Laser Developments Approaching Fundamental Limits to Surgery and Biodiagnostics, R. J. Dwayne Miller; University of Toronto, Canada. The Picosecond IR Laser (PIRL) Scalpel has finally achieved the promise of lasers for surgery - and may even surpass this goal by opening up molecular level guidance for surgery and biodiagnostics.

10:30–12:30 LWB2 • 11:10 Invited
Pulsed Yb Fiber Laser for Underwater Communications, Andrew R. Grant, Douglas F Holcomb; Phase Sensitive Innovations, USA. We propose using an array of high efficiency, frequency-doubled, pulsed Yb fiber lasers for underwater communications. A 1086 nm pulsed Yb laser producing over 1 mJ of energy in a 30 μm core fiber is demonstrated.

10:30–12:30 IWB2 • 11:10 Invited
Optical Imaging through Horizontal-Path Turbulence: A New Solution to a Difficult Problem, William T. Rhodes; Florida Atlantic Univ., USA. Imaging through long path (e.g., several km) turbulence presents difficulties that have until now been largely insurmountable. In this paper we describe a new active-illumination method that we think has good potential for allowing diffraction-limited imaging with large isoplanatic patch size.

10:30–12:30 AIWB2 • 11:10 Invited
Advances in High Power Fiber Lasers for Defense Applications, Mike O’Connor; IPG Photonics Corp, USA. Fiber laser development for defense applications fall into two primary areas: spectrally broad, and spectrally narrow fiber lasers. The former are useful for tactical, close-range applications, and are used as single lasers, or as multiple lasers which are incoherently combined. The latter are being developed for long-range applications, and narrow linewidth is required for either coherent or spectral combining of multiple beams. In this paper, we discuss the recent advances in both types of fiber lasers.
Hyperspectral Imaging and Sounding of the Environment

Adaptive Optics: Methods, Analysis and Applications

Computational Optical Sensing and Imaging

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

FWA • Static Spectrometers and New Development—I—Continued

FWA5 • 09:40

Fourier Transform Spectrometry: The SNR Disadvantage of the Multiplex Architecture, Alessandro Baraducci1, Donatella Gazzè1, Cinzia Lasè1, Paolo Marcuccio1, Vanni Nardone1, Ivan Pippi1; Istituto di Fisica Applicata "Nello Carrara", Consiglio Nazionale delle Ricerche, Italy. Recent works revealed unexpected theoretical bounds to the radiometric performance of FTS. These findings, regarding the SNR of FTS as assessed in the interferogram and the spectral domain, are improved and validated by experimental results.

JWA1

FTS Measurements of Uranium Emission Lines in the Near-Infrared and their Application to the Search for Earth-like Exoplanets, Stefano Rimbert1, James E. Lawler1, Gillian Nave1, Lawrence Ramsey1, Sarvath Mahadevan1; Atomic Physics Division, National Institute of Standards and Technology, USA; Department of Physics, University of Wisconsin, USA; Department of Astronomy–Astrophysics, The Pennsylvania State University, USA. Precise calibrations are needed for high-resolution near-infrared astronomical spectrographs. We have measured the wave-numbers of over 7500 uranium emission lines and used a subset of them to make precise radial velocity measurements.

JWA2

Performance Model of Sitelle, a Wide-Field Imaging FTS for The Study of Visible Emission Lines of Astronomical Objects, Julie Mandar1,2, Friederic Grandmont1, Simon Thibault2, Laurent Drouet2; Université Laval, Canada; ABB Roméo inc., Canada. We are developing a dedicated performance model for Sitelle. We study the sensitivity in wavefront and misalignment to choose the best configuration. As Sitelle is particularly sensitive to vibration we analyze the impact of fluctuation in OPD.

JWA3

Ground-based FTIR Measurements and Modeling of Tropospheric Trace Gases Over Toronto, Cynthia Whalley1, Kimberly Strong1, Dylan Jones1, Daniel Wexler1; Physics, University of Toronto, Canada. Trace gas time series measured with a Bomem DA8 FTIR at the Toronto Atmospheric Observatory are presented. These species are important for air quality and global warming. TAO measurements are compared to GOES-AT and GEOS-Chem.

JWA4

Apodization Function Retrieval with an Improved General Expression, Libing Ren1, Haoyun Wei1, Yan Li1; Precision Instruments, Sun Yat-sen University Laboratory of Precision Measurement Technology and Instruments, China. To obtain unknown apodization function in target spectrometer, an improved general form for apodization function was proposed. Simulation retrievals for some typical apodization functions show the expression is highly efficient.

JWA5

Concepts of Fourier Transform Spectroscopy Using a Sagnac Interferometer, Stephen Lipson1, Kyud Schwartz1; Physics, Technion, Israel. A common path interferometer has exceptional stability: The problem is how to introduce significant variable path difference between counter-propagating beams. Two concepts will be presented. A proposed application is to observational astronomy.

JWA6

Obligatory Effects in the Herschel/SPIRE Imaging Fourier Transform Spectrometer, Gabriel Makowski1, Lacke D. Spencer1, David A. Neapol1, Brad Gomm1; School of Physics and Astronomy, Cardiff University, United Kingdom; Physics and Astronomy, University of Lethbridge, Canada. The Herschel/SPIRE imaging Fourier transform spectrometer employs detector arrays at each output port. The effects of divergence within the spectrometer, known as obliquity effects, are discussed within the context of Herschel/SPIRE.

JWA7

Phase Correction of Fourier Transform Spectrometer Interferograms by Optimization of the Local Oscillator Phase Term, Kathryn J. Conway1, K. Paul Kirkbrace1, Charles C. Harb1; School of Engineering and Information Technology, University of New South Wales, Australia; Forensic and Data Centres, Australian Federal Police, Australia. Phase error compensation is an important consideration in Fourier transform spectroscopy; particularly when obtaining background and sample information from one interferogram. A phase angle optimization algorithm is discussed to address this issue.

JWA8

Sampling Jitter Reduction in CCD-Based Imaging FTS with Predictive Centered Triggering of Detector Integration, Jean-Philippe Detry1, Jerome Genest1, Martin Chamberland1; Centre d'optique, photonique et laser (COPL), Université Laval, Canada; Télésp Inc., Canada. A new triggering scheme is developed to minimize the non-causal problem of matching delays of the metrology and the IR channels in an IFTS when an integrating camera is used. Predictive OPD-centered integration, challenges and results are presented.

JWA9

Open-Path Large Aperture Static Imaging Spectrometer Measurement System, Rayy Wer1, Jianjuan Jiang1, Jiangyue Zhang1, Xiaomeng Zhang2, Sichong Zhou2, Qianghui Wu3; Key Laboratory of Spectral Imaging Technology of Chinese Academy of Sciences, China; Graduate university of Chinese Academy of Sciences, China; Academy of Opto-Electronics of Chinese Academy of Sciences, China. Electronic Information School, Wuhan University, China. Two open-path Fourier Transform Spectrometer measurement systems based on the Large Aperture Static Imaging Spectrometer (LASIS) are described. Their principles, performances and feasibilities are briefly introduced and discussed.

JWA10

Recovery of Exoplanetary Signals in Re-dissolved Speckle Clutter, Sezmen Gladyoz1, Evre N. Ribatski1; Aker Space Research Institute, Technion, Israel; Physics, Technion, Israel. We use a Wynn corrector to radially disperse images of exoplanets while shortening the stellar speckles. This results in a morphological difference between speckles and sources (circles vs. lines). We then apply a matched filter to the data.

JWA11

Kerr-Induced Nonlinear Focal Shift Measurements, Georges Roudheau1, Université d'Angers, France. We report on third order optical nonlinear experimental characterization through focal shift measurements. The focus in the nonlinear regime is related to the nonlinear phase shift. Numerical and experimental results are in very good agreement.

Wednesday, 13 July
Parameter Estimates For Free Space Optical Communications, H. Alan Pike¹, Larry Stotts¹, Paul Kolodzy¹, Malcolm Northcott¹; ¹Defense Strategies & Systems Inc., USA; ¹Defense Advanced Research Projects Agency, USA; ¹Kolodzy Consulting, USA; ¹AOptix, USA. We have developed a methodology, successful at predicting key parameters in propagating 1.55 micron laser beams over distances from 10 km to 200 km, including estimating the effectiveness of adaptive optics systems at both end of these links.

Optical Turbulence Strength Sensing Using a Video Camera, Omer Y. Porat¹, Joseph Shapira¹; ¹Applied Optics Division, Soreq Nuclear Research Center, Israel. We present a method for remote sensing of the path-average turbulence strength, based on measurement of the angle-of-arrival fluctuations of reflections from a naturally illuminated arbitrary target. Experimental estimation shows reliable results.

Cramer-Rao Lower Bound for Passive and Active Imaging Systems, Jean Dolne¹; ¹Boeing, USA. This paper will present results on the fundamental performance of passive and active systems. In the passive Phase diversity mode (PD), we will show how using diversity other than defocus or a combination of multiple diversity functions can improve the performance of phase diversity systems. In the active mode, we will show the fundamental performance of various LADAR systems operating in the Geiger and linear modes.

New Wide Angle Electro-Optic Laser Scanners Enable Optical Sensors on Previously Inaccessible Platforms, Scott Davis; ¹Vescent Photonics Inc., USA. New wide angle (270 degrees demonstrated), analog, 2-D electro-optic laser scanners will be presented. The low size, weight, and power requirements of these scanners expand the range of platforms that are suitable for optical sensors.

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12:30–14:00 Lunch (On Your Own)
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

JWA12 Improvement of Image Resolution Beyond Classical Limit By Phase-Sensitive Optical Parametric Amplifier, Zun Huang1, Doug French1, Igor Jovanovic1, Hossein Yari1; IISEE, Purdue University, USA; ‘Mechanical and Nuclear Engineering, Pennsylvania State University, USA; Lawrence Livermore National Laboratory, USA. When an optical parametric amplifier (OPA) operated as a phase-sensitive amplifier (PSA) is used for point source imaging, the angular resolution improvement can defeat the classical Rayleigh limit, and approach the de Broglie resolution.

JWA13 Numerical Simulations of Metamaterial-based Infrared Sensor for Remote Environmental Monitoring, Alexander K. Popov1, Sergey A. Myshlyev1; University of Wisconsin-Stevens Point, USA; ‘Institute of Physics, Siberian Division of the Russian Academy of Sciences, Russian Federation. The possibility of creation of all-optically controlled, remotely actuated, ultraminiature nonlinear-optical sensor which utilizes negative-index metamaterial and can be exploited for environmental sensing is shown and numerically simulated.

JWA14 Widerfield Ultrastable Heterodyne Interferometry Using a Custom CMOS Modulated Light Camera, Rikesh Patel2, Matt Clark2, Samuel Achampong-Williams2; Applied Optics Group, Electrical Systems and Optics Research Division, University of Nottingham, United Kingdom. A method of detecting optical heterodyne interferometry fringes using a custom CMOS modulated light camera array has been developed. Widerfield phase images are generated using quadrature demodulation and are kept stable using a feedback system.

JWA15 Tunable Single Pixel MEMS Fabry-Perot Interferometer, Annette Kow1, John Kereke2, Alan Raisanen3; Imaging Science, Rochester Institute of Technology, USA. Typically, MEMS Fabry-Perot devices use electrostatic actuation to control mirror spacing and snap-in is an issue. A thermally actuated device has been modeled in COMSOL that lifts the mirror through thermal expansion.

JWA16 Aircraft Measurements of the Aerosol Direct Radiative Effect, Samuel E. LeBlanc1, Sebastian Schmidt2, Peter Wilewitz3; ATOC and LASP, University of Colorado, USA. Aerosol relative forcing efficiency obtained from multiple field experiments is used to compare the direct radiative effect of various aerosol types.

JWA17 Fourier Synthesis in Classical Ghost Imaging, Tomohiro Shirai1, Henri Kellnic2, Tore Setala1; University of Eastern Finland, Finland; ‘Royal Institute of Technology (KTH), Sweden. We describe an optical setup for performing spatial Fourier filtering in ghost imaging with classical coherent light. It is shown that phase contrast imaging is possible with this setup to visualize a pure phase object.

JWA18 Pump Actuated Tunable Liquid Lens, Amir Hassan Firouz1, Mohammadreza Maddah1, Mohammad Hosein Ardekanibaghi2; Department of Electrical Engineering, Semnan University, Iran; Department of Physics, Shahid Beheshti University, Tehran, Iran. A novel liquid-filled lens array design is demonstrated. Liquid lens is sandwiched in transparent flat cell. This Packaged liquid lens created by the vacuum pumping force. It can be tuned either by changing the shape of the liquid-filled lens into bi-convex or meniscus or by changing a filling media with different refractive index via pump actuating. As a result, wide lens array is less sensitive to vibration and convenient for portable devices compared to previous models.

JWA19 Error Budget and Estimation in Ultra-spectral Soundin Retrieved, Donald Zhao1, Allen M. Larentz1, Xu Liu1, Willem L. Smith1; NASA Langley Research Center, USA; ‘Hampton University, USA; ‘University of Wisconsin, USA; ‘University of Maryland Baltimore County, USA. A consistency error analysis scheme through RTM forward and inverse calculations has been developed to estimate the error budget in terms of bias and standard deviation of differences in both radiance and retrieved geophysical parameters.

JWA20 Using Rotational Ramian Scattering in the Atmosphere for Satellite Retrieval of Aerosol Properties, Alexander Vasilekov1, Joanna Joiner2, Omar Torrecilla1, Chenguo Ahsen1, Robert Sperb2; ‘Science Systems and Applications, Inc., USA; ‘NASA Goldfeld Space Flight Center, USA; ‘RT Solutions, Inc., USA. Raman scattering is used for retrieval of aerosol properties from satellite hyperspectral measurements in UV. Comparisons of retrieved aerosol height and single scattering albedo with CALIOP and OMI data show reasonable agreement.

JWA21 Longwave Radiative Energies of Mineral Dust Aerosol, Richard A. Hannell1, Si-Chieh Tsyu2, Chandra N. Hsu1, Qing C2, Shawn Bell1, Wai Zhang1, Junping Huang1, Chuanjiang LV1, Hong-Bon Chen2; NASA Goldfeld Space Flight Center, USA; ‘ESSI; ‘University of Maryland College Park, USA; ‘Department of Atmospheric and Oceanic Sciences, University of Maryland, USA; ‘Science Systems and Applications, Inc., USA; ‘College of Atmospheric Sciences, Lanzhou University, China; ‘Institute of Atmospheric Physics, Chinese Academy of Sciences, China. Longwave direct radiative effects of mineral dust are investigated during previous field campaigns. Surface measurements and radiative transfer modeling are employed for probing dust radiative impacts for regions frequented by dust aerosol.

JWA22 Spectral Calibration of CrIS Instrument On-Orbit, Denise Hagar1; Northrop Grumman Corp., USA. We describe a method for atmospheric spectral validation of the NPP CrIS, based on MetOp IASI data as proxy for CrIS and OIS forward model calculations.

JWA23 Comparison of IASI AND AHI/AVHRR CLOUD Properties in High Latitudes with Corre-s- ter CALIOP AND CPR PRODUCTS, Lydie Lavrenov2, Marie France1; ‘Medefrance, France. This paper presents the comparisons of cloud retrievals of IASI and AHI/AVHRR with independent CALIOP and CPR measurements. The correlation period comprises the Antarctica Concordia campaign with dropsonde providing in-situ information.

JWA24 Evaluation of Cloud Contamination of Infrared Radiance Using Simulated AIRS and IASI Observations, Syhan Hellit2, Yos Reznik; 1Department of Meteorology, University of Wisconsin-Madison, USA; ‘Purdue University, USA. A novel approach with a compact adaptive optics opthalmoscope, Marco Lombardi2, Giuseppe Lombardi2, Domenico Sciuto Lomardo1, Pietro Ducati2; ‘Sterrant Serra1; ‘CRCS Fondazione G.B. Bietti, Italy; ‘LeCyl Laboratory, CRNR-JPC Unit of Support Coenza, Italy; ‘Vision Engineering, Italy. Parafocal photoreceptor packing distribution was evidenced to be correlated between fellow eyes in 12 subjects. The systematic mirror symmetric cone packing distribution may be involved in the first step of binocular visual signal processing.

JWA25 Validation of IASI Temperature and Water Vapor Retrievals with Global Radiosonde Measurements and Model Forecasts, Murty G. Divakarla, Antonia Gambacorta, Christopher Barnett, Mitchell D. Goldberg, Eric Maddy, Tom King, Walter Wolf, Kevin Zhang; 1JMI Systems Group, Inc., USA; 2Doll, USA; 3STAR, NASA/ NESDIS, USA. Atmospheric temperature and water vapor profiles retrieved from the MetOp-IASI instrument were evaluated with global radiosonde measurements and ECMWF analysis. Analysis of information content embedded in these retrievals was also attempted.

JWA26 Solar Adaptive Optics System and Observations at the Hida Observatory, Nobuhiro Minowa1, Yukihiro Itoh2, Shinsuke Yoneda3, Tomohide Sudo1; ‘Computer Sciences, Kitami Institute of Technology, Japan. We develop a solar adaptive optics system at the Hida Observatory in Japan. We report the details of the system and observation results. Solar images observed with the system demonstrate better contrast and finer structures.

JWA27 Halo Suppression using Phase-Sorting Interferometry, Johan L. Coladon1, Matthew Kem-worth1, Michael Hart; ‘Steward Observatory, University of Arizona, USA; ‘Leiden Observatory, Leiden University, Netherlands. Interferometric measurements of an AO-corrected diffraction halo enables an antihalo servo. Simultaneous WFS measurements and fast speckle images allow measurement and suppression of the underlying complex halo, including non-common-path aberrations.

JWA28 Bilateral Cone Density Distribution Analyzed with a Compact Adaptive Optics Ophthalmosco- scope, Marco Lombardi2, Giuseppe Lombardi2, Domenico Sciuto Lomardo1, Pietro Ducati2; ‘Sterrant Serra1; ‘CRCS Fondazione G.B. Bietti, Italy; ‘LeCyl Laboratory, CRNR-JPC Unit of Support Coenza, Italy; ‘Vision Engineering, Italy. Parafocal photoreceptor packing distribution was evidenced to be correlated between fellow eyes in 12 subjects. The systematic mirror symmetric cone packing distribution may be involved in the first step of binocular visual signal processing.

JWA29 A/V Ratio as Predicted by Full Width at Half Maximum and by Blood Vessel Tracking in Presence of Ocular Aberrations, Varu Karsi-tari1, Mee Ozolande2, serge Forni3; Nikita Iroshnikov1, Andrey Larichev1; ‘Department of Ferrelectrics, Institute of Solid State Physics, University of Latvia, Latvia; ‘Department of Medical Physics, M.V.Lomonosov Moscow State University, Rus-sian Federation. Aberrations impact A/V ratio calculated from full width at half maximum. We investigated whether aberrations affect A/V ratio calculated by tracking the vessels. Aberrations changed the A/V ratio. We conclude that aber-rations impact A/V ratio.

JWA30 High Resolution Hartmann Wavefront Sensor for EUV Lithography System, Alessandro Polo1, Florian Boesl1, Silvania Perera1, Urbach Paul2; ‘Imaging Science & Technology, Delft University of Technology, Netherlands. We discuss the use of a Hartmann Wavefront Sensor as an instrument to measure the aberration in an Extreme Ultraviolet Lithography system. Simulations demonstrate the feasibility and advantages in terms of dynamic range and accuracy.

JWA31 The High-order Mode Conversion Based on Optimization-translation Adaptive Optics, Hai C. Zhao1, Xiao Wang1, Hao Ma1, Pa Zhou1, Yan Nie1, Shan H. Wang1, Xiao J. Xu1; ‘National University of Defense Technology, China. We present research on high-order Gaussian laser beam transformation by using adaptive optics (AO) technique. The numerical simulation and experimental results indicate the feasibility of blind-optimization AO in mode transforma-tion system.

Imaging and Applied Optics: OSA Optics & Photonics Congress • July 10–14, 2011
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–15:40
LWC • Laser Communication/Atmosphere I
Linda Thomas; Office of Naval Research, United States, Presider

LWC1 • 14:00  Invited
The Lunar Laser Communications Demonstration, Bryan Robinson1, Don Borenson1, D. A. Buri- anek1, D. V. Murphy1, ‘Massachusetts Inst of Tech Lincoln Lab, USA. The Lunar Laser Communications Demonstration (LLCD) will demonstrate high-rate duplex lasercom between a lunar spacecraft and a ground terminal. We describe the LLCD system architecture and provide an overview of the space- and ground-terminal designs.

LWC2 • 14:40  Invited
Mobile Lasercom Systems Using Modulating Retro-reflectors, Peter G. Goetz1, William S. Rahmowski1, Rita Mahon1, Mike Ferraro1, James L. Murphy1, Michele R. Suite1, Christopher L. Moore1, Harris R. Burn1, Walter K. Smith1, Warren W. Schultz1, ‘Optical Sciences Division, Naval Center for Space Technology, ‘Chemistry Division, Naval Research Laboratory, USA. The use of lasercom on mobile platforms is complicated by the pointing precision required. Modulating retro-reflectors greatly relax pointing requirements, enabling lasercom on a variety of mobile platforms not possible with traditional lasercom.

LWC3 • 15:20
Propagation of a General Multi-Gaussian Schell-Model Beam in Turbulent Atmosphere, Mehdi Sharifi1, Bin Lau1, Yongxing Ren1, Anhong Dang1, Hong Guo1; 1Institute of Quantum Electronics, Peking University, China. The investigations on propagation of a multi-Gaussian Schell-model beam in turbulent atmosphere reveal that, under certain condition, initial coherence width can be a knob for changing the average intensity profile at the receiver plane.

14:00–15:40
JWB • Joint AIO/IS Session I: Biophotonics
Sean Christian; Optrology, Inc., United States, Presider

JWB1 • 14:00  Invited
Optofluidic Microscopy: Chip-scale imaging cell cytometry, Changhuei Yang1, Guoan Zheng1, Seung Ah Lee1, Sean Pang1, Lapman Lee1, Changhuei Yang1; Caltech, USA. We will discuss our recent work on chip-scale microscopy, including fluorescence and laser-scanning imaging techniques.

JWB2 • 15:20
A Compact Probe for β+-Emitting Radiotracer Detection in Surgery, Biopsy and Medical Diagnostics based on Silicon Photomultipliers, Christian Mester1, Claudio Bruschini2, Patricia Magro1, Nicolas Demartiner1, Vincent Dunet1, Eugene Grigoriev4, Anatoli Konoplyannikov4, Maurice Matter2, John O. Prior2, Eduard Dimbovski1; 1EPFL, Switzerland; 2CHUV, Switzerland; 3TU Delft, Netherlands; 4Forimtech SA, Switzerland. We present a new probe for radiotracer detection in vivo. The device is based on silicon photomultipliers coupled with a scintillator and wirelessly compensated for supply voltage and temperature variations. The probe is positron sensitive.

16:00–16:30 Coffee Break/ Exhibits Open, Ballroom Foyer, Convention Level

Imaging and Applied Optics: OSA Optics & Photonics Congress • July 10–14, 2011
Upper atmospheric Doppler winds, a completed laboratory DASH concept for a DASH optical interferometer to passively measure spatial heterodyne spectrometers, Engineering Science, St. Cloud State University, USA; 3Space Science Roesler1, Walter Harris 2, Edwin Mierkiewicz 1, John Harlander 3; It is based on direct viewing of the sun to measure atmospheric, to observe methane, water vapor, and carbon dioxide on Mars. We present a compact, high resolution SHS spectrometer concept tuned to 630nm as a step towards a FUV design that will operate high-resolution all-reflection spatial heterodyne spectrometer design, development and performance tests of a narrow-band, tunable spatial heterodyne spectrometer that has been installed at total internal reflection. Near field subwavelength spatial sampling of the many factors that influence the Earth’s radiation budget.

Doppler Asymmetric Spatial Heterodyne (DASH) Interferometer Babcock3, Frederick Roesler 4; 1Physics, St Cloud State University, USA; 2US Naval Research Laboratory, USA; 3Artep, Inc., USA; 4Department of Physics, Astronomy and Engineering Science, St. Cloud State University, USA. We describe laboratory and field tests of a Doppler Asymmetric Spatial Heterodyne (DASH) interferometer for upper atmospheric wind observations of the O[1D] 630 nm emission.

Miniaturized Mars Methane Monitor (M4): An Ongoing Study of an Instrument Concept, Christoph R. Englert1, John Harlander1, Robert Dehajjate2, Michael H. Stevens3; ‘Space Science Division, Naval Research Laboratory, USA; ‘Dept of Physics, Astronomy and Engineering Science, St. Cloud State University, USA; ‘Space Department, The Johns Hopkins University Applied Physics Laboratory, USA. We present an instrument concept to observe methane, water vapor, and carbon dioxide on Mars. It is based on direct viewing of the sun to measure atmospheric, mid-wavelength infrared absorption.

A Second Generation Tunable Spatial Heterodyne Spectrometer for Ground-Based Observations of Diffuse Emission Line Targets, Walter Harris1, Sona Hosseini1, Jason Corliss1; 1University of California, Davis, USA. We report construction and testing of a tunable spatial heterodyne spectrometer that has been installed at the Coude Auxiliary Telescope on Mt. Hamilton. The instrument combines high sensitivity and resolving power with broadband capability.

Development and Field Tests of Narrowband All-Reflective Spatial Heterodyne Spectrometers, Jason B. Corliss1,2, Frederick Roesler1, Walter Harris1, Edwin Markiewicz2; John Harlander1; 1University of Wisconsin-Madison, USA; 2University of Colorado Boulder, USA. We describe the design, development and performance tests of a narrow-band, high-resolution all-reflection spatial heterodyne spectrometer tuned to 830nm as a step towards a FUV design that will operate at the 121nm lyman-alpha line.

Compact Bidimensional Sampling Spectrometer, Hao Yan1, Anand Asundi1; 1Nanyang Technological University, Singapore. Anand Asundi1; 1NANYANG TECHNOLOGICAL UNIVERSITY, Singapore. Anand Asundi1; 1Institute of Optics, University of Rochester, USA. A gigapixel array is used for synthetic-aperture digital holography. Considering propagation and sampling requirements, a high-resolution image is reconstructed using sharpness metrics in combination with speckle-averaging independent realizations.

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Quantifying the Information Content of Hyperspectral Cloud Data, Odelle M. Coddington1, Peter Pilonowski1, Tomislava Vukicevic2; Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, USA; NASA's Future HyspIRI Mission and the EO-1 Hyperion Collections, Betty Middleton1, NASA Goddard Space Flight Ctr, USA. NASA's Hyperspectral Infrared Imager (HyspIRI) concept for a global survey mission with two instruments, a visible-shortwave infrared imaging spectrometer (380-2500 nm) and an 8-band multispectral thermal imager, will be described. Also, the ten years (2001 present) of a global sampling mission by a heritage sensor, the Hyperion instrument on Earth Observing-1 satellite, will be summarized.

High-resolution all-reflection spatial heterodyne spectrometry is reconstructed using sharpness metrics in combination with speckle-averaging independent realizations.

Digital Holographic Imaging of Multi-Phase Flows, Lei Tian1, Hanhong Gao1, George Barbastathis1,2; 1MIT, USA; 2Singapore-MIT Alliance for Research and Technology (SMART) Centre, Singapore. In-line digital holography is applied to study multi-phase flows. Cautious formed by bubbles are studied and used to sort different phases in the flows.

What is the Reconstruction Range for Compressive Fresnel Holography?, Yair Rivenson1, Stern Adrian1; 1Ben-Gurion University of the Negev, Israel. We discuss some basic guidelines for using the Fresnel transform as a compressive sensing operator. We show that when practicing the compressive Fresnel transform, the reconstruction distance affects the reconstruction result.
**Pier 4**

Application of Lasers for Sensing & Free Space Communication

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

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<th>Time</th>
<th>Session Name</th>
<th>Presenter and Affiliation</th>
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<tr>
<td>16:30-18:30</td>
<td><strong>LWD • Laser Communication/ Atmosphere II</strong></td>
<td><strong>Linda Thomas; Office of Naval Research, United States, Presider</strong></td>
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<tr>
<td>LWD1</td>
<td>16:30 • <em>Invited</em></td>
<td><strong>A Transportable Atmospheric Testing Suite</strong>, Rita Mahon1, Christopher L. Moore1, Harris R. Burnst2, Mike Ferrans2, William S. Babcock2, Michel R. Suite1, Linda Thomas1; Code 6364, Naval Research Laboratory, USA; Code 6129, Naval Research Laboratory, USA. A Transportable Atmospheric Testing Suite (TATS) consisting of sensors to monitor atmospheric turbulence and meteorological parameters over both direct and retroreflected free space optical links is described.</td>
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<tr>
<td><strong>LWD2 • Laser Communication/ Atmosphere II</strong></td>
<td><strong>Linda Thomas; Office of Naval Research, United States, Presider</strong></td>
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<td>LWD2</td>
<td>17:10 • <em>Invited</em></td>
<td><strong>Robust Fiber-to-fiber Free-Space Optical Communications under Strong Atmospheric Turbulences</strong>, Yoshinori Arimoto1; Space Communication Systems Laboratory, National Institute of Information and Communications Technology, Japan. This paper describes the SMF-coupled FSO terminals which use mutual beacon tracking, diffraction limited signal beam pointing and advanced initial beacon acquisition system to provide robust link operation under strong atmospheric turbulences.</td>
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<tr>
<td>LWD3</td>
<td>17:50 • Free Space Quantum Communication using Continuous Polarization Variables</td>
<td><strong>Bettina Heine1</strong>, Christian Pfeintinger2, Christoph Wittmann1, Christoph Marquardt2, Gerd Leuchs2; Max Planck Institute for the Science of Light, Germany; Institute of Optics, Information and Photonics and Erlangen Graduate School in Advanced Optical Technologies (SAOT), University of Erlangen-Nuremberg, Germany. We experimentally investigate atmospheric influences on quantum communication using continuous polarization variables. Signal and local oscillator are combined in one spatial mode, which leads to excellent interference at the homodyne detection.</td>
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<td>LWD4</td>
<td>18:10 • Diffraction-Attenuation Resistant Beams</td>
<td><strong>Leonardo A. Ambrosio1</strong>, Michel Zamboni-Rached1, Hugo E. Hernández-Figueroa2; Department of Microwaves and Optics, DMO, FEEC, Unicamp, University of Campinas, Brazil. Diffraction-Attenuation Resistant Beams are generated by suitably superposing Bessel beams. We report theoretical results revealing that they can be used not only for short-range applications, but also to overcome atmospheric attenuation in FSO.</td>
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<td><strong>JWC • Joint AIO/IS Session II: 3D Imaging</strong></td>
<td><strong>Sri Rama Prasanna Pavani; Ricoh Innovations, United States, Presider</strong></td>
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<td>JWC1</td>
<td>16:30 • <em>Invited</em></td>
<td><strong>SIM and Deflectometry: New Tools to Acquire Beautiful, SEM-like 3D Images</strong>, Gerd Hausler1, Markus Vogel2, Zheng Yang3, Alexander Kessel1, Christian Faber1; Institute of Optics, Univ. of Erlangen-Nuremberg, Germany. Structured-illumination microscopy and microdeflectometry acquire the shape of microscopic objects with a noise level down to 1 nanometer, a depth of field 100 times larger than the Rayleigh depth, and slope angles up to 80°.</td>
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<td>JWC2</td>
<td>17:10 • <em>Invited</em></td>
<td><strong>An Algorithm for High-Speed 3-D Profilometry</strong>, Benjamin Braker1, Eric Moore1; Chiaro Technologies, USA. Structured light profilometers measure static object shapes but their measurement of moving objects is limited. We present a decoding algorithm which, when used with high-speed hardware, produces high-speed profilometry of general objects.</td>
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<td>JWC3</td>
<td>17:50 • 3D Far-field Optical Nanoscopy and Aperiodic Volume Optics</td>
<td><strong>Rafael Piestun1; Univ. Colorado, USA. Abstract Not Available</strong></td>
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NOTES
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

16:30–18:10
CWC • Other Sensing Modalities
Sapna Shroff, Digital
Optics Research group at Ricoh Innovations Inc., United States, Presider

CWC1 • 16:30  Invited
Radiometric Consistency in Source Specifications for Photolithography, Alan E. Rosenbluth1, Josee Tirapu Aztiria2, Kehan Tian1, David Melville1; 1IBM T.J. Watson Research Center, USA; 2IBM Semiconductor Research and Development Center, USA. Mask simulations are made consistent with the brightness theorem if the source map is rescaled by pixel-solid-angle. Standard radiometry factors preserve consistency during propagation, and are derivable from rigorous vector diffraction integrals.

CWC2 • 17:10  Invited
Reconstruction Strategies for Modulated Polarimeters, Charles F. LaCasse1, Scott Tyo1, Russell A. Chipman1; 1University of Arizona, USA. Modulated polarimeters measure the polarimetric information in an optical field by modulating the intensity in a polarization-dependent way. This modulation creates side bands in Fourier transform space that carry the desired information.

CWC3 • 17:50
Dynamic 3D Measurement for Specular Reflecting Surface with Monoscopic Fringe Reflectometry, Lei Huang1, Chiseng Ng1, Anand Asundi1; 1Nanyang Technological University, Singapore. Dynamic full-field 3D measurement of specular surfaces can be conveniently implemented with fringe reflection technique. An experimental study on measuring water wave variations is carried out to demonstrate the feasibility of the proposed approach.

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FWC1 • 16:30
GOSAT/TANSO: Instrument Design and Level 1 Product Processing Algorithms, Jun Yoshida1, Takahiro Kawashima1, Juro Ishida1, Akihiko Kuze2, Hiroshi Suto2, Kei Shiomi2, Masakatsu Nakajima2; 1NEC TOSHIBA Space Systems, Ltd, Japan; 2Japan Aerospace Exploration Agency, Japan. The Greenhouse gases Observing SATellite (GOSAT) has acquired mainly carbon dioxide (CO2) and methane (CH4) absorption spectra globally from space since early 2009. TANSO-FTS (Thermal And Near infrared Sensor for carbon Observation Fourier Transform Spectrometer) is a space-born FTS which has 3 SWIR bands (0.76, 1.6 and 2.0 um) and 1 TIR band (5.5 - 14.3 um) for observation of scattering light and thermal radiation from the earth. In order to improve the GOSAT data quality, the level 1 product processing algorithms has been developed for several years. The instrument design of the GOSAT/TANSO-FTS and the overview of the level 1 product processing algorithms are described.
We present results for negative feedback avalanche diodes (NFADs), which are InP-based SWIR solid-state infrared sensors for active imaging, such as avalanche detection, polarimetric and multispectral capabilities using manufacturable technologies.
Key to Authors and Presiders

(Bold denotes Presider or Presenting Author)

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Imaging and Applied Optics: OSA Optics & Photonics Congress • July 10–14, 2011
Imaging and Applied Optics: QSA Optics & Photonics Congress • July 10–14, 2011

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Imaging and Applied Optics:
OSA Optics & Photonics Congress
Postdeadline Papers

Pier 5
AO Postdeadline Session
Tuesday, July 12, 2011 16:30 - 18:30
Gordon Love; University of Durham, UK, Presider

APDP1 • 16:30
Inverse Problem Approach to the detection of Exoplanets in Multi-Wavelength Data, N. Devaney, É. Thiébaut, W.M. Kellerer, Wizinowich, Aquila Optics, Switzerland; Gemini Observatory, USA; W.M. Keck Observatory, USA. We present the results of the implementation of an Adaptive Optics (AO) Point Spread Function Reconstruction (PSF-R) algorithm on the Gemini-North (Altair) and W.M. Keck systems, for the simplest mode: on-axis bright natural guide star (NGS). We find that unknown telescope, instrument and non-common path aberrations - that are not accounted for in the current model - are as important as the residual turbulence aberrations. We discuss these limitations here and describe our plans to measure and include these unknown aberrations in our model.

APDP2 • 16:50
Practical Implementation of Natural Guide Star Adaptive Optics Point Spread Function Reconstruction on Gemini/Altair & Keck II Systems, Laurent Jolissaint, Julian Christou, Chris Neyma, Peter Wizinowich, Aquila Optics, Switzerland; Gemini Observatory, USA; W.M. Keck Observatory, USA. We present the results of the implementation of an Adaptive Optics (AO) Point Spread Function Reconstruction (PSF-R) algorithm on the Gemini-North (Altair) and W.M. Keck systems, for the simplest mode: on-axis bright natural guide star (NGS). We find that unknown telescope, instrument and non-common path aberrations - that are not accounted for in the current model - are as important as the residual turbulence aberrations. We discuss these limitations here and describe our plans to measure and include these unknown aberrations in our model.

APDP3 • 17:10
The Gemini Multi-Conjugate Adaptive System Sees Star Light, F. Rigaut, B. Neichel, M. Bec, M. Boccas, C. D’Ogerville, V. Fesquet, R. Galeez, G. Gauschas, G. Tranchot, C. Trujillo, M. Edwards, R. Carrasco, Gemini Observatory, Chile. The Gemini Multi-Conjugate Adaptive Optics system (GeMS) has been in commissioning in the first 5 months of 2011. In this paper we present the first results of this commissioning period and plans for the future.

APDP4 • 17:30
Phase Sensor for Solar Adaptive-Optics, Aglae Kellerer, Big Bear Solar Observatory, USA. A new wavefront sensor for solar adaptive optics is presented. The measured quantity is directly proportional to the wavefront phase – no additional computation is required. The method is now being tested on an optical bench.

APDP5 • 17:50
Wavefront sensing in XUV: HHG beam profile measurement, P. Homer, B. Rus, J. Hrebicek, J. Nejdl, Department of Ultraintense Lasers Physics v.v.i. / PALS Centre, Academy of Sciences of the Czech Republic, Czech Republic. We will present results of an experiment dedicated to the XUV wavefront profile measurement of the HHG (High-order Harmonic Generation) beam, carried at the PALS laser center. The wavefront sensing has been achieved by using the PDI (Point Diffraction Interferometer) technique. The performance of the developed PDI sensor has been tested with 10-Hz XUV source emitting at the wavelength \(\lambda = 30\text{nm}\), generated in Ar gas cell by 300 mJ, 40-fs IR laser pulses. The design and development of this XUV wavefront sensor will also be discussed, showing advantages and limitations of applicability of the PDI technique in the XUV and soft-X-ray spectral region.
The Use of Adaptive Optics in Imaging the Eyes of Small Animals, Melanie C. W. Campbell\textsuperscript{1,2,3}, Marsha L. Kisilak\textsuperscript{1,2}, Mark Bird\textsuperscript{1,2,3}, Elizabeth Irving\textsuperscript{1,2}, \textsuperscript{1}Physics & Astronomy, and \textsuperscript{2}School of Optometry, University of Waterloo, \textsuperscript{3}Guelph Waterloo Physics Institute, Waterloo, Ontario, Canada. High resolution imaging of a wide variety of animals is important to understanding their vision and to imaging retinal details in animal models of human disease. We discuss the differing requirements and advantages of AO correction across species.

Salon B
Joint FTS/HISE/AO/COSI Poster Session
Wednesday, July 13, 2011 10:30 -- 12:30

JWA32 Postdeadline Poster - AO
Kalman and H-infinity Controllers for GeMS, I. Rodriguez\textsuperscript{1}, B. Neichel\textsuperscript{1}, A. Guesalaga\textsuperscript{1}, F. Rigaut\textsuperscript{2}, D. Guzman\textsuperscript{1}, \textsuperscript{1}Center for Astro-Engineering, Department of Electrical Engineering, Pontificia Universidad Catolica, Chile; \textsuperscript{2}Gemini Observatory, Chile. GeMS is the Gemini Multi-conjugate System. The system includes 5 Laser Guide Stars, 3 Natural Guide Stars, 3 Deformable Mirrors 1 Tip-Tilt Mirror. In this paper we focus on the control of the Tip-Tilt loop. Two new controllers have been implemented and tested, namely Kalman and H-infinity. We demonstrate that these controllers provide the means to efficiently attenuate vibration or certain frequency bands for GeMS.

Salon C
COSI Postdeadline Session
Wednesday, July 13, 2011 10:30 -- 11:30
Micheal Gehm, University of Arizona, USA, Presider

CPDP1 • 10:30
Adaptive Periodic-Correlation Algorithm for Extended Scene Shack-Hartmann Wavefront Sensing, Erkin Siddick, Jet Propulsion Laboratory, California Institute of Technology, USA. We present an adaptive periodic-correlation algorithm for large dynamic range extended-scene Shack-Hartmann wavefront sensing. We show that it accurately measures very fine image shifts over many pixels under a variety of practical imaging conditions.

CPDP2 • 10:50
Lensless Tomographic Microscopy on a Chip, Serhan O. Isikman\textsuperscript{1}, Waheb Bishara\textsuperscript{1}, Sam Mavandadi\textsuperscript{1}, Frank Yu\textsuperscript{1}, Steve Feng\textsuperscript{1}, Randy Lau\textsuperscript{1}, Aydogan Ozcan\textsuperscript{1,2,3}, \textsuperscript{1}Electrical Engineering Department, University of California, USA; \textsuperscript{2}California NanoSystems Institute (CNSI), University of California, USA. A lensless optical tomography platform is demonstrated for use in high throughput 3D imaging applications. Through the use of pixel super-resolution techniques in partially-coherent digital in-line holography and tomographic reconstruction, this computational microscope achieves <1\mu m \times <1\mu m \times <3\mu m spatial resolution along the x, y and z directions, respectively, over a large imaging volume of \sim 15mm^3.

CPDP3 • 11:10
Field Test of PANOPTES-Based Adaptive Computational Imaging System Prototype, Manjunath Somayajulu, Marc P. Christensen\textsuperscript{1}, Esmaeil Faramarzi\textsuperscript{2}, Dinesh Rajan\textsuperscript{1}, Juha-Pekka Laine\textsuperscript{1}, Dombhull Granquist-Fraser\textsuperscript{2,3}, Peter Sebelius\textsuperscript{1}, Arthur Zachai\textsuperscript{1}, Murali Chaparala\textsuperscript{1}, Gregory Blasche\textsuperscript{1}, Keith Baldwin\textsuperscript{1}, Babatunde Ogunfemi\textsuperscript{1,4}, \textsuperscript{1}Department of Electrical Engineering, Southern Methodist University, USA; \textsuperscript{2}The Charles Stark Draper Laboratory, USA; \textsuperscript{3}Department of Biomedical Engineering, Worcester Polytechnic Institute, USA; \textsuperscript{4}Department of Electrical and Computer Engineering, Northeastern University, USA. We describe the design and prototype development of a visible-band, multi-resolution, steerable computational imager in a flat profile, based on the PANOPTES architecture. We present this imager’s superresolution capabilities via field test results.
Salon A  
Joint FTS/HISE Postdeadline Session  
Wednesday, July 13, 2011 16:30 -- 18:10  
Felix Friedl-Vallon; Karlsruher Institut fuer Technologie Germany; Pierre Tremblay, University Laval, Canada, Presiders

JPDP1 • 16:30 FTS - INVITED  
GOSAT/TANSO: Instrument Design and Level 1 Product Processing Algorithms, Jun Yoshida¹, Takahiro Kawashima¹, Juro Ishida¹, Akihiko Kuze², Hiroshi Suto², Kei Shiomi², Masakatsu Nakajima²; ¹NEC TOSHIBA Space Systems, Ltd, Japan; ²Japan Aerospace Exploration Agency, Japan. The Greenhouse gases Observing SATellite (GOSAT) has acquired mainly carbon dioxide (CO2) and methane (CH4) absorption spectra globally from space since early 2009. TANSO-FTS (Thermal And Near infrared Sensor for carbon Observation Fourier Transform Spectrometer) is a space-born FTS which has 3 SWIR bands (0.76, 1.6 and 2.0 um) and 1 TIR band (5.5 - 14.3 um) for observation of scattering light and thermal radiation from the earth. In order to improve the GOSAT data quality, the level 1 product processing algorithms has been developed for several years. The instrument design of the GOSAT/TANSO-FTS and the overview of the level 1 product processing algorithms are described.

JPDP2 • 17:10 HISE  
Spectrometers for Ocean and Atmospheric Sensing, Tim Valle¹, James Leitch¹, Chuck Hardesty¹, Curtiss O. Davis² and Nicholas Tufillaro², Kelly Chance³, Xiong Liu³, Scott Janz³, Ken Pickering³, Jun Wang³; ¹Ball Aerospace, USA; ²College of Oceanic and Atmospheric Sciences/ Oregon State University, USA; ³Smithsonian Institution/Smithsonian Astrophysical Observatory, USA. Describe the motivation, goals, and plans for MOS and GeoTASO, two NASA Instrument Incubator Program sponsored technology development projects directed at supporting the NASA GEO-CAPE ocean and atmospheric science mission.

JPDP3 • 17:30 FTS  
On-Orbit Absolute Radiance Standard for Future IR Remote Sensing Instruments – Overview of Recent Technology Advancements, Claire Pettersen¹, Fred A. Best¹, Douglas P. Adler¹, Henry E. Revercomb¹, P. Jonathan Gero¹, Joseph K. Taylor¹, Robert O. Knuteson¹, and John H. Perepezko¹; ¹University of Wisconsin, Space Science and Engineering Center, USA; ²University of Wisconsin, Materials Science and Engineering, USA. A summary of the development and recent advancements of the On-Orbit Absolute Radiance Standard at the University of Wisconsin Space Science and Engineering Center. This work is funded under the NASA Instrument Incubator Program.

JPDP4 • 17:50 FTS  
Spectroscopic Interferometric Method of Revealing Spectral Features from Extra-Solar Planets, Eyal Schwartz, Stephen G. Lipson, Physics department, Technion – Israel Institute of Technology, Haifa, Israel. The signal contrast in a light source between an Earth-like extra-solar planet and a parent star (typical sun-like) is a difficult obstacle in imaging and spectroscopic analysis of a distant light source observed on earth. We suggest a method of using parts of an interferogram of the combined light sources (both planet and sun) in order to increase the signal to noise ratio and identify the specific spectral features from the planet in the background of the parent star.
**Withdrawals**

The following poster and papers were withdrawn after the program guide went to print: JTuB2; JTuB5; JTuB8; JTuB9; JWA4; JWA18; JWA23. LMA1; LMA2; LMC4; LWC3; JPDP2; LTuA2.

**Presenter Changes**

CWC3 will be presented by Yan Hao Nanyang Technological University, Singapore. JWB2 will be presented by Shona Steward, ChemImage Corporation, USA. AMB1 will be presented by Robert Wilson, UKATC, Royal Observatory Edinburgh, UK.

HTuC1 will be presented by Allen Huang GeoMetWatch-STORM: Global Constellation of Next-generation Ultraspectral Geostationary Observatory in lieu of Margaret Kalacska. His paper is included in this update sheet.

**Presider Updates**

Ping Yang will preside over HWB 14:00-16:00 in Pier 7/8.

**Author Updates**

The author block for AIMB4 should read ElfedLewis; University of Limerick, Ireland.

**Networking over Lunch**

Tuesday, 12 July 12:30 – 14:00

*Sponsored by the OSA Information Acquisition, Processing and Display Technical Division*

David Brady, Division Chair, and Chris Dainty, OSA President, invite you to join them over lunch for some lively networking with your colleagues. OSA is pleased to offer complimentary sandwiches and beverages to all who attend.

**Postdeadline Papers: Key to Authors and Presiders**

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**Student Awards**

Vyas Akondi, Indian Inst. Of Astrophysics, India has been named the recipient of the 2011 Robert S. Hilbert Memorial Student Travel Grant. Please help us congratulate him on this prestige award.

**Postdeadline Papers**

Postdeadline Papers are appended to the back of the program guide. Key to postdeadline authors is below.

**Web Access**

To access the internet in the meeting area use this wireless access code:

SSID: DATAVALET_MR
Login: IMA61
Password: wusyki
Important Program Changes

LS&C

Monday, July 11th, LMA Hybrid Laser/RF Communications
Session from 8:40-10:00 in Pier 4 has been cancelled

The talks have been moved to the Tuesday, July 12th, 10:30-12:10
LTuB - Network Technologies
Juan Juarez, John Hopkins, United States, Presider

LTuB1 10:30
Diversity Rateless Round Robin for Networked FSO Communications
Roger Hammons

LTuB2 11:10
Optical Automatic Gain Controller for High-Bandwidth Free-Space Optical Communication Links
Juan Juarez

LTuB3 11:30
Customized Bit Error Rate (cBERT) Tester for Characterizing Frequent Fade Communications Channels
James Riggins

AIO

AIMD1 at 16:30 has been moved to AIWB at 12:30
Process Analytical Technology: Bringing Solutions to the Plant Floor
Katherine Bakeev