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

June 7-8, 2010, The Westin La Paloma, Tucson, AZ, USA

Applied Industrial Optics (AIO) is an inaugural meeting and will concentrate on research on three general topics:

1. **Industrial Spectroscopy**
2. **Industrial Imaging**
3. **Optical Metrology**

The research will focus on the development and application of technology to enhance production efficiency, quality, and/or safety in an industrial setting, and will explore the current developments in applied optics its far-reaching future industrial implications. Learn more.

It is a *must-attend* event for those in the various industries including: food and beverage, pharmaceutical, petrochemical, pulp and paper, semiconductor, machine automation, and chemical.

Pre-Registration is now closed. You may still register on-site at the Westin La Paloma in the Lobby Foyer (Tucson, Arizona) beginning Sunday, June 6.

Take advantage of all AIO has to offer:

- Six meetings for the price of one
- Tabletop exhibit
- Post Deadline Sessions reporting critical breakthroughs
- Poster sessions providing one-on-one discussion time with presenters
- Networking events
- Short course for professional development

Conference Program

View the conference program and plan your itinerary for the conference

- Browse speakers and the agenda of sessions <insert link to PDF>
- Browse sessions by type or day.
- Use Advanced Search to search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference.
- Download your personal itinerary to your mobile device.
- Add your personal itinerary to your electronic calendar.
- Email your itinerary to a colleague who might be interested in attending.

Download pages from the Congress program book (includes all meetings in the Imaging and Applied Optics Congress)!

- Abstracts
- Agenda of Sessions
- Key to Authors and Presiders

Special Opportunities- for Students and Young Professionals

Imaging and Applied Optics Congress: OSA Optics & Photonics Congress

- Applied Industrial Optics: Spectroscopy, Imaging and Metrology (AIO)
- Digital Image Processing and Analysis (DIPA)
- Imaging Systems (IS)
- Optical Remote Sensing of the Environment (ORS)
- Optics for Solar Energy (SOLAR)
- Photonic Metamaterials and Plasmonics (META)

Special Events Details

- Welcome Reception
- Poster Sessions
- Post Deadline Paper Sessions
- Rump Session
- Tour of the University of Arizona
- OSA/MIT CIPS Short Course Videocast

Sponsor:

OSA

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

June 7-8, 2010, The Westin La Paloma, Tucson, AZ, USA

Program

The program for Applied Industrial Optics: Spectroscopy, Imaging and Metrology (AIO) will be held Monday, June 7 through Tuesday, June 8th. No events are scheduled for Sunday, June 6; however participants may register and pick up their materials on Sunday afternoon.

- Call for papers (pdf)
- Online conference program
- Download pages from the program book
- About the meeting topics
- Invited speakers
- Short course
- Special events

Online Conference Program

Searchable Conference Program Available Online!

- Browse speakers and the agenda of sessions (pdf).
- Browse sessions by type or day.
- Use Advanced Search to search the program by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference.
- Download your personal itinerary to your mobile device.
- Add your personal itinerary to your electronic calendar.
- Email your itinerary to a colleague who might be interested in attending.

You may search the program without creating an account; however, you will not be able to create or save a personal itinerary without first creating an account. We strongly recommend that you create a user account first.

View the Agenda
Plan Your Conference

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Download pages from the program book!

- Agenda of sessions (pdf)
- Abstracts (pdf)
- Key to authors and presiders (pdf)

About Applied Industrial Optics: Spectroscopy, Imaging and Metrology

The meeting will focus on advances in Applied Industrial Optics (AIO). The meeting will consist of three general topics:

1. Industrial Spectroscopy
2. Industrial Imaging
3. Optical Metrology

While each topic will focus on the development and application of technology that is utilized to enhance production efficiency, quality, and/or safety in an industrial setting, consideration will also be given to current developments in applied optics that may have far-reaching future industrial implications.

The sessions on industrial spectroscopy are anticipated to cover all forms of optical spectroscopy, including but not limited to UV-Vis, NIR, Raman, Fluorescence, and LIBS. In addition, it is anticipated that a number of talks will deal with advanced spectral processing techniques and algorithms (i.e., chemometrics) which are aimed at enabling real-time applications.

The sessions on industrial imaging are anticipated to cover industrial applications of both spatial (i.e., machine vision or object recognition) and spectral (i.e., hyper-spectral or multispectral) imaging.

The sessions on optical metrology are anticipated to cover all areas of applied industrial optics that do not ideally fit within the classifications of spectroscopy or imaging, such as interferometric sensing (i.e., pressure and temperature), LIDAR, phase-based chemical sensing, and optical techniques for physical parameter measurements such as voltage and/or current.

The Applied Industrial Optics (AIO) will be collocated with five other Topical Meetings, three of which are synergistic with AIO: Optical Remote Sensing of the Environment (ORS), Imaging Systems (IS), and Digital Image Processing and Analysis (DIPA). This should serve to both enhance the session’s attendance and facilitate access to topics of interest beyond the focus of AIO.

It is anticipated that the meeting will draw from multiple industries such as: food and beverage, pharmaceutical, petrochemical, pulp and paper, semiconductor, machine automation, and chemical; thereby facilitating a highly multidisciplinary audience.

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

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Chairs & Committee Members

The Technical Program Chairs and Committee Members are integral to the success of the meeting. These volunteers dedicate countless hours to planning, including such critical activities as raising funds to support the event, securing invited speakers, reaching out to colleagues to encourage submissions, reviewing papers, and scheduling sessions. On behalf of OSA, its Board, and its entire staff, we extend enormous gratitude to the following members of the Applied Industrial Optics: Spectroscopy, Imaging and Metrology (AIO) Technical Program Committee.

- Program Committee
- Information for Conference Chairs and Committee Members
- Information for Session Chairs/Presiders

Program Committee

General Chairs

- Sean Christian, *Optrology, Inc.,* USA
- Bertrand Lanher, *Polarmetrics,* USA

Program Chairs

- Jess Ford, *Weatherford Intl.,* USA
- Dominic Polizzi, *Optics Technology,* USA

Committee Members

- Chris Cotton, *ASE Optics,* USA
- Joe Dallas, *AVO Photonics,* USA
- Jim Demas, *Univ. of Virginia,* USA
- Jason Dickens, *Glaxo Smith Kline,* USA
- Jason Eichenholtz, *Ocean Optics,* USA
- Sven Kruger, *Holoeye Photonics AG,* Germany
- Fred Long, *Spectroscopic Solutions,* USA
- Nick MacKinnon, *OneLight Corp.,* Canada
- Russ May, *Prime Photonics,* USA
- Olga Pawluczyk, *P&P Optica,* Canada
- Michael Strauss, *Caelum Group,* USA
- Michael Sullivan, *Kiara Biosystems,* USA
- Jack Zhou, *B&W Tek, Inc.,* USA

If you are a member of the committee and have any questions or concerns at any point along the way, please refer to the information below or contact your program manager.

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Information for Conference Chairs and Committee Members

- View the Calendar of Deadlines for the Meeting
- View the Chairs' Manual

- View the Call for Papers
- View Fundraising Information
- View Exhibit and Sponsorship Information
- View Author/Presenter Information
- View Peer Review Instructions
- View Scheduling Instructions
- View Student Travel Grant Information
- View Registration Information
- View Housing Information

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Information for Session Chairs/Presiders

The role of the session presider (or session chair) is an important one. In many ways, the success of the session and the presentations within it depends on the presider. First and foremost, OSA recognizes the significance of the role of the session presider, and we thank you for volunteering to serve in this critical role!

The information on this page is arranged in the following sections and is intended to assist you in managing a successful session:

Arriving at Your Session Room

Presiders are requested to identify themselves to the audiovisual personnel at least 20 minutes before the session begins for a quick review of equipment and procedures.

Guidelines for Presiding over a Session

Remember to introduce yourself as the presider and announce the session. The total amount of time allotted for each presentation is listed in the online program as well as in the conference program book, and start times for each presentation are listed on the presider check-in sheet at the podium. A 60-minute mechanical timer will be available for your use. We recommend that the timer is set two minutes prior to the end of the presentation time in order to provide a warning to wrap up the talk and start the discussion period. Notify the authors of this warning system. It is also important to remind the speaker to repeat the questions asked from the audience.

Maintaining the scheduled timing of papers is very important. In cases where the paper is withdrawn or the speaker does not show, use the time for an extended question period for authors of previously presented papers or call a break. PLEASE DO NOT START TALKS EARLIER THAN THEY ARE SCHEDULED. All requests to modify the program schedule should be directed to the program chair.

We will have presider check-in sheets in your session room to complete and return to management at the completion of your session. When monitoring the session we ask that you note any changes or no-shows on this sheet for our records.

IMPORTANT NOTICE: Due to licensing restrictions, the use of music in presentations, including video presentations, is prohibited. If a speaker uses music during his/her presentation, please inform Meeting Management immediately.

For additional tips on how to be a great presider, watch a video featuring Dr. Ben Eggleton (CUDOS, Univ. of Sydney, Australia), or read the notes detailing a few of Dr. Eggleton's most important points.

Completing the Presider Check-in Sheet

Once you arrive at your session room, you will find a folder marked “Presider Check-In” at the podium or on the table at the front of the room. This folder will contain a sheet for each session in that room. Please be sure to remove only the sheet that applies to the session you are chairing, and leave the others in the folder. The check-in sheet will list the talks within your session, the order in which they will be given, and the name of the author giving the presentation. Please complete the check-in form as follows:

- Estimate the number of attendees in the session at the start of the session, about halfway into the session, and at the end of the session; note these counts where indicated in the upper right corner.
- Check the box in the rightmost column to indicate which speakers presented during the session.
- Make note of any no-show speakers or replacement speakers.
- Leave the completed sheet in the folder in the pocket marked “Completed.”
- Leave the folder on the podium or table for the next session presider. (If you are chairing the last session of the day, please leave the folder in the room for meeting management.)

The check-in form serves two purposes: 1) to assist you in running an effective session and 2) to help OSA ensure that the appropriate speakers’ files are archived on OSA Optics InfoBase after the meeting. Only those authors who attend and present are included in the InfoBase, so it’s important that you make note of any presenters who are absent.

View a sample check-in sheet.

Again, we appreciate your assistance in serving as a session presider!

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Exhibit

OSA Congresses are unique, medium sized meetings where 300-500 industry experts and top researchers and developers share their latest research and collaborate on new and future applications within their specialized fields. The meetings focus on the most advanced developments within specific topical areas of the optics and photonics industry. Exhibiting at The OSA Imaging and Applied Optics Congress offers you an extremely targeted opportunity to display your company's products that fall within these co-located topical meeting areas:

- Applied Industrial Optics: Spectroscopy, Imaging, and Metrology (AIO) **New!**
- Digital Image Processing and Analysis (DIPA) **New!**
- Imaging Systems (IS)**New!**
- Optical Remote Sensing of the Environment (ORS)
- Optics for Solar Energy (SOLAR) **New!**
- Photonic Metamaterials and Plasmonics (META)

Current Exhibitor List (as of May 25, 2010)

Alternative Vision Corp
Avo Photonics
Catalina Scientific Instruments
Deposition Sciences
Nanoplus
Optical Perspectives Group
Optimax
Veeco

Reserve Your Exhibit Space

Bonus: You will receive one free technical pass for every tabletop space or 10'x10' booth you purchase.

Exhibit Rates

Sponsorship Opportunities for OSA Optics and Photonics Congresses

Full List of OSA Exhibiting Opportunities

For More Information about Reserving Exhibit Space at OSA Meetings, please call +1 202.416.1474 or email exhibitsales@osa.org

Exhibitor Service Manual (includes set-up times, registration instructions, checklist of deadlines and shipping instructions)

For additional questions about exhibit logistics, please call +1 202-416-1972 or topicalexhibits@osa.org.

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Alternative Vision Corporation is a value-added reseller of high-performance imaging components and equipment to OEMs and systems integrators. Our current product lines include stock and custom monochrome and color cameras, smart cameras, vision processors, stock and custom CMOS image sensors, sensor sockets, manual and motorized NIR/SWIR/MWIR/LWIR infrared lenses, 2-5 port spectral separation prisms, laser welding and cutting optics, finite-conjugate optics, optical design services and a selection of unique optical components.

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Optical Perspectives Group, LLC is a consulting firm specializing in the hardware aspects of optics, particularly the fabrication, testing, assembly and alignment of optical components and systems. In support of these functions, OPG markets two products; the Point Source Microscope (PSM) used for the alignment of optics and optical systems, and the CaliBall, an artifact used for calibrating interferometer transmission spheres using the random ball test.

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Special Events

OSA/MIT CIPS Short Course Videocast

Monday, June 7, 2010
8:00 a.m.-2:00 p.m.

Course held in conjunction with OSA Solar Energy Meeting of June 8-8, 2010 -Explore the rapidly expanding roles of optics and photonics in solar energy generation.

This course is intended for researchers, engineers, graduate students and other technologists who wish to enhance their knowledge in the solar and optics/photonics fields. No expertise in the course topics is assumed.

Instructors will include

- Prof. Marc Baldo, MIT- Solar Energy Tutorial
- Prof. Tonio Buonassisi, MIT- Silicon Photovoltaics
- Prof. Vladimir Bulovic, MIT- Thin-film Photovoltaics

Click for Short Course details and Registration information.

Joint Welcome Reception

Monday, June 7, 2010
7:00 p.m.-8:30 p.m.

Start the Congress excitement early by joining us on Monday, June 7th, for the Welcome Reception. This reception is the perfect kick-off to this year's congress. Free to all Technical Conference Attendees. Meet with colleagues from around the world. Light hors d'oeuvres will be served.

Poster Sessions

Tuesday, June 8, 2010
2:00 p.m. – 4:00 p.m. and
7:00 p.m. – 7:45 p.m.

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. During afternoon poster session, posters will be presented from the AIO, IS, META and ORS meetings. The evening poster session will highlight the Solar meeting poster presentations.

University of Arizona, College of Optical Science Tour

Tuesday, June 8, 2010
7:00 pm – 8:00 pm

Location:
Tour Begins in the West Wing of the Optical Sciences Building

Transportation:
6:30 pm – The bus departs from Westin La Paloma
8:15 pm - The bus will depart from to the University to the Westin La Paloma.
Please note: Limited Space available.

Self Transportation:
Parking is available in the Cherry Avenue parking structure, just south of the Optical Sciences Building
For those who will be driving, additional directions and parking information are available at:
http://www.optics.arizona.edu/Maps/Default.htm

As an attendee of the Imaging and Applied Optics Congress, you are invited to take a tour of the internationally renowned University of Arizona College of Optical Sciences. The College, the largest institute for optics education in the United States, is dedicated to research and education in all areas of optics.

The College of Optical Sciences, founded as the Optical Sciences Center, has been shaping the future since 1964 by offering highest-quality, on-campus and on-line graduate and undergraduate education, cutting-edge research programs, and a solid commitment to the economic development of the optics industry. The College focuses on providing solutions for the optics industry worldwide by initiating internationally recognized research programs and offering more than 90 courses in optical sciences.

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

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Invited Speakers

- AMA1, **Title to Be Announced**, ***Edgar A. Mendoza****; Redondo Optics Inc., USA.*
- AMA4, **Title to Be Announced**, ***Carl Jackson****; Sensl, Ireland.*
- AMB3, **A Case Study in Measuring Ultra-Low Level Sulfur in Diesel Using WD-XRF**, ***Larry Arias****, Alexander Seyfarth; Bruker AXS Inc., USA.*
- AMC1**, LIBS in Industry: Sparks Fly, *Steven G. Buckley*[1]**, *Gregg A. Lithgow[1], Christopher B. Stipe[2]; [1]Photon Machines, Inc., USA, [2]Seattle Univ., USA.*
- AMC4**, Deploying LIBS in Industry: Four Examples of Applied LIBS Technologies, *Arel Weisberg[1],*** *Joseph Craparo1, Robert De Saro1, Carlos Romero[2], Romauld Pawluczyk[3], Andrew I. Whitehouse[4]; [1]Energy Res. Co., USA, [2]Energy Res. Ctr., Lehigh Univ., USA, [3]P&P Optica, Canada, [4]Applied Photonics, Ltd., UK.*
- ATuA1, **Long-Term Metrological Qualification of Optical Feedback Cavity Enhanced Absorption Spectroscopy (OFCEAS); Measurement of Dihydrogen Sulfur in Natural Gas**, ***Lucien Lonigro****; ap2e, France.*
- ATuB1, **Use of White LEDs in High Speed Industrial Visible-Light Spectrophotometry Applications**, ***James Freal****; Hunter Lab, USA.*
- ATuB4**, A Novel Spectroscopic Technique's Journey of Acceptance in Biopharmaceutical QC Laboratories, *Arthur Watson****; Convergent Bioscience Ltd., Canada.*
- ATuC1, **Title to Be Announced**, ***Ken Johnson****; Georgia Tech Res. Inst., USA*

Agenda of Sessions — Sunday, June 6

3:00 p.m.–6:00 p.m.	**Registration Open,** *Lobby Foyer*

— Monday, June 7

	Sonoran I	Murphey I & II	Sonoran II	Canyon I	Finger Rock	Canyon III
	AIO	DIPA	IS	META	ORS	SOLAR
7:00 a.m.–6:00 p.m.	**Registration Open,** *Lobby Foyer*					
7:45 a.m.–8:00 a.m.		**DIPA Opening Remarks**	**IS Opening Remarks**	**META Opening Remarks**	**ORS Opening Remarks**	
8:00 a.m.–10:00 a.m.		**DMA • Image Quality**	**IMA • Military Applications I**	**MMA • Metamaterials I**	**OMA • New Sensors and Methods I: Hyperspectral Imaging**	
10:00 a.m.–10:30 a.m.	**Coffee Break/Exhibits Open,** *Pavilion*					
10:30 a.m.–12:30 p.m.	**AMA • Optical Metrology I**	**DMB • Nonlinear Image Processing**	**IMB • Military Applications II**	**MMB • Plasmonics I**	**OMB • New Sensors and Methods II**	
12:30 p.m.–2:00 p.m.	**Lunch Break** *(on your own)*					
2:00 p.m.–4:00 p.m.	**AMB • Optical Metrology II** (ends at 3:40 p.m.	**DMC • Image Restoration**	**IMC • Imaging Optics I**	**MMC • Towards Applications I**	**OMC • Developments in LiDAR**	**SMA • Keynote Session**
4:00 p.m.–4:30 p.m.	**Coffee Break/Exhibits Open,** *Pavilion*					
4:30 p.m.–6:30 p.m.	**AMC • Selected Topics: Optical Applications in Industry**	**DMD • Digital Image Processing and Optics** (ends at 6:50 p.m.)	**IMD • Imaging Optics II**	**MMD • Plasmonics II**	**OMD • Littoral Applications of Remote Sensing**	**SMB • Concentrator PV Systems**
7:00 p.m.–8:30 p.m.	**Welcome Reception,** *Arizona Deck and Foyer*					

Key to Conference Abbreviations

AIO	**Applied Industrial Optics: Spectroscopy, Imaging, and Metrology**
DIPA	**Digital Image Processing and Analysis**
IS	**Imaging Systems**
META	**Photonic Metamaterials and Plasmonics**
ORS	**Optical Remote Sensing of the Environment**
SOLAR	**Optics for Solar Energy**

Agenda of Sessions — Tuesday, June 8

	Sonoran I	Murphey I & II	Sonoran II	Canyon I	Finger Rock	Canyon III
	AIO	DIPA	IS	META	ORS	SOLAR
7:30 a.m.–5:30 p.m.	**Registration Open,** *Lobby Foyer*					
8:00 a.m.–10:00 a.m.	**ATuA • Spectroscopy, Color, & Imaging I**	**DTuA • Medical Image Processing I**	**ITuA • Imaging Sensors I**	**MTuA • Metamaterials II**	**OTuA • Remote Sensing of Vegetation**	**STuA • Solar Concentrator Characterization**
10:00 a.m.–10:30 a.m.	**Coffee Break/Exhibits Open,** *Pavilion*					
10:30 a.m.–12:30 p.m.	**ATuB • Spectroscopy, Color, & Imaging II**	**DTuB • Medical Image Processing II**	**ITuB • Imaging Sensors II**	**MTuB • Plasmonics III**	**OTuB • Environmental Applications**	**STuB • Concentrator Design and Holographic Concentrator Systems**
12:30 p.m.–2:00 p.m.	**Lunch Break** *(on your own)*					
2:00 p.m.–4:00 p.m.	**JTuA • Joint AIO/IS/META/ORS Poster Session,** *Pavilion*					
2:00 p.m.–4:00 p.m.	**STuC • Coatings and Light Trapping,** *Canyon III*					
4:00 p.m.–4:30 p.m.	**Coffee Break/Exhibits Open,** *Pavilion*					
4:30 p.m.–6:30 p.m.	**ATuC • Chemical Sensing**		**ITuC • Imaging Sensors III**	**MTuC • Plasmonics IV**		**STuD • Concentrator System Design**
7:00 p.m.–7:45 p.m.	**STuE • Solar Poster Session,** *Pavilion*					
8:00 p.m.–9:00 p.m.	**AIO Rump Session**					**SOLAR Rump Session**

Key to Conference Abbreviations

AIO **Applied Industrial Optics: Spectroscopy, Imaging, and Metrology**
DIPA **Digital Image Processing and Analysis**
IS **Imaging Systems**
META **Photonic Metamaterials and Plasmonics**
ORS **Optical Remote Sensing of the Environment**
SOLAR **Optics for Solar Energy**

Agenda of Sessions — Wednesday, June 9

	Sonoran I	Murphey I & II	Sonoran II	Canyon I	Finger Rock	Canyon III
	AIO	DIPA	IS	META	ORS	SOLAR
7:30 a.m.–5:00 p.m.	**Registration Open,** *Lobby Foyer*					
8:00 a.m.–10:00 a.m.			**IWA • Computational Imaging I**	**MWA • Active Structures**		**SWA • Light Trapping and Plasmonics**
10:00 a.m.–10:30 a.m.	**Coffee Break/Exhibits Open,** *Pavilion*					
10:30 a.m.–12:30 p.m.			**IWB • Computational Imaging II** (ends at 11:50 a.m.)	**MWB • Metamaterials III**		**SWB • Light Management and Spectrum Splitting**
12:30 p.m.–2:00 p.m.	**Lunch Break** *(on your own)*					
2:00 p.m.–4:00 p.m.			**IWC • 3-D Imaging**	**MWC • Plasmonics V**		**SWC • Device and Module Characterization**
4:00 p.m.–4:30 p.m.	**Coffee Break/Exhibits Open,** *Pavilion*					
4:30 p.m.–6:30 p.m.			**IWD • Projective Imaging** (ends at 6:10 p.m.)	**MWD • Towards 3-D Structures**		**SWD • Organic and Thin Film PV**

Key to Conference Abbreviations

AIO **Applied Industrial Optics: Spectroscopy, Imaging, and Metrology**
DIPA **Digital Image Processing and Analysis**
IS **Imaging Systems**
META **Photonic Metamaterials and Plasmonics**
ORS **Optical Remote Sensing of the Environment**
SOLAR **Optics for Solar Energy**

Murphey I & II

Digital Image Processing and Analysis

Sonoran II

Imaging Systems

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

8:00 a.m.–10:00 a.m.
DMA • Image Quality
David G. Stork; Ricoh Innovations, USA, Presider

DMA1 • 8:00 a.m. Plenary
Blind Image Quality Assessment is Not Impossible, *Alan C. Bovik*; *Univ. of Texas at Austin, USA.* In this talk I will discuss our recent efforts on blind or "no reference" image quality assessment problems, including machine learning approaches and the looming question of stereo (3-D) image quality.

DMA2 • 9:00 a.m. Invited
Application-Driven Spectral Image Quality Assessment and Prediction, *John P. Kerekes*; *Rochester Inst. of Technology, USA.* The assignment of a quantitative spectral image quality metric is discussed with an approach proposed. Quality is divided into fidelity and utility components, with utility studied in the context of object detection in hyperspectral imagery.

DMA3 • 9:40 a.m.
Image Interpolation Using FREBAS Transform with Single Image-Based Super-Resolution, *Satoshi Ito*, *Yushi Harada, Yoshifumi Yamada; Utsunomiya Univ., Japan.* Image interpolation with super-resolution effects using the FREBAS transform, which is a kind of multi-resolution analysis, is proposed. Real-value constraint in the iteratively algorithm extrapolate the signal in the FREBAS domain and images makes clear.

8:00 a.m.–10:00 a.m.
IMA • Military Applications I
Ronald Driggers; NRL, USA, Presider

IMA1 • 8:00 a.m. Invited
Military Imaging System Performance, *Keith Krapels*; *US Army Night Vision Lab, USA.* Abstract not available.

IMA2 • 8:40 a.m. Invited
Imaging Systems in the Army, *Don Reago*; *US Army Night Vision Lab, USA.* Abstract not available.

IMA3 • 9:20 a.m. Invited
Advanced Imaging Systems for Navy Applications, *James Waterman*; *NRL, USA.* Imaging system capability in the infrared has been advanced significantly over the past 5 years due to innovations in detector, readout circuit, electronics, optics, and image processing technology.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits Open, *Pavilion*

Canyon I

Photonic Metamaterials and Plasmonics

Finger Rock

Optical Remote Sensing of the Environment

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

8:00 a.m.–10:00 a.m.
MMA • Metamaterials I
Martin Wegener; Karlsruhe Inst. of Technology, Univ. of Karlsruhe, Germany, Presider

MMA1 • 8:00 a.m. Invited
Controlling Light at the Nanoscale: Nonlinear and Switchable Photonic Metamaterials, *Nikolay Zheludev*; *Univ. of Southampton, UK.* Composite metamaterials containing chalcogenide glass, carbon nanotubes, graphene, semiconductor quantum dots and fabricated from cuprate superconductor offer new photonic functionalities.

MMA2 • 8:40 a.m. Invited
High Harmonic Generation in Plasmonic Nanostructure, *Seung-Woo Kim*, *In-Yong Park, Seungchul Kim, Joonhee Choi; KAIST, Republic of Korea.* 2-D and 3-D metallic nanostructures are fabricated and tested to generate EUV high harmonics by enhancing the electric field of a femtosecond laser by means of surface plasmons resonance.

MMA3 • 9:20 a.m.
Two-Photon Absorption Enhancement with Gold Nanoantennas Array, *Joshua D. Borneman*[1], *Vladimir P. Drachev[1], Kuo-Ping Chen[1], Alexander V. Kildishev[1], Vladimir M. Shalaev[1], Konstantin Yamnitskiy[2], Robert Norwood[2], N. Peyghambarian[2], Lazaro A. Padilha[3], Scott Webster[3], David J. Hagan[3], Eric W. Van Stryland[3]; [1]Purdue Univ., USA, [2]Univ. of Arizona, USA, [3]Univ. of Central Florida, USA.* Gold dipole nanoantennas which have strong local electromagnetic fields are used to enhance two-photon absorption. A 30 to 40 times enhancement is observed for BDPAS (4,4'-bis(diphenylamino) stilbene) at 600 nm.

MMA4 • 9:40 a.m.
Flipped-Fishnet Structure Design for Optical Modulator, *Jun Xu*, *Hyungjin Ma, Nicholas X. Fang; Univ. of Illinois at Urbana-Champaign, USA.* We investigate a novel design of NIM modulator for optical communication. Numerical studies indicate a strong modulation of fiber-guided signal. Experimental observation verifies simulation results, that shows the good potential for on-fiber small footprint modulator.

8:00 a.m.–10:00 a.m.
OMA • New Sensors and Methods I: Hyperspectral Imaging
Melba Crawford; Purdue Univ., USA, Presider

OMA1 • 8:00 a.m.
A Comparison of Optical Design Forms of Hyperspectral Instruments for Remote Sensing, *Timothy N. Miller*, *Raymond M. Bell, Jr.; Lockheed Martin Space Systems Co., USA.* We describe and compare five popular optical designs for remote-sensing hyperspectral sensors. We discuss the benefits and limitations of each, and consider first-order parameters that may lead a designer towards a particular option.

OMA2 • 8:20 a.m. Invited
Detailed Terrain Characterization from a Space Based Imaging Spectrometer, *Thomas W. Cooley*; *AFRL, USA.* Imaging spectrometers have been developed and matured over the past 30 years beginning with developmental airborne systems. Beginning with the NASA Hyperion instrument, space borne systems are providing data to a broad user community to explore the myriad applications of spaceborne imaging spectrometer data. This presentation will explore the range of terrain characterization applications and products which are being addressed currently and those that could be met in the future as sensors are improved and tailored to the user needs.

OMA3 • 9:00 a.m.
Atmospheric Correction of Spectral Imagery from Sensor Systems with Changing Viewing Geometry over a Scene, *Gerald W. Felde*, *Gail P. Anderson, Thomas W. Cooley; AFRL, USA.* Simulated radiance cubes are used to gain a quantitative understanding of FLAASH reflectance retrieval errors due to viewing geometry errors. For a particular zenith view angle error, the retrieval error increases as the viewing becomes more off-nadir.

OMA4 • 9:20 a.m. Invited
The Hyperspectral Imager for the Coastal Ocean (HICO) and Environmental Characterization of the Coastal Zone from the International Space Station, *Michael Corson*[1], *Robert L. Lucke[1], Curtiss O. Davis[2]; [1]NRL, USA, [2]Oregon State Univ., USA.* The Hyperspectral Imager for the Coastal Ocean (HICO) operating on the International Space Station is the first demonstration of environmental characterization of the coastal ocean using hyperspectral imagery from space.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits Open, *Pavilion*

Sonoran I — Applied Industrial Optics: Spectroscopy, Imaging, and Metrology

Murphey I & II — Digital Image Processing and Analysis

Sonoran II — Imaging Systems

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

10:30 a.m.–12:30 p.m.
AMA • Optical Metrology I

Jess Ford; Weatherford Intl., USA, Presider

AMA1 • 10:30 a.m. Invited

Title to Be Announced, *Edgar A. Mendoza*; *Redondo Optics Inc., USA.* Abstract not available.

AMA2 • 11:10 a.m.

Fluorescence Lifetime Sensing of Temperature with Erbium Doped Lead Germano Tellurite Glass, *Indumathi Kamma,* ***Rami Reddy Bommareddi****; Alabama A&M Univ., USA.* A non contact and nondestructive method is described for optical sensing of temperature by measuring laser excited fluorescence from erbium doped glass. Temperature calibration plot has been developed from room temperature to 600C.

AMA3 • 11:30 a.m.

Extremely High-Resolution LADAR System for Precision Length Metrology and Imaging, *Peter A. Roos*[1], *Randy R. Reibel[1], Trenton J. Berg[1], Brant M. Kaylor[1], Zeb W. Barber[2], Wm. Randall Babbitt[2]; [1]Bridger Photonics, Inc., USA, [2] Spectrum Lab, Montana State Univ., USA.* We report a precision LADAR system that can achieve 35 µm FWHM range-peak-width resolution and 86 nm range precisions for absolute distance and length metrology and precision 3-D LADAR imaging applications.

AMA4 • 11:50 a.m. Invited

Title to Be Announced, *Carl Jackson*; *Sensl, Ireland.* Abstract not available.

10:30 a.m.–12:30 p.m.
DMB • Nonlinear Image Processing

Michael T. Orchard; Rice Univ., USA, Presider

DMB1 • 10:30 a.m. Invited

Nonlinear Image Representation: Lessons from Biology, *Eero Simoncelli*; *New York Univ., USA.* Abstract not available.

DMB2 • 11:10 a.m. Invited

Sparse Reconstructions Using Simple Transforms: Tessellating the State-of-the-Art in Image Reconstruction, *Onur Guleryuz*; *DOCOMO Communications Labs USA, Inc., USA.* Abstract not available.

DMB3 • 11:50 a.m.

Dictionary-Based Optical Filter Selection for Multi-Application Spectral Signature Classification, *Jun Ke[1],* ***Kathrin Berkner**[2], Dirk Robinson[2], David G. Stork[2]; [1]Univ. of Arizona, USA, [2]Ricoh Innovations, Inc., USA.* We describe a method for selecting filter sets for simultaneously optimizing the classification rates in two separate spectral signature classification problems. Our system's performance is comparable to traditional hyper-or multispectral classifiers, but uses fewer filters.

DMB4 • 12:10 p.m.

Continuum Fusion: A New Beginning for Non-Bayesian Detection Algorithms, *Alan Schaum*; *NRL, USA.* A new methodology is described for addressing composite hypothesis testing problems. Continuum Fusion integrates an infinity of optimal methods, when the correct choice is unknown. An example problem is solved geometrically.

10:30 a.m.–12:30 p.m.
IMB • Military Applications II

Don Reago; US Army Night Vision Lab, USA, Presider

IMB1 • 10:30 a.m. Invited

Imaging at DARPA MTO, *Nibir Dhar*; *DARPA, USA.* Abstract not available.

IMB2 • 11:10 a.m.

Static Architecture for Compressive Motion Detection in Persistent, Pervasive Surveillance Applications, *Michael D. Stenner*[1], *Daniel J. Townsend[1], Michael E. Gehm[2]; [1]MITRE Corp., USA, [2]Univ. of Arizona, USA.* High-resolution, wide-field-of-view airborne imaging produces large optical systems and data streams. Significant simplification is possible if motion detection, rather than full imaging, is the goal. We consider a static, compressive-sensing architecture for this problem.

IMB3 • 11:30 a.m.

Performance Testing of an Extended Depth of Field Digital Night Vision Device, *Jonathan C. James*[1], *R. Brandon Vaughan[1], Jack W. Wood[1], Gisele Bennett[1], Russell S. Draper[2], Art Hastings[2], James Stevens[2], Kyle Bryant[2]; [1]Georgia Tech Res. Inst., USA, [2]Night Vision and Electronic Sensors Directorate, US Army Res., Development and Engineering Command, USA.* Performance testing of a night vision technology demonstrator incorporating wavefront coding to increase image depth-of-field was recently completed. Test results indicate that depth-of-field was increased with some loss in performance in other image quality aspects.

IMB4 • 11:50 a.m.

New Technologies to Enable Millimeter-Wave Imaging, *Joseph N. Mait*[1], *David A. Wikner[1], Mark S. Mirotznik[2], Christy Fernandez-Cull[3]; [1]ARL, USA, [2]Univ. of Delaware, USA, [3]Duke Univ., USA.* We apply structured passive elements and computational imaging to millimeter waves to enable a mobile imager. Experimental results are presented.

IMB5 • 12:10 p.m.

Rugged Optics for Multispectral Imaging Systems, *Ishwar Aggarwal*, *Jasbinder Sanghera, Shyam Bayya, Woohong Kim, Andrew Miller, Brandon Shaw, Erin Fleet; NRL, USA.* We have developed a new rugged multiband optic with transmission in SWIR, MWIR and LWIR region from a new polycrystalline ceramic material. The status of these development efforts will be discussed.

12:30 p.m.–2:00 p.m. Lunch Break *(on your own)*

Canyon I

Photonic Metamaterials and Plasmonics

Finger Rock

Optical Remote Sensing of the Environment

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

10:30 a.m.–12:30 p.m.
MMB • Plasmonics I
Mark I. Stockman; Georgia State Univ., USA, Presider

MMB1 • 10:30 a.m. Invited

Surface Enhanced Raman Scattering Using the "Hottest" Hot Spots Only, ***Katrin Kneipp****, Harald Kneipp; Technical Univ. of Denmark, Denmark.* We report SERS of single molecules residing exclusively in the hottest hot spots of silver or gold nanoaggregates or on a fractal surface of those metals and discuss the ultimate spectroscopic potential of such experiments.

MMB2 • 11:10 a.m. Invited

Molecular Plasmonics: Single Molecules and Single Nanoparticles, ***Richard Van Duyne****; Northwestern Univ., USA.* Abstract not available.

MMB3 • 11:50 a.m.

Large-Area Dense Plasmonic Nanoarrays for Surface Enhanced Raman Applications, ***Vladimir Liberman***[1]*, Cihan Yilmaz*[2]*, Theodore M. Bloomstein*[1]*, Mordechai Rothschild*[1]*, Sivasubramanian Somu*[2]*, Yolanda Echegoyen*[2]*, Ahmed Busnaina*[2]*;* [1]*MIT Lincoln Lab, USA,* [2]*NSF Nanoscale Science and Engineering Ctr. for High-Rate Nanomanufacturing, USA.* Two new techniques for forming dense plasmonic nanoarrays utilizing 157-nm interference lithography on a 90-nm pitch grid include 1) convective assembly of Au nanoparticles into pre-patterned PMMA templates and 2) direct patterning of Ag nanocones.

MMB4 • 12:10 p.m.

Experimental Demonstration of a Plasmonic Sensor Based on Perfect Absorption, ***Na Liu***[1,2]*, Martin Mesch*[2]*, Thomas Weiss*[2]*, Harald Giessen*[2]*;* [1] *Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA,* [2]*Univ. of Stuttgart, Germany.* We demonstrate a near-infrared narrow-band plasmonic perfect absorber. Our sensor is wide angle, nearly polarization independent, and allows for the extremely sensitive detection of concentration changes of glucose solution at a fixed frequency.

10:30 a.m.–12:30 p.m.
OMB • New Sensors and Methods II
John Cipar; AFRL, USA, Presider

OMB1 • 10:30 a.m. Invited

Coastal Features and River Plumes as Seen with the Hyperspectral Imager for the Coastal Ocean (HICO), ***Curt O. Davis***[1]*, Robert Arnone*[2]*, Richard Gould*[2]*, Michael R. Corson*[3]*, Marcos Montes*[3]*;* [1]*Oregon State Univ., USA,* [2] *Stennis Space Ctr., NRL, USA,* [3]*NRL, USA.* The Hyperspectral Imager for the Coastal Ocean (HICO) is now operating on the International Space Station. Here we review the processing of HICO data and its application to study coastal features and river plumes.

OMB2 • 11:10 a.m.

Snapshot Spectral Imaging Using Birefringent Interferometry and Image Replication, *Alistair Gorman, Gonzalo Muyo,* ***Andrew R. Harvey****; Heriot-Watt Univ., UK.* A snapshot multi-spectral imaging technique is described which employs cascaded birefringent interferometers to simultaneously project multiple spectral images onto a single detector array. Example images are also shown.

OMB3 • 11:30 a.m.

Flight Model Development of a Compact Imaging Spectrometer for a Microsatellite STSAT3, ***Jun Ho Lee***[1]*, Tae Seong Jang*[2]*, Kyung In Kang*[2]*, Seung-Wu Rhee*[3]*;* [1]*Kongju Natl. Univ., Republic of Korea,* [2]*KAIST, Republic of Korea,* [3]*Korea Aerospace Res. Inst., Republic of Korea.* COMIS is a very compact imaging spectrometer for STSAT3. It weighs only 4.3kg while being capable of hyperspectral imaging at GSDs of 27 m over a 28 km swath at an altitude of 700 km.

OMB4 • 11:50 a.m. Invited

Bringing All Lidar Data Together: Investigations of Spatially Coincident Terrestrial, Airborne, and Satellite Lidar Data for Deriving Vegetation Structure Metrics, ***Sorin Popescu****; Texas A&M Univ., USA.* This study aims to compare forest structure metrics obtained by processing data from spatially coincident discrete-return airborne lidar, ICESat waveforms, and a ground-based laser scanner. Results are significant for scaling up and calibration purposes.

12:30 p.m.–2:00 p.m. Lunch Break *(on your own)*

Sonoran I

Applied Industrial Optics: Spectroscopy, Imaging, and Metrology

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

2:00 p.m.–3:20 p.m.
AMB • Optical Metrology II
Dominick Polizzi; Optics Technology Inc., USA, Presider

AMB1 • 2:00 p.m.
Optical Diffraction Based Single Image Method to Obtain Nanometer Resolution Deflection Profiles in Micro-Cantilever Based Sensors, *Arindam Phani*; *Indian Inst. of Science, India.* A single image Optical Diffraction based profiling method is proposed employing a double micro-cantilever(MC) structure achieving deflection resolutions of 1nm and surface stress changes of 50μN/m in a typical MC based sensor.

AMB2 • 2:20 p.m.
Flexible and Convertible Depth Exposure in Fluorescence Microscopy, *Koichiro Kishima*; *Sony Corp., Japan.* We proposed and confirmed the effective method to measure three dimensional positions of fluorescent markers by only a couple of exposure with conventional fluorescence microscope. We also demonstrated this method for measuring chromatic aberration.

AMB3 • 2:40 p.m. Invited
A Case Study in Measuring Ultra-Low Level Sulfur in Diesel Using WD-XRF, *Larry Arias*, *Alexander Seyfarth; Bruker AXS Inc., USA.* The talk illustrates the progression of X-Ray Fluorescence spectroscopy (XRFS) Wavelength dispersive instrumentation as a function of the measurement of sulfur in diesel based on the ASTM D-2622 method.

Murphey I & II

Digital Image Processing and Analysis

2:00 p.m.–4:00 p.m.
DMC • Image Restoration
Eero Simoncelli; New York Univ., USA, Presider

DMC1 • 2:00 p.m. Invited
Image Priors and Blind Deconvolution, *William Freeman*; *MIT, USA.* "Blind deconvolution" is a beautiful, ill-posed problem: given an image that has been blurred by some unknown convolution kernel, estimate the image before it was it blurred. Lurking within this problem are nice, deep questions: What is an image, and how can you tell when one has been blurred? How should we solve very underdetermined inference problems?

DMC2 • 2:40 p.m.
Object Dependent Manifold Priors for Image Deconvolution, *Jie Ni*, *Pavan Turaga, Vishal M.Patel, Rama Chellappa; Dept. of Electrical and Computer Engineering, Univ. of Maryland, USA.* In this paper we propose a manifold based deconvolution algorithm by estimating a manifold from a set of natural images that exploits the availability of the sample class data for regularizing the deblurring problem.

DMC3 • 3:00 p.m.
Wide Angle Ir Detection through a Conical Mirror: Some Preliminary Results, *Thomas B. Slack, Robert K. Reynolds,* ***Khan Iftekharuddin***; *Univ. of Memphis, USA.* 360° planar viewing is achieved by placing a polished aluminum cone in front of a long-wave IR camera. Objects are extracted from the circular reflected image for means of detection and classification.

DMC4 • 3:20 p.m.
Iterative Exposure Bracketing, *Keigo Hirakawa*; *Univ. of Dayton, USA.* High dynamic range (HDR) imaging requires bracketing—low dynamic range images with varying exposures—and postprocessing to blend appropriately exposed portions together. We analyze HDR recoverability of bracketing, which is not well understood despite popularity of HDR.

DMC5 • 3:40 p.m.
Discrete Filters and Transforms to Localize Signal Transitions, *Ramakrishnan Sundaram*; *Gannon Univ., USA.* Band-pass filters and block-based transforms are developed to retrieve signal discontinuities in sampled data. The filter coefficients are determined from the space or frequency-sampled Laplacian-of-Gaussian filter. The procedure is applied to detect edges in images.

Sonoran II

Imaging Systems

2:00 p.m.–4:00 p.m.
IMC • Imaging Optics I
Gisele Bennett; Georgia Tech, USA, Presider

IMC1 • 2:00 p.m. Invited
An Aberration-Free Lens with Zero F-Number, *David Schurig*; *North Carolina State Univ., USA.* Starting from the Luneberg lens index profile, we apply the transformation design method to the problem of far-field imaging of (infinitely) distant objects.

IMC2 • 2:40 p.m. Invited
Extreme Form Factor Imagers, *Joseph E. Ford*, *Eric Tremblay; Univ. of California at San Diego, USA.* Optical design for imagers is always a problem in constrained optimization, where the application provides both optical performance as well as the typically conflicting constraints on the system cost and/or physical footprint. Here we review work on several imaging systems where the physical shape of the imager has been a dominant factor in the optical system design, including a narrow imager and light source in a laryngoscope for neonatal infants as well as a number of extremely thin imagers based on the concentric folded lens geometry.

IMC3 • 3:20 p.m.
Lens Aberration Correction Using Locally Optimal Mask Based Low Cost Light Field Cameras, *Rohit Pandharkar*, *Ahmed Kirmani, Ramesh Raskar; MIT, USA.* We present a method to convert the ill-posed deblurring problem into a well-posed one allowing efficient deblurring of the lens aberration blur. We achieve this by building a locally optimal mask low cost lightfield camera.

IMC4 • 3:40 p.m.
Increased Field of View through Optical Multiplexing, *Vicha Treeaporn*, *Amit Ashok, Mark A. Neifeld; Univ. of Arizona, USA.* A compact thin-film shuttered multi-beamsplitter superposition imaging solution to reduce some of the system size and weight costs typically associated with conventional wide field of view imaging techniques is described and demonstrated.

4:00 p.m.–4:30 p.m. Coffee Break/Exhibits Open, *Pavilion*

Canyon I

Photonic Metamaterials and Plasmonics

Finger Rock

Optical Remote Sensing of the Environment

Canyon III

Optics for Solar Energy

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

2:00 p.m.–4:00 p.m.
MMC • Toward Applications I
Katrin Kneipp; Technical Univ. of Denmark, Denmark, Presider

MMC1 • 2:00 p.m.
An Integrated Electrically Driven Coherent Source of Surface Plasmon Polaritons, *Chulsoo Kim,* ***Igor Vurgaftman****, Richard A. Flynn, J. R. Lindle, William W. Bewley, Konrad Bussmann, Jerry R. Meyer, James P. Long; NRL, USA.* We demonstrate a versatile electrically-driven source of coherent SPPs by end-coupling a quantum-well laser to an integrated plasmonic waveguide with coupling efficiency of ≈36%. The SPP peak power generated at room temperature is 36 mW.

MMC2 • 2:20 p.m.
Electromodulation of Photonic Metamaterials, *Lihua Shao[1], Matthias Ruther[1], Stefan Linden[1], Joerg Weissmueller[1],* ***Martin Wegener****[2]; [1]Inst. of Nanotechnology, Karlsruhe Inst. of Technology, Germany, [2]Inst. of Applied Physics, Karlsruhe Inst. of Technology, Germany.* By applying voltages of about 1V to very thin metal nanostructures via an aqueous electrolyte, we demonstrate reversible modulation of split-ring-resonator resonances by as much as 60 THz at around 300 THz resonance frequency.

MMC3 • 2:40 p.m.
Paper Withdrawn

MMC4 • 3:00 p.m.
A Novel Approach of Antireflection Coating Using Planar Metamaterials, ***Hou-Tong Chen****, Jiangfeng Zhou, John F. O'Hara, Frank F. Chen, Abul K. Azad, Antoinette J. Taylor; Los Alamos Natl. Lab, USA.* We experimentally demonstrate a novel antireflection coating using planar metamaterials. It dramatically reduces the reflectance and enhances the transmittance over a wide range of incidence angles for both polarizations near the designed wavelengths.

MMC5 • 3:20 p.m. Invited
Fast and Low Power Optical Modulation in Metamaterials ***Nicholas Fang****; Univ. of Illinois at Urbana-Champaign, USA.* In this talk, I will discuss the progress of optical modulation in fishnet metamaterials at telecommunication wavelength. To optimize the modulation depth, we conducted analysis using an effective LC circuit model.

2:00 p.m.–4:00 p.m.
OMC • Developments in LiDAR
Chris Parrish; NOAA/NOS, Natl. Geodetic Survey, USA, Presider

OMC1 • 2:00 p.m.
Using Lidar Surface Returns to Reduce Uncertainty in Aerosol Retrievals from Elastic Scatter Lidar, ***John Reagan****, Christopher McPherson; Univ. of Arizona, USA.* This paper addresses methods for improving atmospheric aerosol retrievals from elastic scatter lidar by taking into account surface returns from land and water as a constraint on the retrieval.

OMC2 • 2:20 p.m.
Mapping Land Use Patterns in an Urbanizing Landscape Using LiDAR Intensity Data, ***Kunwar K. Singh****, John B. Vogler, Qingmin Meng, Ross K. Meentemeyer; Univ. of North Carolina at Charlotte, USA.* This paper demonstrates that LiDAR intensity can be a feasible alternative for accurate mapping and assessment of land use patterns in an urbanized landscape at high accuracy by integrating intensity with other derivatives of LiDAR.

OMC3 • 2:40 p.m.
Mid-Infrared Laser Source For Long-Range Range-Resolved Remote Monitoring of CO_2, ***Trenton J. Berg****, Peter A. Roos; Bridger Photonics, Inc., USA.* We report a sub-10-ns, > 1 mJ mid-infrared laser at 2.0 µm for remote sensing and range resolved concentration mappings of carbon dioxide. The source will enable meter-level CO_2 measurements from 100-meter distances.

OMC4 • 3:00 p.m. Invited
Simulating an Airborne Lidar Bathymetry (ALB) System, ***Shachak Pe'eri****, Amaresh M. V. Kumar, Brian R. Calder; Univ. of New Hampshire, USA.* This study's focus is on the horizontal and vertical uncertainties associated with ALB measurements due to scattering through the water column. A lidar simulator was constructed and we present its design and preliminary results.

OMC5 • 3:40 p.m.
New Approaches for Evaluating Lidar-Derived Shoreline, ***Christopher E. Parrish****[1], Stephen A. White[1], Brian R. Calder[2], Shachak Pe'eri[2], Yuri Rzhanov[2]; [1]NOAA/NOS, Natl. Geodetic Survey, USA, [2]Ctr. for Coastal and Ocean Mapping, Univ. of New Hampshire, USA.* This study presents and compares two new methods of assessing the uncertainty of lidar-derived National Shoreline mapped by NOAA's National Geodetic Survey: an empirical (ground-based) approach and a stochastic (Monte Carlo) approach.

2:00 p.m.–4:00 p.m.
SMA • Keynote Session
Alan Kost; Univ. of Arizona, USA, Presider

SMA1 • 2:00 p.m. Invited
Introducing the Department of Energy's Advanced Research Projects Agency – Energy (ARPA-E): Finding Solar Energy Technology Gamechangers in a Crowded Field, ***David Danielson****; Advanced Res. Projects Agency - Energy (ARPA-E), USA.* In this talk, ARPA-E's Founding Program Director Dr. David Danielson will provide an introduction to ARPA-E's approach to investing in transformational energy R&D projects and will discuss potential game-changing opportunities in solar energy technology.

SMA2 • 3:00 p.m. Invited
Maximizing the Efficiency Cost Ratio in a CPV System via a Tolerant Optical Design, ***Juan C. Miñano****[1,2], Pablo Benítez[1,2], Pablo Zamora[2], Rubén Mohedano[1], Aleksandra Cvetkovic[1], Marina Buljan[2], Julio Chaves[1], Roberto Alvarez[1]; [1]LPI, USA, [2]Univ. Politécnica de Madrid, Spain.* An advanced CPV-concentrator with a Fresnel primary and a refractive secondary produces both high concentration with high tolerance and excellent light homogenization. It compares well with conventional Fresnel-based CPV from both optical and cost standpoints.

4:00 p.m.–4:30 p.m. Coffee Break/Exhibits Open, *Pavilion*

Sonoran I

Applied Industrial Optics: Spectroscopy, Imaging, and Metrology

Murphey I & II

Digital Image Processing and Analysis

Sonoran II

Imaging Systems

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

4:30 p.m.–6:30 p.m.
AMC • Selected Topics: Optical Applications in Industry

Sean M. Christian; Optrology, Inc., USA, Presider

AMC1 • 4:30 p.m. Invited
LIBS in Industry: Sparks Fly, *Steven G. Buckley*[1], *Gregg A. Lithgow[1], Christopher B. Stipe[2]; [1]Photon Machines, Inc., USA, [2]Seattle Univ., USA.* Laser-induced breakdown spectroscopy (LIBS) is emerging as a potent industrial spectroscopy. Uniquely capable for light-element detection, useful for material identiifcation, depth profiling, and elemental surface mapping, LIBS can solve numerous industrial problems in real-time.

AMC2 • 5:10 p.m.
Design and Development of Micro Inspection Device for Product Packages, *James Joseph*, *Vinay Ravi, Lye Sun Woh, Murukeshan Vadakke Matham; Nanyang Technological Univ., Singapore.* Defect detection in product packages is essential for safe storage and transportation of manufactured products. A micro imaging device used to perform product package inspection and the methods to accomplish the defect detection is presented.

AMC3 • 5:30 p.m.
Rapid Screening for Quality Control and Adulteration in Anti-Diabetic Drugs: Quantitative and Qualitative Analysis by LIBS, *Ulises Contreras*[1], *Nancy Ornelas-Soto[1], Marco A. Meneses-Nava[1], Oracio Barbosa-García[1], Pedro L. López-de-Alba[2], Leticia López-Martínez[2]; [1]Ctr. de Investigaciones en Óptica, A.P., Mexico, [2]Inst. de Investigaciones Científicas, Univ. de Guanajuato, Mexico.* This work describes an anti-diabetic medicament analysis by using LIBS. The emissions from elements present only in the active pharmaceutical ingredient and the Intensity ratios between them and the sample´s background allow a quality inspection.

AMC4 • 5:50 p.m. Invited
Deploying LIBS in Industry: Four Examples of Applied LIBS Technologies, *Arel Weisberg*[1], *Joseph Craparo[1], Robert De Saro[1], Carlos Romero[2], Romauld Pawluczyk[3], Andrew I. Whitehouse[4]; [1]Energy Res. Co., USA, [2]Energy Res. Ctr., Lehigh Univ., USA, [3]P&P Optica, Canada, [4]Applied Photonics, Ltd., UK.* Energy Research Company and its partners have developed LIBS for aluminum manufacturing, coal-fired power production, and other industrial applications. In this paper we review essential design aspects of the equipment and their resulting performance advantages.

4:30 p.m.–6:50 p.m.
DMD • Digital Image Processing and Optics

William Pratt; Univ. of Southern California, USA, Presider

DMD1 • 4:30 p.m.
Image-Based Measurement of Phase Transfer Function, *Vikrant R. Bhakta*, *Manjunath Somayaji, Marc P. Christensen; Southern Mehtodist Univ., USA.* A method for measuring the Phase Transfer Function (PTF) from a high-contrast edge image is proposed and the advantages of utilizing the knowledge of PTF in computational, sparse aperture and multiplexed imaging are discussed.

DMD2 • 4:50 p.m.
Synthetic Dual Wavelength Optical Phase Unwrapping Using Digital Image Processing, *Alejandro Restrepo-Martinez*[1], *Román Castañeda[2]; [1]Inst. Tecnológico Metropolitano, Colombia, [2]Univ. Nacional de Colombia Sede Medellin, Colombia.* A Synthetic dual wavelength optical phase unwrapping (S-DWOPU) was developed. It had an optical and a synthetic phase map; last one, made by digital image processing. Then the dual wavelength optical phase unwrapping was done.

DMD3 • 5:10 p.m.
Adaptive Optics Photometry of Faint Companions with a Wavelet-Based Maximum Likelihood Estimator, *Roberto Baena Gallé*[1], *Szymon Gladysz[2]; [1]Univ. of Barcelona, Spain, [2]European Southern Observatory, Germany.* We use the Bayesian framework and the wavelet transform to estimate differential photometry in binary systems imaged with adaptive optics. We compare our results to estimates obtained by using PSF-fitting and multi-frame blind deconvolution.

DMD4 • 5:30 p.m.
A Probabilistic Model for Stratospheric Soil-Independent Dust Aerosol Detection, *Pablo Rivas-Perea*, *Jose G. Rosiles; Univ. of Texas at El Paso, USA.* We present a simple probabilistic model for dust aerosol detection, analysing MODIS 11.3µm and 12.02µm thermal emissive bands. We introduce a dust aerosol probabilistic visualization, and a feasible extension to classification.

DMD5 • 5:50 p.m.
Neural Network for the Digital Cleaning of an Oil Painting, *Cherry May Palomero, **Maricor Soriano**; Natl. Inst. of Physics, Philippines.* We demonstrate that a neural network can be trained to learn the transformation from dirty to clean segments of a painting and used it to digitally clean an image of Amorsolo's "Malacañang by the River".

DMD6 • 6:10 p.m.
Multispectral Images Segmentation of Ancient Documents with Lattice Memories, *Juan C. Valdiviezo-Navarro*, *Gonzalo Urcid-S.; Inst. Nacional de Astrofísica, Óptica y Electrónica, Mexico.* This manuscript introduces a method for the autonomous segmentation of ancient documents multispectral images. The procedure uses lattice associative memories to determine the purest spectra in the scene. We present results from the Archimedes Palimpsest.

DMD7 • 6:30 p.m.
Characterization of Optical Images Using the Method of Phase Space Map, *Manu Vaishakh*[1], *V. P. N. Nampoori[2]; [1]Nanyang Technological Univ., Singapore, [2]Cochin Univ. of Science and Technology, India.* We characterize optical images using reconstructed phase space which is employed in nonlinear dynamics using time series approach. Geometry of phase space is reconstructed with spatial variable taking the status of time variable.

4:30 p.m.–6:30 p.m.
IMD • Imaging Optics II

Peter Catrysse; Stanford Univ., USA, Presider

IMD1 • 4:30 p.m. Invited
The Issues of Artefacts and Noise in Hybrid Imaging Systems, *Andrew Harvey*[1], *Mads Demenikov[1], Gonzalo D. Muyo[1], Tom Vettenburg[1], Nick Bustin[2], Ian Hasler[2], Andy Wood[2]; [1]Heriot-Watt Univ., UK, [2]Qioptiq Ltd., UK.* Previous research in hybrid imaging tends to have emphasized constancy of the modulation transfer function and ignored the significant variations in the phase-transfer function.

IMD2 • 5:10 p.m. Invited
Coherent Lensless Imaging, *James R. Fienup*; *Inst. of Optics, Univ. of Rochester, USA.* Coherent imaging has numerous advantages over incoherent imaging, but at a cost of requiring coherent laser illumination.

IMD3 • 5:50 p.m.
Creating Aperture Masks in Phase Space, *Roarke W. Horstmeyer*[1], *Se Baek Oh[2]; [1]MIT Media Lab, USA, [2]Dept. of Mechanical Engineering, MIT, USA.* The Wigner distribution is used to model the PSF of an aperture mask at different defocus planes. Algorithmic methods of determining an optimal mask pattern for a desired set of impulse responses are investigated.

IMD4 • 6:10 p.m.
Optimization of Hybrid Imaging Systems Including Digital Deconvolution in the Presence of Noise, *Frédéric Diaz*[1,2], *François Goudail[2], Brigitte Loiseaux[1], Jean-Pierre Huignard[1]; [1]Thales Res. and Technology, France, [2]Lab Charles Fabry de l'Institut d'Optique, CNRS, Univ. Paris-Sud, France.* We address the depth of focus enhancement in hybrid imaging systems, including a phase mask and a deconvolution filter. A final image quality criterion is introduced to optimize and compare different masks.

7:00 p.m.–8:30 p.m. Welcome Reception, *Arizona Deck and Foyer*

Photonic Metamaterials and Plasmonics

Optical Remote Sensing of the Environment

Optics for Solar Energy

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

Canyon I — Photonic Metamaterials and Plasmonics

4:30 p.m.–6:30 p.m.
MMD • Plasmonics II
Nikolay Zheludev; Univ. of Southampton, UK, Presider

MMD1 • 4:30 p.m.
Measurement of the Coupling Efficiency for Surface Plasmon Modes Generated by Nanogrooves, *Qiaoqiang Gan*[1], *Yongkang Gao*[1], *Lin Zhu*[2], *Filbert Bartoli*[1]; [1]*Lehigh Univ., USA*, [2]*Clemson Univ., USA*. We present a simple far-field experiment to validate the theoretical predicted functional dependence of the SPP coupling efficiency on groove width, in good agreement with the SPP picture proposed by Lalanne's group.

MMD2 • 4:50 p.m.
Theoretical Investigation of Fabrication-Related Disorders on the Properties of Subwavelength Metal-Dielectric-Metal Plasmonic Waveguides, *Changjun Min*, ***Georgios Veronis***; *Louisiana State Univ., USA*. We rigorously investigate the effect of fabrication-related disorders in subwavelength metal-dielectric-metal plasmonic waveguides. We use a Monte Carlo method to calculate the roughness-induced enhancement of the attenuation coefficient with respect to a smooth waveguide.

MMD3 • 5:10 p.m. Invited
Plasmonic Resonators Based on Two-Wire Transmission Lines, *Bert Hecht*; *Univ. Würzburg, Germany*. Dark-mode resonators based on single-crystalline gold will be discussed that exhibit very small modal volumes and comparatively large Q-factors. Individual structures are analyzed by electron microscopy as well as 1- and 2-photon photoluminescence spectroscopy.

MMD4 • 5:50 p.m.
Optical Design with Inhomogenous Resonant Guided Wave Networks, *Eyal Feigenbaum*, *Harry A. Atwater; Caltech, USA*. Resonant guided wave networks enable the design of enhanced Q-factor resonators; optical materials with network architecture-dependent wave dispersion; and a two color router.

MMD5 • 6:10 p.m.
Theory of Spoof Plasmons in Real Metals, *Anastasia Rusina*, *Maxim Durach, Mark I. Stockman; Georgia State Univ., USA*. We develop a theory of spoof plasmons propagating on real metals perforated with planar periodic grooves. The optimum geometrical parameters for the propagation and THz energy concentration are found.

Finger Rock — Optical Remote Sensing of the Environment

4:30 p.m.–5:50 p.m.
OMD • Littoral Applications of Remote Sensing
Charles M. Bachmann; NRL, USA, Presider

OMD1 • 4:30 p.m.
Atmospheric Correction of Hyperspectral Imagery in the Littoral Environment, *Marcos J. Montes*; *NRL, USA*. Atmospheric correction of remote sensing imagery of littoral areas is challenging for numerous reasons. This presentation will include a review of these challenges, as well as a review of several proposed solutions.

OMD2 • 4:50 p.m.
Coastal Characterization from Hyperspectral Imagery, *Charles M. Bachmann*[1], *C. Reid Nichols*[2], *Marcos J. Montes*[1], *Robert A. Fusina*[1], *John C. Fry*[2], *Rong-Rong Li*[1], *Deric Gray*[1], *Daniel Korwan*[1], *Christopher Parrish*[3], *Jon Sellars*[3], *Stephen A. White*[3], *Jason Woolard*[3], *Krista Lee*[4], *Cecilia McConnon*[4], *Jon Wende*[4]; [1]*NRL, USA*, [2]*Marine Information Resource Corp., USA*, [3]*NOAA/NOS, USA*, [4]*Naval Postgraduate School, USA*. Coastal mapping products and models from hyperspectral remote sensing experiments in different coastal types are compared: barrier island coast (Virginia, 2007), coral coast (Hawaii 2009), mangrove coast (Australia, 2009), and coral limestone and volcanic coasts (Guam and CNMI, 2010).

OMD3 • 5:10 p.m.
Hyperspectral Remote Sensing for Mapping Littoral Water Depth, *Enjie Jing*, *Roy Hughes; Defence Science and Technology Organisation, Australia*. Bathymetry of littoral waters was retrieved from airborne hyperspectral sensor data. The result demonstrated that water depths up to 20 m can be extracted reasonably well compared with those from the conventional hydrographical survey means.

OMD4 • 5:30 p.m.
Comparison of Efficiency of Algorithms for Polarization Computation in Turbid Media, *Sergey V. Korkin*[1], *Vladimir P. Budak*[2], *Alexei I. Lyapustin*[1]; [1]*Goddard Earth Sciences and Technology, Univ. of Maryland, USA*, [2]*Moscow Power Engineering Inst., Russian Federation*. Fast yet accurate algorithm for polarization computation in a highly anisotropic scattering media is offered. The comparison with the traditional approach is produced.

Canyon III — Optics for Solar Energy

4:30 p.m.–6:30 p.m.
SMB • Concentrator PV Systems
Raymond Kostuk; Univ. of Arizona, USA, Presider

SMB1 • 4:30 p.m. Invited
Flatcon® Concentrator Photovoltaic Modules—Design Principles and Field Experience, *Andreas Gombert*; *Concentrix Solar GmbH, Germany*. The FLATCON® concentrator photovoltaic (CPV) technology is presented. The first system in the US was installed in 2009 and shows an AC power efficiency of 25% and an AC energy efficiency of 22%.

SMB2 • 5:10 p.m.
Non-Imagine Solar Stationary Concentrators with Using Combination of Prisms and Reflective Surfaces, *Sergey N. Kivalov*, *Richard Perez; ASRC, Univ. of Albany, USA*. The paper presents two designs of combined prismatic-parabola-cylindrical stationary concentrators. They reach 8.4X and 10.4X concentration levels for nonsymmetrical and symmetrical concentrators correspondingly and can be used with solar cells for electricity and heat generation.

SMB3 • 5:30 p.m.
Photovoltaic and Solar Thermal Improvement Factors in Fiber Optic Filtered Hybrid Systems, *Scott Shepard*; *College of Engineering and Computer Science, Univ. of Central Florida, USA*. We define photovoltaic and hybrid system improvement factors which can characterize the utility of optical filters for solar energy applications. Comparison of two types of optical fiber filtered concentrators is then facilitated by this metric.

SMB4 • 5:50 p.m. Invited
A 5KW CPV Collector Design Using an Inflated Plastic Film Primary Mirror, *Leo Baldwin*; *Cool Earth Solar, USA*. The design objectives and methodologies for a monolithic multichannel secondary optic to compliment the inflated plastic primary collector in a utility-scale concentrated photovoltaic system is presented.

7:00 p.m.–8:30 p.m. Welcome Reception, *Arizona Deck and Foyer*

Sonoran I

Applied Industrial Optics: Spectroscopy, Imaging, and Metrology

Murphey I & II

Digital Image Processing and Analysis

Sonoran II

Imaging Systems

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

8:00 a.m.–10:00 a.m.
ATuA • Spectroscopy, Color, & Imaging I
Sean M. Christian; Optrology, Inc., USA, Presider

ATuA1 • 8:00 a.m. Invited
Long-Term Metrological Qualification of Optical Feedback Cavity Enhanced Absorption Spectroscopy (OFCEAS); Measurement of Dihydrogen Sulfur in Natural Gas, ***Lucien Lonigro****; ap2e, France.* Abstract not available.

ATuA2 • 8:40 a.m.
Point of Dispense Drug Verification Using Coded Aperture Raman Spectroscopy and Image Analysis, ***David J. Brady****, Prasant Potuluri, Brett Guenther, Evan Cull, Yuting Qi, Ken Chapman; Centice Corp., USA.* Coded aperture Raman spectroscopy enables standoff through container classification of wide classes of dispensed pharmaceuticals. Sensitivity relative to conventional Raman systems is increased by nearly an order of magnitude, enabling efficient integration in pharmacy workflow.

ATuA3 • 9:00 a.m.
Online NIR Multispectral Imaging Using Non-Contact Interactance for Fish and Meat Quality Measurements, ***Marion O'Farrell***[1]*, Jon Tschudi*[1]*, Helene Schulerud*[1]*, Jens Petter Wold*[2]*, Silje Ottestad*[2]*;* [1]*Sintef ICT, Norway,* [2]*Nofima Mat AS, Norway.* A NIR multispectral imaging system in the region 760-1040nm, that achieves non-contact interactance, is presented. The absorption of the light is increased and measurement of inhomogeneous or intact food products is possible.

ATuA4 • 9:20 a.m.
Dichroic Filter Array Multispectral Imaging Systems, ***Jason M. Eichenholz****; Ocean Optics Inc., USA.* The lithographically patterned dichroic filter arrays (DFAs) is a new approach to multispectral imaging. The DFA technique offers simultaneous spectral and spatial imaging at a significant cost, size, and complexity advantage over conventional hyperspectral imagers.

ATuA5 • 9:40 a.m.
AOTF Reflectance Spectroscopy: A Diagnostic of Organically Modified Surfaces, ***Rula M. Tawalbeh****, David Voelz, David Glenar, Xifeng Xiao, Nancy Chanover; New Mexico State Univ., USA.* A compact AOTF-based point spectrometer that operates at room temperature is described for measuring reflectance spectra over the 1.7 to 3.4 µm range. It provides "quick look" in situ detection of organically modified surfaces.

8:00 a.m.–9:40 a.m.
DTuA • Medical Image Processing I
Alan C. Bovik; Univ. of Texas at Austin, USA, Presider

DTuA1 • 8:00 a.m. Plenary
What Can Digital Processing Do for 3-D Super-Resolution Microscopy? ***Rafael Piestun****; Univ. of Colorado at Boulder, USA.* Novel three-dimensional fluorescence microscopy techniques enable diffraction unlimited imaging. Resolution is limited by the photon count and the underlying noise. I discuss the role digital design and post-processing plays in attaining the new fundamental limits.

DTuA2 • 9:00 a.m.
3-D Reconstruction of Fluorescence Microscopy Image Intensities Using Multiple Depth-Variant Point-Spread Functions, *Vimeetha Myneni,* ***Chrysanthe Preza****; Univ. of Memphis, USA.* We show that the use of multiple depth-variant point-spread functions in 3-D fluorescence intensity reconstruction provides improved optical sectioning over deconvolution methods by correcting depth-induced aberrations in 3-D cell images.

DTuA3 • 9:20 a.m.
Performance Tradeoffs in a Model Breast Tomosynthesis System, ***Stefano Young***[1]*, Predrag Bakic*[2]*, Kyle J. Myers*[3]*, Subok Park*[3]*;* [1]*Univ. of Arizona, USA,* [2]*Univ. of Pennsylvania, USA,* [3]*FDA Ctr. for Devices and Radiological Health, USA.* Digital breast tomosynthesis (DBT) researchers need accurate, inexpensive, task-based assessment tools for optimizing multivariate DBT systems. With improved object statistics and better multiprojection observer models, our computational framework approaches detailed multi-parameter mapping of performance tradeoffs.

8:00 a.m.–10:00 a.m.
ITuA • Imaging Sensors I
Boyd Fowler; Fairchild Imaging, USA, Presider

ITuA1 • 8:00 a.m. Invited
Near-Field Imaging of Infrared Antennas, ***Peter M. Krenz***[1]*, Glenn D. Boreman*[1]*, Brian A. Lail*[2]*, Robert Olmon*[3]*, Markus Raschke*[3]*;* [1]*Univ. of Central Florida, USA,* [2]*Florida Inst. of Technology, USA,* [3]*Univ. of Washington, USA.* The electric near-field distribution on a dipole-coupled co-planar strip line is measured at 28.3 THz. The attenuation and propagation constants are determined by fitting the standing wave equation to the measured data.

ITuA2 • 8:40 a.m. Invited
Towards Photon Counting X-Ray Image Sensors, ***Bart Dierickx***[1,2]*, Benoit Dupont*[1]*, A. Defernez*[1]*, P. Henckes*[1]*;* [1]*Caeleste CVBA, Belgium,* [2]*Vrije Univ. Brussels, Belgium.* Photon counting prevails over charge integration, for medical X-ray imaging. Yet realization is hindered by technical and economical factors. The question is: what does it take to make a photon counting X-ray sensor?

ITuA3 • 9:20 a.m. Invited
Nanophotonics for Solid-State Imaging, ***Peter B. Catrysse****, Lieven Verslegers, Christian C. Fesenmaier, Yijie Huo; Stanford Univ., USA.* I explore the challenges and opportunities for nanophotonics that have emerged in solid-state image sensors as pixel size is scaling down to the single wavelength range following scaling of feature sizes in advanced semiconductor processes.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits Open, *Pavilion*

Canyon I	Finger Rock	Canyon III
Photonic Metamaterials and Plasmonics	Optical Remote Sensing of the Environment	Optics for Solar Energy

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

8:00 a.m.–10:00 a.m.
MTuA • Metamaterials II
Harald Giessen; 4th Physics Inst., Univ. of Stuttgart, Germany, Presider

MTuA1 • 8:00 a.m. Invited
Coupling in Metamaterials: Friend or Foe? ***Ekaterina Shamonina****; Univ. of Erlangen-Nuremberg, Germany.* Abstract not available.

MTuA2 • 8:40 a.m.
Photonic Band Structure of Dispersive Metamaterials Formulated as a Hermitian Eigenvalue Problem, ***Aaswath Raman****, Shanhui Fan; Stanford Univ., USA.* We formulate the photonic band structure calculation of any lossless dispersive metamaterial as a Hermitian eigenvalue problem. We further show that the orthonormal basis formed by the lossless eigenmodes rigorously models lossy dispersive systems.

MTuA3 • 9:00 a.m.
Hyperbolic Metamaterial Route to Engineer the Photonic Density of States, ***Zubin Jacob****, Ji-Young Kim, Gururak V. Naik, Evgenii Nnarimanov, Alexandra E. Boltasseva, Vladimir M. Shalaev; Purdue Univ., USA.* We demonstrate the decrease in the spontaneous emission lifetime of dye molecules due to the enhanced photonic density of states (PDOS) of a hyperbolic metamaterial (HMM), opening the route to PDOS engineered HMM devices.

MTuA4 • 9:20 a.m. Invited
Silver-Filled Alumina Membrane: Metamaterial with Hyperbolic Dispersion and Near-Zero Singularity, ***M. A. Noginov***[1]*, Yu. A. Barnakov*[1]*, H. Li*[1]*, G. Zhu*[1]*, T. U. Tumkur*[1]*, M. Mayy*[1]*, Z. Jacob*[2]*, L. Alekseyev*[2]*, E. E. Narimanov*[2]*;* [1]*Norfolk State Univ., USA,* [2]*Purdue Univ., USA.* We have developed a class of metamaterials- alumina membranes filled with silver nanowires - which have unique physical properties and are potentially suitable for a variety of applications ranging from transformation optics to quantum optics.

8:00 a.m.–10:00 a.m.
OTuA • Remote Sensing of Vegetation
John Cipar; AFRL, USA, Presider

OTuA1 • 8:00 a.m. Invited
Multi-Source Geospatial Information Integration and Analysis for Coastal Management and Decision Making, ***Rongxing Li****; Ohio State Univ., USA.* This paper reviews coastal-related research being undertaken at the Mapping and GIS Laboratory, the Ohio State University, on the multi-source geospatial information integration and analysis for coastal management and decision making.

OTuA2 • 8:40 a.m. Invited
Assessing the Extent of Conservation Tillage Using Hyperspectral Imaging, ***Craig Daughtry***[1]*, Guy Serbin*[2]*, P. C. Doraiswamy*[1]*, J. B. Reeves III*[1]*, E. R. Hunt, Jr.*[1]*;* [1]*US Dept. of Agriculture, USA,* [2]*ASRC Management Service, USA.* Physically-based spectral indices that detect absorption features associated with cellulose and lignin are linearly related to crop residue cover, a key indicator of soil tillage intensity, and are robust across diverse agricultural landscapes.

OTuA3 • 9:20 a.m. Invited
Mapping Coastal Wetlands Using Small-Footprint, Green-Wavelength Lidar, ***Amar Nayegandhi****; Jacobs Technology Inc., US Geological Florida Integrated Science Ctr., USA.* Full-waveform digitizing of the return pulse using a short-pulse, green-wavelength airborne lidar system provides unprecedented capabilities to map nearshore wetland environments.

8:00 a.m.–10:00 a.m.
STuA • Solar Concentrator Characterization
Joseph E. Ford; Univ. of California at San Diego, USA, Presider

STuA1 • 8:00 a.m. Invited
Direct and Inverse Methods of Characterization of Solar Concentrators, ***Antonio Parretta***[1,2]*, Giuliano Martinelli*[1]*, Andrea Antonini*[3]*, Donato Vincenzi*[1]*, C. Privato*[4]*;* [1]*Univ. of Ferrara, Italy,* [2]*ENEA Ctr. Ricerche "E. Clementel", Italy,* [3]*CPower SRL, Italy,* [4]*ENEA Ctr. Ricerche Portici, Italy.*. We discuss two classes of methods for characterizing solar concentrators (mainly nonimaging): "direct" and "inverse", in relation to the way these are irradiated. We derive the optical collection efficiency under collimated and diffused light.

STuA2 • 8:40 a.m.
SCOTS: A Fast, Inexpensive Test of Solar Concentrators, ***Robert Parks****; College of Optical Sciences, Univ. of Arizona, USA.* The Software Configurable Optical Test System (SCOTS) is a simple, inexpensive yet highly flexible optical test configurable for almost any specular surface. It consists of a computer generated, patterned display and a digital imaging detector.

STuA3 • 9:00 a.m.
Measurement of Sun-Tracking Accuracy and Solar Irradiance through Multispectral Imaging, ***Donato Vincenzi***[1]*, Stefano Baricordi*[1]*, Massimiliano Occhiali*[1]*, Marco Stefancich*[2]*, Antonio Parretta*[3]*, Giuliano Martinelli*[1]*;* [1]*Univ. of Ferrara, Italy,* [2]*CNR-IMEM, Italy,* [3]*ENEA Ctr. Ricerche "E. Clementel", Italy.* We present the design guidelines and the characterization of a multispectral camera tailored to be used as accuracy measurement device for sun trackers. The camera has been calibrated for direct normal irradiance measurements.

STuA4 • 9:20 a.m. Invited
Tools Development for CPV Characterization Based on CCD Camera Measurements, ***Rebeca Herrero Martín****, C. Domínguez, I. Antón, S. Askins, G. Sala; Inst. de Energía Solar, Univ. Politécnica de Madrid, Spain.* Two characterization techniques based on a CCD camera have been developed: an inverse illumination method based on cell light emission and a lens deformation analysis method. Its application to a specific CPV technology is presented.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits Open, *Pavilion*

Sonoran I

Applied Industrial Optics: Spectroscopy, Imaging, and Metrology

Murphey I & II

Digital Image Processing and Analysis

Sonoran II

Imaging Systems

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

10:30 a.m.–12:30 p.m.
ATuB • Spectroscopy, Color, & Imaging II
Bertrand Lanher; Polarmetrics Corp., USA, Presider

ATuB1 • 10:30 a.m. Invited
Use of White LEDs in High Speed Industrial Visible-Light Spectrophotometry Applications, ***James Freal****; Hunter Lab, USA.* This paper describes the advantages and disadvantages of using white (Ce^{3+}:YAG coated) LEDs as light sources in industrial spectrophotometric applications. Various sources are evaluated and a design for a practical spectrophotometer is presented.

ATuB2 • 11:10 a.m.
Sequential Filter Wheel Multispectral Imaging Systems, ***Jason M. Eichenholz****; Ocean Optics Inc., USA.* The sequential rotating filter wheel is a new approach to multispectral imaging, which offers HDTV quality images with on-board data processing and display at a significant cost and size advantage over conventional hyperspectral imagers.

ATuB3 • 11:30 a.m.
Calibration of a Multi-Object Spectrometer with Programmable and Arbitrary Field of View, *Trine Kirkhus, Britta G. Fismen, Jon Tschudi,* ***Marion O'Farrell****; SINTEF ICT, Norway.* Employing digital micro-mirror devices to simultaneously select illumination and detection regions, increases flexibility in spectral measurements. We present a method for collecting regional reference spectra, for optimum accuracy, without compromising the flexibility of the system.

ATuB4 • 11:50 a.m. Invited
A Novel Spectroscopic Technique's Journey of Acceptance in Biopharmaceutical QC Laboratories, ***Arthur Watson****; Convergent Bioscience Ltd., Canada.* This talk describes our company's journey to gain approval and acceptance in QC laboratories of major biopharmaceutical companies for a novel spectroscopic technique- imaged capillary isoelectric focusing.

10:30 a.m.–12:30 p.m.
DTuB • Medical Image Processing II
Khan Iftekharuddin; Univ. of Memphis, USA, Presider

DTuB1 • 10:30 a.m. Plenary
Title to Be Announced, ***Joseph O'Sullivan****; Washington Univ. in St. Louis, USA.* Abstract not available.

DTuB2 • 11:30 a.m.
Comparative Study of Feature Measures for Histopathological Images of the Lung, ***Ravi K. Samala****, Venkata S. Potunuru, Jianying Zhang, Sergio D. Cabrera, Wei Qian; Univ. of Texas at El Paso, USA.* Texture features of histopathological images of lung carcinoma have been evaluated using gray level co-occurrence matrices and multi-wavelets. The investigation is done from a pathological perspective resulting in optimum subset of features for classification.

DTuB3 • 11:50 a.m.
Adc Estimation in Multi-Scan DWMRI, ***Abhinav K. Jha***[1]*, Matthew A. Kupinski*[1]*, Jeffrey J. Rodriguez*[2]*, Renu M. Stephen*[3]*, Alison T. Stopeck*[3]*;* [1]*College of Optical Sciences, Univ. of Arizona, USA,* [2]*Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA,* [3]*Arizona Cancer Ctr., Univ. of Arizona, USA.* A maximum-likelihood-based scheme for estimating the Apparent Diffusion Coefficient (ADC) value in diffusion-weighted MRI is presented, using which data from multiple scans acquired at the same diffusion-gradient value can be used for accurate ADC computation.

DTuB4 • 12:10 p.m.
Attenuation Correction in Fluorescent X-Ray Computed Tomography Using Synchrotron Incident Sheet-Beam, ***Tetsuya Yuasa***[1]*, Shunsuke Nakamura*[1]*, Qingkai Huo*[1]*, Tohoru Takeda*[2]*, Avraham Dilmanian*[3]*;* [1]*Yamagata Univ., Japan,* [2]*Kitasato Univ., Japan,* [3]*Brookhaven Natl. Lab, USA.* We first clarify the measurement process of fluorescent X-ray computed tomography using synchrotron sheet-beam. Then, we propose the analytical reconstruction method, and show its efficacy by computer simulation.

10:30 a.m.–12:30 p.m.
ITuB • Imaging Sensors II
Glenn D. Boreman; Univ. of Central Florida, USA, Presider

ITuB1 • 10:30 a.m. Invited
Curved Focal Plane Arrays: Advantages and Fabrication Using a MEMS Post-Process ***Peter Peumans****; Stanford Univ., USA.* Abstract not available.

ITuB2 • 11:10 a.m. Invited
High Speed CMOS Pixel Physics and Electronics, ***Boyd Fowler****; Fairchild Imaging, USA.* Abstract not available.

ITuB3 • 11:50 a.m. Invited
Resolution Limits in Digital Photography: The Looming End of the Pixel Wars, ***Rick Baer****; Aptina Imaging, USA.* Diffraction and motion blur limit impose limits on pixel size and therefore on digital camera resolution. Photographic utility is actually a better metric for camera comparisons than resolution.

12:30 p.m.–2:00 p.m. Lunch Break *(on your own)*

Canyon I

Photonic Metamaterials and Plasmonics

Finger Rock

Optical Remote Sensing of the Environment

Canyon III

Optics for Solar Energy

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

10:30 a.m.–12:30 p.m.
MTuB • Plasmonics III
Richard Van Duyne; Northwestern Univ., USA, Presider

MTuB1 • 10:30 a.m.
Luminescence Quenching Due to High-Order Surface Plasmon Modes of Metal Nanoparticles, *Jacob Khurgin*[1], *Greg Sun*[2]; [1]*Johns Hopkins Univ., USA,* [2]*Univ. of Massachusetts at Boston, USA.* Our model of high-order SP modes supported by metal nanoparticles provides analytical treatment of luminescence quenching and can be used to optimize nanoparticle size and its separation from the emitter to yield maximum enhancement factor.

MTuB2 • 10:50 a.m.
Coupled-Mode Theory of Plasmonic Field Enhancement in Complex Metal Nanostructures, *Greg Sun*[1], *Jacob Khurgin*[2]; [1]*Univ. of Massachusetts at Boston, USA,* [2]*Johns Hopkins Univ., USA.* Theoretical model capable of analytical estimate of plasmonic field enhancement in complex metal structures is developed. When applied to metal nano-clusters the model predicts same order enhancement in the nano-gaps and near the tips.

MTuB3 • 11:10 a.m. Invited
Plasmonic Nanodevices for Single Molecule and Atto Molar Detection, *Enzo Di Fabrizio*; *Italian Inst. of Technology, Italy.* Different plasmonic based devices are fabricated using novel micro and nano-fabrication techniques for single molecule detection: Self-similar Ag-nanosphere based plasmonic devices, device comprising tapered nanolens and, Si micropillars based superhydrobhobic surface.

MTuB4 • 11:50 a.m.
Second Harmonic Generation from a Single Gold Nanoparticle, *Jérémy Butet, Julien Duboisset,* ***Guillaume Bachelier****, Isabelle Russier-Antoine, Christian Jonin, Emmanuel Benichou, Pierre-François Brevet; Univ. Claude Bernard Lyon1 - CNRS, France.* Second Harmonic Generation from a single gold nanoparticle in a homogeneous matrix is reported for the first time and compared to ensemble measurements in solution and Finite Elements Method simulations.

MTuB5 • 12:10 p.m.
Cathodoluminescence Imaging of Plasmonic Modes of Ag Naostructures, *Anil Kumar*; *Univ. of Illinois at Urbana-Champaign, USA.* We report cathodoluminescence spectroscopy on Ag triangular nanostructures with specially designed substrates having near-vacuum index and low luminescence. FDTD simulations were carried out to predict the role of substrate and the experimentally observed out-of-plane mode.

10:30 a.m.–12:30 p.m.
OTuB • Environmental Applications
Marcos J. Montes; NRL, USA, Presider

OTuB1 • 10:30 a.m.
Evolution of Vegetation First Derivative Spectra over the Summer-to-Autumn Transition, *John Cipar*, *Thomas Cooley; AFRL/RVBYH, USA.* We use derivative analysis to study changes in reflectance during the period of deciduous leaf senescence between summer and autumn. Temporal changes are caused by loss of light-absorbing chlorophyll, allowing scattering to dominate reflectance characteristics.

OTuB2 • 10:50 a.m. Invited
Evaluating Materials of Environmental Concern Using Hyperspectral Imaging, *Gregg Swayze*; *US Geological Survey Spectroscopy Lab, USA.* Imaging spectroscopy has been successfully used to aid researchers in characterizing potential environmental impacts posed by acid-rock drainage, Katrina related oil spills, and asbestos in serpentine mineral deposits and urban dust.

OTuB3 • 11:30 a.m.
Holographic Sensors for Environmental Monitoring, *Izabela G. Naydenova*[1], *Svetlana Mintova*[2], *Suzanne Martin*[1], *Vincent Toal*[1]; [1]*Dublin Inst. of Technology, Ireland,* [2]*Lab Catalyse and Spectrochimie (LCS), ENSICAEN, Univ. de Caen, CNRS, France.* The properties of holographic sensors for environmental monitoring fabricated in zeolite doped photopolymerisable nanocomposites have been studied. The sensors based on volume transmission holograms have been theoretically modelled and their sensitivity have been discussed.

OTuB4 • 11:50 a.m.
Using Hyperspectral Vegetation Indices as a Proxy to Monitor Soil Salinity, *Ting-Ting Zhang*; *Inst. of Biodiversity Science, Fudan Univ., China.* For monitoring soil salinity, the potential of various hyperspectral vegetation indices were investigated. Furthermore, the most sensitive band combinations to salt-stress were identified and developed into a satisfied and specific salinity index for heterogeneous vegetation.

OTuB5 • 12:10 p.m.
The Advanced Analyst Exploitation Environment, *Jake Clements*, *Colin Doody, John Schott, Karl Walli; Rochester Inst. of Technology, USA.* In this paper we discuss model building and data fusion through photogrammetry, advanced forms of exploitation through simple math and stats models, and the advantages of integrating these together in an interactive computer gaming environment.

10:30 a.m.–12:30 p.m.
STuB • Concentrator Design and Holographic Concentrator Systems
R. John Koshel; Univ. of Arizona, USA, Presider

STuB1 • 10:30 a.m. Invited
Paper Withdrawn

STuB2 • 11:10 a.m.
Dual Aperture Holographic Planar Concentrator Photovoltaic Module Energy Harvesting Performance, *Juan M. Russo*, *Jose E. Castillo Aguilella, Glenn Rosenberg; Prism Solar Technologies, Inc., USA.* Dual aperture holographic planar concentrator modules are compared to single aperture modules. Direct-current IV and alternating-current power curves are presented and used to compare modules with similar silicon active area and cell efficiency.

STuB3 • 11:30 a.m.
Planar Holographic Solar Concentrators for Low and Medium Ratio Concentration System, *Jose M. Castro*, *Deming Zhang, Raymond Kostuk; Univ. of Arizona, USA.* We analyze two planar holographic solar concentrator designs for low and medium concentration ratio applications. This type of solar concentrators can provide concentration and spectral filtering in a small form factor concentrator configuration.

STuB4 • 11:50 a.m.
Reduced Temperature of Holographic Planar Concentrators, *Jose E. Castillo*, *Juan M. Russo, Starr Herr-Cardillo, Rakesh Kumar, Glenn Rosenberg; Prism Solar Technologies, Inc., USA.* We present the temperature data for several examples of holographic planar concentrators. The extended holographic regions act as radiative transfer surfaces which reduce the temperature of the cells used with the concentrating film.

STuB5 • 12:10 p.m.
Seasonal and Low Light Performance of a Dual Aperture Holographic Planar Concentrator Photovoltaic Module, *Juan M. Russo*, *Jose E. Castillo, Eric Aspnes, Glenn Rosenberg; Prism Solar Technologies, Inc., USA.* Dual aperture holographic planar concentrator modules are compared to single aperture modules for a seasonal period of nine months. Seasonal, clear and cloudy day power and energy curves are presented to compare the modules.

12:30 p.m.–2:00 p.m. Lunch Break *(on your own)*

Tuesday, June 8

2:00 p.m.–4:00 p.m.
JTuA • Joint AIO/IS/META/ORS Poster Session

JTuA1
Materials for Infrared Surface Plasmon Resonance Biosensor, ***Justin W. Cleary***[1], *Robert E. Peale*[1], *Glenn D. Boreman*[1], *Isaiah Oladeji*[2], *Richard Soref*[3], *Walter R. Buchwald*[3]; [1]*Univ. of Central Florida, USA,* [2]*Sisom Thin Films, USA,* [3]*Hanscom Air Force Base, USA.* Silicides, heavily-doped semiconductors, and semimetals are investigated theoretically and experimentally as surface plasmon hosts for infrared surface plasmon resonance biosensors. Tighter IR mode confinement than for usual Au gives better overlap with biological analytes.

JTuA2
Observations of UV Extraordinary Optical Transmission and Localized Field Enhancement through Nanoslits, ***Qiaoqiang Gan***, *Liangcheng Zhou, Volkmar Dierolf, Filbert Bartoli; Lehigh Univ., USA.* The UV extraordinary optical transmission through nanoslit structures in the far-field and localized field enhancement in the near-field are both directly observed. Numerical modeling results are also presented, showing good agreement with the experiment results.

JTuA3
Control of the Fluorescence Features of a Dipole Emitter with Coupled Plasmonic Modes, ***Cédric Vandenbem***[1], *David Brayer*[2], *Luis S. Froufe-Pérez*[3], *Rémi Carminati*[2]; [1]*Univ. of Namur, Belgium,* [2]*ESPCI ParisTech, France,* [3]*Inst. de Cienca de Materiales, CSIC, Spain.* Based on the concept of plasmon hybridization, we study the control of the fluorescence characteristics of a dipole emitter near dimers and metallic thin films. Spectral control can be achieved with nanometer scale spatial sensitivity.

JTuA4
3-D Hybrid Plasmonic Waveguide Components with Outstanding Performance, ***Hong-Son Chu***, *Er-Ping Li, Ping Bai, Wolfgang Johannes Reinhard Hoefer; A*STAR-Inst. of High Performance Computing, Singapore.* Novel hybrid plasmonic waveguide consisting of a SiO2-stripe sandwiched between a Si-nanowire and a silver-film is used to design different bends and ring resonators. Their superior performance makes them promising building blocks for integrated plasmonics.

JTuA5
Three-Dimensional Metamaterial Nanotips, *Stefan Mühlig*[1], ***Carsten Rockstuhl***[1], *Falk Lederer*[1], *Constantine Simovski*[2], *Jacek Pniewski*[3]; [1]*Inst. of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Univ. Jena, Germany,* [2]*Dept. of Radio Science and Engineering / SMARAD, Helsinki Univ. of Technology, Finland,* [3]*Faculty of Physics, Univ. of Warsaw, Poland.* We investigate the optical properties of a three-dimensional metamaterial nanotip containing a large number of densely packed metallic nanospheres. The different eigenmodes sustained by the structure and their peculiar polarization state are revealed.

JTuA6
Self-Imaging Effect in Plasmonic Multimode Waveguides, ***André G. Edelmann***, *Stefan F. Helfert, Jürgen Jahns; Fern Univ. in Hagen, Germany.* Numerical studies of the self-imaging phenomenon ("Talbot-effect") as an example of multimode propagation in plasmonic waveguides were performed. For a suitable choice of the parameters the field remains finite after several Talbot lengths.

JTuA7
Quest for the Elusive Lossless Metal, ***Jacob B. Khurgin***[1], *Gregory Sun*[2]; [1]*Johns Hopkins Univ., USA,* [2]*Univ. of Massachusetts at Boston, USA.* Metals that are lossy at low frequencies can become lossless in mid-infrared once the inter-atomic distances exceed certain value. While this condition is not met in Nature, advances in nanoassembly may render lossless metals feasible.

JTuA8
Angle and Polarization Dependent Tuning of Plasmonic Spectra in Nanoparticle Arrays: Towards Active Plasmonics, ***Bala Krishna Juluri***, *Yue Bing Zheng, Qingzhen Hao, Lasse Jensen, Tony Jun Huang; Pennsylvania State Univ., USA.* We report two plasmonic platforms that provide dynamic tuning of extinction spectra. These platforms are based on Au nanodisc arrays where changing the angle and polarization of incidence light cause continuous shift of extinction spectra.

JTuA9
Sensitive Optical Sensing Using Vertical Plasmonic Mach-Zehnder Interferometer, ***Qiaoqiang Gan***, *Yongkang Gao, Filbert Bartoli; Lehigh Univ., USA.* By observing the wavelength shift of the peaks or valleys of the SPP interference pattern, a highly compact vertical plasmonic Mach-Zehnder interferometer with a potential to achieve a very high sensitivity is proposed.

JTuA10
All-Angle Negative Refraction in Quartz, *Rízia R. da Silva*[1], ***Thomas Dumelow***[1], *José A. P. da Costa*[1], *Sara B. Honorato*[2], *Alejandro P. Ayala*[2]; [1]*Univ. do Estado do Rio Grande do Norte, Brazil,* [2]*Univ. Federal do Ceará, Brazil.* We investigate all-angle negative refraction in quartz crystals at far infrared wavelengths. This is possible due to the material´s anisotropic phonon response. The predicted behavior is consistent with experimental results.

JTuA11
The Optical Mechanical Analogy—from Fundamentals to Applications, ***Dentcho A. Genov***[1], *Shuang Zhang*[2], *Xiang Zhang*[2]; [1]*Louisiana Tech Univ., USA,* [2]*Univ. of California at Berkeley, USA.* We propose to link the fields of optical metamaterials and celestial mechanics, opening the way to investigate light phenomena reminiscent of orbital motion, strange attractors and chaos, in a controlled laboratory environment.

JTuA12
Photonic Metamaterial Absorber Designs for Infrared Solar-Cell Applications, ***Kamil Boratay Alici***, *Ekmel Ozbay; Bilkent Univ., Turkey.* We propose a metamaterial based absorber design that operates at the infrared regime. The absorption peak was 83.6%. We can incorporate solar-cell layers inside the metamaterial absorber in order to significantly increase solar-cell efficiency.

JTuA13
Plasmonic Multimode Waveguides with Transversely Structured Core, ***André G. Edelmann***, *Stefan F. Helfert, Jürgen Jahns; Fern Univ. in Hagen, Germany.* We analyze plasmonic multimode waveguides with transverse structured core using different metals. This allows one to influence the propagation and attenuation characteristics of specific eigenmodes. We show numerical results based on two core designs.

JTuA14
The Generation of Airy-Type Surface Plasmon Polaritons, ***Dai Haitao***[1,2], *X. W. Sun*[1]; [1]*Nanyang Technological Univ., Singapore,* [2]*Fudan Univ., China.* We demonstrated an approach to generate Airy-type surface plasmon polaritons (AiSPPs) by binary plasmonics elements. The propagation dynamics of AiSPPs achieved by binary plasmonics method are demonstrated numerically utilizing full-vector Huygens-Fresnel principle.

JTuA15
Design Optimization of Transition Metamaterials, ***Tolanya Gibson***[1], *Matthew Pennybacker*[2], *Irene Mozjerin*[1], *Ildar Gabitov*[2], *Vladimir Shalaev*[3], *Natalia Litchinitser*[1]; [1]*SUNY Buffalo, USA,* [2]*Univ. of Arizona, USA,* [3]*Purdue Univ., USA.* We report a detailed study of the effect of the graded index transition metamaterials design parameters on the resonant absorption of the obliquely incident electromagnetic wave in the vicinity of the zero index transition point(s).

JTuA16
Plasmonic Nanoparticles Manipulating Solar Systems: A Dipole Mode-Complex Image Analysis, *Mohammad M. Tajdini, Shabnam Ghadarghadr,* ***Hossein Mosallaei***; *Northeastern Univ., USA.* This paper presents an efficient technique for modeling large array of plasmonic particles deposited on layered substrate, offering energy-efficient solar-systems. Dipole Mode (DM) theory along with Complex Image (CI) technique will characterize the performance successfully.

JTuA17
Controlling Metamaterials with Light, ***Sangeeta Chakrabarti***, *S. Anantha Ramakrishna, Harshawardhan Wanare; Indian Inst. of Technology Kanpur, India.* Control over the magnetic response of SRR-based and plasmonic metamaterials, accompanied by reduced dissipation, is demonstrated using coherent optical processes. Further, we show how such processes induce propagating modes in plasmas, below their plasma frequency.

JTuA18
Novel Nanotechnology for a Fine Plasmon Wavelength Tuning, ***Rita Najjar***[1], *Salim Boutami*[1], *Cyril Cayron*[1], *Viviane Muffato*[1], *Alistair Kean*[2], *Srinivas Saranu*[2], *Rudi Santbergen*[3], *Etienne Quesnel*[1]; [1]*CEA, France,* [2]*MANTIS, UK,* [3]*Delft Univ. of Technology, Netherlands.* Control of silver nanoparticles characteristics using a dedicated nano-clusters source and wavelength tuning of Plasmon resonance generated by small nanoparticles using different matrices. The results have been validated by advanced surface Plasmon modeling.

JTuA19
Terahertz Response High Conductivity Copper-Clad Polyimide Metamaterials, ***Yew Li Hor***; *Inst. of High Performance Computing, Singapore.* This paper demonstrates a cost effective mass production of terahertz response metamaterials utilizing direct to copper-clad-polyimide Microfluidic-jetted deposition. The fabricated structures are characterized using THz time-domain spectroscopy within 0.1 to 2 THz in transmission mode.

JTuA20
Paper Withdrawn

JTuA21
Determination of Negative Permittivité, Permeability and Refraction of Metamaterials, ***Mondher Labidi***, *Jamel Belhadj Tahar, Fethi Choubani; Res. Unit Systems of Telecommunications (6'Tel), SUP'COM, Tunisia.* In this paper we analyze the reflection and transmission coefficients calculated from transfer matrix simulations on finite lengths of electromagnetic metamaterials, to determine the effective permittivity ε, permeability μ and refractive index n.

JTuA22
Field Enhancements and Directivities of Plasmonic Interference Nanostructures with Two Localized Hot Spots, ***Hsin-Hung Cheng***[1], *Ying-Yu Chang*[1], *Jia-Han Li*[1], *Jen-You Chu*[2], *Ding-Zheng Lin*[2], *Yi-Ping Chen*[2]; [1]*Natl. Taiwan Univ., Taiwan,* [2]*Industrial Technology Res. Inst., Taiwan.* The finite-difference time-domain method is used to study the field enhancements and directivities of plasmonic nanostructures with two localized hot spots. The plasmonic far field interference can be predicted well by Young's double slit formula.

JTuA23
A Artificial Negative Index Film Applied to near-Filed Optical Storage with a Solid Immersion Lens, ***Taikei Suyama***[1], *Yaoju Zhang*[2], *Yoichi Okuno*[1]; [1]*Graduate School of Science and Technology, Kumamoto Univ., Japan,* [2]*College of Physics and Electronic Information, Wenzhou Univ., China.* We report a new method of enhancing the intensity of spot of near-field optical storage system with solid immersion lens. This method is based on surface plasmas excited by a real artificial negative index film.

Joint AIO/IS/META/ORS

2:00 p.m.–4:00 p.m.
JTuA • Joint AIO/IS/META/ORS Poster Session—Continued

JTuA24
Total Variation Adaptive Scene-Based Nonuniformity Correction, *Esteban Vera*, *Pablo Meza, Sergio Torres; Univ. of Concepcion, Chile.* We propose an adaptive scene-based nonuniformity correction method based on the minimization of the total variation of the estimated irradiance, which provides enhanced results in both simulated and real infrared imagery, showing less ghosting artifacts.

JTuA25
Modeling of 2-D/3-D Ladar Systems: Experimental Assessment, *Laurent Hespel*, *Guillaume Anna, Nicolas Riviere, Aurelie Bonnefois, Marie Therese Velluet, Dominique Hamoir; ONERA, France.* We developed two numerical models to address respectively, 2-D Flash and 3-D Ladar imaging. After a short description of the models used, a comparison of numerical and experimental results is conducted.

JTuA26
The Digital Camera is an Imaging System, *Joyce Farrell*, *Peter Catrysse, Brian Wandell; Stanford Univ., USA.* We describe methods for simulating the complete image processing pipeline of a digital camera, including the scene, optics, sensor, processing and display output.

JTuA27
Reproduction of Scenes Using Duplicate Physical Structures, *Syed Qasim Bukhari*; *Univ. de Granada, Spain.* Reproduction of original structure means creating a physical structure, exactly equal in shape and appearance, producing same visual sensation as of the original. In this paper we describe such reproduction.

JTuA28
Coastal Vegetation Mapping from Hyperspectral Imagery, *Krista Lee*[1], *Charles M. Bachmann[2], Robert A. Fusina[2], Marcos J. Montes[2], Rong-Rong Li[2], John C. Fry[3], C. Reid Nichols[3], Christopher Parrish[4], Jon Sellars[4]; [1]Naval Postgraduate School, USA, [2]NRL, USA, [3]Marine Information Resource Corp., USA, [4]NOAA/NOS, USA.* Leaf and canopy level reflectance have been measured by us in an ongoing effort to characterize coastal vegetation in a variety of coastal types. We compare results of these efforts for coastal vegetation mapping.

JTuA29
An Automated Hybrid Approach to Large Area Land Use Classification and Change Detection, *Francis Padula*, *Julia L. MacDonough, Dan Bondy, Monica Cook; Integrity Applications, Inc., USA.* An automated, supervised Gaussian Maximum Likelihood classifier which leveraged a priori scene knowledge from MODIS was developed to rapidly identify and exploit large area land use change over time using Global Landsat Survey data.

JTuA30
Tropical Woodland Biomass Burning and Carbon Emission: A Case Study in Sudan, *Weicheng Wu*, *Eddy De Pauw; Intl. Ctr. for Agricultural Res. in the Dry Areas, Syrian Arab Republic.* This paper reports on an assessment of woodland burning, biomass loss and carbon emission into atmosphere in a tropical African savannah based on multi-source image processing and woody biomass models developed earlier by the authors.

JTuA31
Assessment of Surface Deformation in Pamir-Alai Region Due to Nura Earthquake Using Insar, *Kanayim O. Teshebaeva*, *Alexsander Zybovich; Central Asian Inst. for Applied Geosciences, Kyrgyzstan.* Analysis of ALOS and PALSAR images before and after Nura earthquake to assess deformation in earth surface shows 188cm LOS deformation with low coherence in some images while observed fringe pattern shows uplift and subsidence.

JTuA32
Direct Correlation between Anthropogenic Ozone Production and Ethylene in the Urban Atmosphere, *Taieb Gasmi*; *Div. of Sciences and Engineering, Saint Louis Univ. at Madrid, Spain.* Correlation between ozone concentration and ethylene in the urban atmosphere is both demonstrated and supported by a photochemical smog model. Experimental results hence ascertain that ethylene as hydrocarbon plays a role in tropospheric ozone generation.

JTuA33
Toward the Development of a Hierarchical Coastal Classification System—an Example from the Mariana Islands, *John C. Fry[1], Michael D. Duncan[2],* ***Charles M. Bachmann***[3], *C. Reid Nichols[1]; [1]Marine Information Resources Corp., USA, [2]NAVFAC Marianas, USA, [3]NRL, USA.* Abstract not available.

JTuA34
Submicron Displacement Measurement by Measuring Autocorrelation of the Transmission Function of a Grating, *Khosro Madanipour*[1], *Mohammad Taghi Tavassoly[2]; [1]Amirkabir Univ. of Technology, Islamic Republic of Iran, [2]Univ. of Tehran, Islamic Republic of Iran.* It is shown by measuring the autocorrelation of the transmission function for gratings of pitches in order of sub millimeter, submicron displacements can be measured. This technique is not expensive, complicated and sensitive to vibration.

JTuA35
3-D Profile Reconstruction of Surface Based on Projection of a Single Fringe Pattern and Ftp Analysis, *Fateme Mohammadi*, *Amir Hossein Rezaie, Khosro Madanipour; Amirkabir Univ. of Technology, Islamic Republic of Iran.* We present simple but very efficient technique for 3-D profilometry of surface.A videoprojector projects a single fringe pattern on a surface. By applying Fourier Transform analysis and phase unwrapping, the 3-D profile can be reconstructed.

JTuA36
Measurement of Heat Transfer Coefficient and Temperature Profile around Axisymmetric Objects by Moiré Deflectometry, *Fatemeh Salimi Meidaneshahi*[1], *Khosro Madanipour[2], Babak Shokri[1]; [1]Shahid Beheshti Univ., Islamic Republic of Iran, [2]Amirkabir Univ. of Technology, Islamic Republic of Iran.* The spatial temperature distribution and heat transfer coefficient have been measured by moiré deflectometry. This technique can be applied to measure temperature distribution, refractive index of transparent axisymmetric plasmas and for optimum design of instruments.

Optics for Solar Energy

2:00 p.m.–4:00 p.m.
STuC • Coatings and Light Trapping
Martha Symko-Davies; Natl. Renewable Energy Lab, USA, Presider

STuC1 • 2:00 p.m. Invited
Large Area Optical and Opto-Electronic Solar Thin Film Applications, *Mark George*; *General Plasma Inc., USA.* In this paper we review the predominate large area thin film coating technologies used for manufacture of optical solar devices. We discuss typical film properties and their technical challenges for several important solar applications.

STuC2 • 2:40 p.m.
2-D Blazed Grating for Light Trapping in Thin Silicon Solar Cells, *Jo Gjessing*[1,2], *Aasmund Sudbø[3], Erik Stensrud Marstein[1]; [1]Inst. for Energy Technology, Norway, [2] Dept, of Physics, Univ. of Oslo, Norway, [3]Univ. Graduate Ctr. at Kjeller, Norway.* We propose a novel sub-micron back-side grating for light trapping in thin silicon solar cells. The 2-D-blazed grating has the potential to increase the optical thickness of the solar cell by a factor of 17.

STuC3 • 3:00 p.m.
A Scattering Model for Transparent Thin Films with Surface Textures, *Klaus Jaeger*, *Miro Zeman; Delft Univ. of Technology, Netherlands.* Scattering properties of surface-textured thin films that are used in thin-film silicon solar cells, such as angular intensity distribution and haze, were calculated with the scalar scattering theory. Good agreement with measured data was achieved.

STuC4 • 3:20 p.m. Invited
Anti Reflection Coating Optimization for Concentrator Solar Cells, *Marta Victoria*, *C. Domínguez, I. Antón, G. Sala; Inst. de Energía Solar, Univ. Politécnica de Madrid, Spain.* When optimizing antireflection coating for concentrator solar cells, the incidence angles distribution and the broad spectral bandwidth, must be considered. Here, numerical optimization of ARC layer thicknesses and spectral transmission characterization are presented.

4:00 p.m.–4:30 p.m. Coffee Break/Exhibits Open, *Pavilion*

Sonoran I

Applied Industrial Optics: Spectroscopy, Imaging, and Metrology

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

4:30 p.m.–6:30 p.m.
ATuC • Chemical Sensing
Jess Ford; Weatherford Intl., USA, Presider

ATuC1 • 4:30 p.m. Invited
Title to Be Announced, ***Ken Johnson****; Georgia Tech Res. Inst., USA.* Abstract not available.

ATuC2 • 5:10 p.m.
Taking Front-Face Fluorescence-Based Measurement of Lipid Oxidation out of the Lab, ***Marion O'Farrell***[1]*, Britta G. Fismen*[1]*, Jon Tschudi*[1]*, Diego Airado-Rodríguez*[2]*, Jens Petter Wold*[2]*;* [1]*Sintef ICT, Norway,* [2]*Nofima Mat AS, Norway.* This paper presents a low-cost, at-line, front-face fluorescence system, for measuring lipid oxidation in food products. It will be used to determine the quality of the food by measuring the level of rancidity.

ATuC3 • 5:30 p.m.
Investigation of Hexagonal Boron Nitride by Terahertz Time-Domain Spectroscopy, ***Jon Leist***[1]*, Mira Naftaly*[2]*, Richard Dudley*[2]*;* [1]*Momentive Performance Materials, Inc., USA,* [2]*Natl. Physical Lab, UK.* Four grades of hexagonal boron nitride have been investigated using terahertz time-domain spectroscopy. Optical properties at terahertz frequencies were found to be related to material structure and physical properties.

ATuC4 • 5:50 p.m.
Identification and Quantification of Maple, Corn Starch and Cane Syrup in "Maple Syrup" Products Using FTIR-ATR Spectrometry, ***Bertrand Lanher****; Polarmetrics Corp., USA.* Abstract not available.

ATuC5 • 6:10 p.m.
Analysis of Tequila Extracts by Solid Phase Extraction Combined with ATR-FTIR Spectroscopy, ***Oracio Barbosa-García****, Nancy Ornelas-Soto, Marco A. Meneses-Nava, Gabriel Ramos-Ortíz, Jose L. Maldonado, Juan L. Pichardo-Molina; Ctr. de Investigaciones en Optica, A.C., Mexico.* Infrared spectroscopy combined with chemometric tools, was used for differentiate rested tequila brands. The main solid compounds of tequila were obtained by a pre-concentration of commercial samples through use of the solid phase extraction technique.

Sonoran II

Imaging Systems

4:30 p.m.–5:30 p.m.
ITuC • Imaging Sensors III
Michael Kriss; MAK Consultants, USA, Presider

ITuC1 • 4:30 p.m. Invited
Surveillance of Dynamic Threats in Complex Urban Environments, ***Michael Eismann****; AFRL, USA.* The Air Force Research Laboratory is developing advanced EO/IR sensing concepts for urban surveillance including hyperspectral change detection, infrared wide area surveillance, and feature-aided target tracking in complex, culturally-cluttered areas.

ITuC2 • 5:10 p.m.
Gigagon: A Monocentric Lens Design Imaging 40 Gigapixels, ***Daniel L. Marks****, David J. Brady; Duke Univ., USA.* The Gigagon is a f/2.5 five element monocentric lens resolving under 2 arcsec over a 120 degree field of view intended to image onto megapixel sensors tiled over the focal surface.

Canyon III

7:00 p.m.–7:45 p.m.
STuE • SOLAR Poster Session

STuE1
Theoretical Aspects of Light Collection in Solar Concentrators, ***Antonio Parretta***[1,2]*, Letizia Zampierolo*[1]*, Dario Roncati*[3]*;* [1]*Univ. of Ferrara, Italy,* [2]*ENEA Ctr. Ricerche "E. Clementel", Italy,* [3]*O.C.E.M. S.p.A., Italy.* The theory of light collection in solar concentrators irradiated in the "direct" mode (from input aperture) is revisited and new concepts are introduced. Application of the theory is made mainly to nonimaging (CPC) concentrators.

STuE2
Theory of the "Inverse Method" for Characterization of Solar Concentrators, ***Antonio Parretta***[1,2]*, D. Roncati*[3]*;* [1]*Univ. of Ferrara, Italy,* [2]*ENEA Ctr. Ricerche "E. Clementel", Italy,* [3]*O.C.E.M. S.p.A., Italy.* The theory of "inverse method" applied to the optical characterization of solar concentrators is revisited. New optical quantities are introduced and the experimental procedure for measuring the on-axis absolute "direct" transmission efficiency is reported.

STuE3
Acceptance Angle and Illumination Uniformity for Overfilled Optical Concentrators, ***Alan R. Kost***[1,2]*, Katherine X. Liu*[2]*, Charles Qian*[2]*;* [1]*Univ. of Arizona, USA,* [2]*All Optronics Inc., USA.* Solar concentrators are frequently characterized by an acceptance angle that specifies optical throughput when the concentrator is misaligned. Here we introduce an effective acceptance angle that includes the effect of illumination non-uniformatity on system performance.

STuE4
Chromatic Aberration and Attenuation Properties of Water-Based Rod Optical Waveguides for Use in Hybrid Solar Energy Systems, ***Scott Shepard****; Univ. of Central Florida, USA.* We analyze a variety of optical filtering technologies and find that water-based rod waveguides can provide a cost effective alternative to the use of optical fiber for improving the performance of hybrid photovoltaic/solar-thermal systems.

STuE5
Synthesis And Characterization of Kiton Red Doped Zno Nanorod Arrays for Solar Cell, ***Fozia Z. Haque***[1]*, Lokesh Shastri*[1]*, Mushahid Husain*[2]*;* [1]*M.A.N.I.T., BHOPAL, India,* [2]*J.M.I., NEW DELHI, India.* Kiton red dye sensitized solar cell (DSSC) using ZnO nanoparticle and nanorods grown on FTO substrate provides a credible alternative concept to present day photovoltic device. Nanoparticles were investigated through SEM, XRD and I-V study.

STuE6
Growth and Characterization of CuO Nano-Structures by Electrochemical Process, ***Juan A. Aguilar***[1]*, M. Guzmán*[2]*, S. Fuentes*[1]*, S. Aguilera*[1]*, R. A. Zarate*[1]*;* [1]*Dept. of Physics, Faculty of Science, Univ. Católica del Norte, Chile,* [2]*Dept. of Chemical, Faculty of Science, Univ. Católica del Norte, Chile.* It was sucessfully synthesized CuO thin films strongly adhered to the substrate by an electrochemical treatment of a copper foil submerged in a 1M KOH solution, these films are composed of very diminute fibrous.

Canyon I

Photonic Metamaterials and Plasmonics

Canyon III

Optics for Solar Energy

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

4:30 p.m.–6:30 p.m.
MTuC • Plasmonics IV
Nicholas Fang; Univ. of Illinois at Urbana-Champaign, USA, Presider

MTuC1 • 4:30 p.m. Invited
Spatiotemporal Near-Field Control in Nanostructures, ***Martin Aeschlimann***[1], *Michael Bauer*[2], *Daniela Bayer*[1], *Tobias Brixner*[3], *Stefan Cunovic*[4], *Frank Dimler*[3], *Alexander Fischer*[1], *Walter Pfeiffer*[4], *Martin Rohmer*[1], *Christian Schneider*[1], *Felix Steeb*[1], *Christian Strüber*[4], *Dmitri V. Voronine*[4]; [1]*Univ. of Kaiserslautern, Germany,* [2]*Univ. Kiel, Germany,* [3]*Univ. Würzburg, Germany,* [4]*Univ. Bielefeld, Germany.* The high sensitivity and lateral resolution of a photoemission electron microscope is used to verify a scheme for a simultaneous spatial and temporal control of nanooptical fields by means of femtosecond polarization shaped laser pulses.

MTuC2 • 5:10 p.m.
The Electrodynamics of Light Transmission for Subwavelength Single Apertures and Aperture Arrays, ***John Weiner***[1], *Henri Lezec*[1], *Domenico Pacifici*[2]; [1]*NIST, USA,* [2]*Brown Univ., USA.* Modern nanofabrication tools, coherent light sources, quantitative light measurements, and three-dimensional numerical vector field simulations have led to a radical revision of early claims of "extraordinary transmission" based on classical electrodynamic models and Bloch-state analyses.

MTuC3 • 5:30 p.m.
Modulating Subwavelength Transmission in Nanoaperture Arrays with Metallic Nanoparticles, ***Matthew J. Kofke***, *David H. Waldeck; Dept. of Chemistry, Univ. of Pittsburgh, USA.* Optical transmission through subwavelength nanoaperture arrays can be modulated by metallic nanoparticles that are nested in the nanoaperture. The localized surface plasmon resonance of nanoparticles can strongly modulate and in some cases dominate the transmission.

MTuC4 • 5:50 p.m.
Giant Splitting of Localized Electric and Magnetic Plasmon Modes in a Photonic Microcavity, *Ralf Ameling,* ***Harald Giessen***; *Univ. of Stuttgart, Germany.* A cut-wire pair is strongly coupled to photonic modes in a microcavity. This results in large anticrossings of the electric and magnetic plasmon modes and the cavity mode dispersion, being useful for plasmon-quantum emitter coupling.

MTuC5 • 6:10 p.m.
Giant Surface-Plasmon-Induced Drag Effect, ***Maxim Durach***, *Anastasia Rusina, Mark Stockman; Georgia State Univ., USA.* We predict a giant surface-plasmon-induced drag-effect rectification (SPIDER). In nanowires, this giant SPIDER generates rectified THz potential up to 10V and electric fields up to 10^5-10^6V/*cm*. The giant SPIDER is an ultrafast effect.

4:30 p.m.–6:30 p.m.
STuD • Concentrator System Design
Juan Carlos Miñano; LPI, USA, Presider

STuD1 • 4:30 p.m. Invited
New Optical Concept for Concentrator Photovoltaics, ***Roger Angel;*** *Univ. of Arizona, USA.* Sunlight is collected by 3.1 x 3.1 m square dish reflectors. At each focus, light is apportioned by secondary optics onto many cells in a concave array, with each cell receiving the same 1000x concentration.

STuD2 • 5:10 p.m.
Radial Coupling Method for Orthogonal Concentration within Planar Micro-Optic Solar Collectors, ***Jason H. Karp***, *Eric J. Tremblay, Joseph E. Ford; Univ. of California at San Deigo, USA.* We present an orthogonal concentration method to further confine sunlight within planar solar collectors. Radial-oriented couplers create micro-optic solar concentrators with >375x geometric concentration and a 20% reduction in guiding loss.

STuD3 • 5:30 p.m.
Low Concentration Planar Holographic CIGS, ***Jose E. Castillo***, *Juan M. Russo, Eric D. Aspnes, Glenn Rosenberg; Prism Solar Technologies, Inc., USA.* We present the results of combining CIGS cells with diffractive film. The film, originally designed for silicon solar applications worked well with the CIGS, yielding a significant boost in performance, especially at low light levels.

STuD4 • 5:50 p.m. Invited
Material Choices and Tolerance Budget in the Optical Design of Solar Photovoltaic Concentrators, ***Ralf Leutz***, *Ling Fu, Hans Philipp Annen; Concentrator Optics GmbH, Germany.* Novel materials (including a thermoformable silicone) for concentrating photovoltaics (CPV) are included in a clear conceptual tolerance budget for the systematic interaction of optical and mechanical design of parquet and module.

Tuesday, June 8

Canyon III

7:00 p.m.–7:45 p.m.
STuE • SOLAR Poster Session—Continued

STuE7
Improved Contact Design Methodology for Solar Cells, ***Jing-Jing Li***, *Ding Ding, Swee Hoe Lim, Yong-Hang Zhang; Arizona State Univ., USA.* A rigorous approach to optimize the layout of the front contact under the real working condition of the solar cell is proposed.

STuE8
Optical Biasing Effects on Multijunction Solar Cells, ***Swee H. Lim***, *Kevin O'Brien, Elizabeth H. Steenbergen, Yong-Hang Zhang; Ctr. for Nanophotonics and School of Electrical, Computer and Energy Engineering, Arizona State Univ., USA.* We analyze and demonstrate the electrical and optical characterization techniques for multijunction solar cells to explain and quantify measurement artifacts commonly encountered under practical test conditions.

STuE9
Gold and Silver Colloidal Nanoparticles Deposition on Monocrystalline Solar Cells, ***Roberto Villarroel***[1], *Sandra Fuentes*[1], *Patricio Leyton*[2], *Sara Aguilera*[1], *Ramon Zarate*[1]; [1]*Univ. Católica del Norte, Chile,* [2]*Univ. Andres Bello, Chile.* The objetive of this investigation is enhancement the effciency of monocrystalline solar cells through the deposition of gold and silver colloidal nanoparticles fabricated with dif ferent diameters and with sodium citrate as reductant.

STuE10
A Quasi Gradien-Index Antireflection Coating for Solar Cell, ***Chung An Hu***[1], *T. J. Yang*[2], *S. L. Yang*[1]; [1]*Natl. Chiao Tung Univ., Taiwan,* [2]*Chung Hua Univ., Taiwan.* A five-layer quasi-parabolic antireflection coat is proposed to improve the conversion efficiency of solar cells. The performance is pefect over a wide wavelength and wide incident angle.

STuE11
Elaboration and Obtainment of Transparent Conductive Diamond Like Carbon Films for Si PV Application, ***Armen S. Gharibyan***; *State Engineering Univ. of Armenia, Armenia.* Transparent, conductive DLC films have been elaborated as replacement of Si PV cells' metallic gratings applying PECVD technology. Conductivity and transparency of films have correspondingly been reached up to 104Ohm^{-1}*cm^{-1} and up to 85%.

8:00 p.m.–9:00 p.m. AIO Rump Session, *Sonoran I*

8:00 p.m.–9:00 p.m. SOLAR Rump Session, *Canyon III*

Sonoran II

Imaging Systems

8:00 a.m.–10:00 a.m.
IWA • Computational Imaging I
Todd Sachs; Aptina Imaging Corp., USA, Presider

IWA1 • 8:00 a.m. Invited

A Review of Some Recent Work in the Area of Imaging and Optical Signal Processing, ***John Sheridan****; Univ. College Dublin, Ireland.* A review is presented of research recently carried out in our group. Topics discussed include: (i) Imaging through turbulent media; (ii) Numerical algorithms; (iii) Controlling speckle and metrology; (iv) Digital holography; and (v) Optical encryption/multiplexing.

IWA2 • 8:40 a.m.

Coded Strobing Photography for High-Speed Periodic Events, ***Dikpal Reddy***[1]*, Ashok Veeraraghavan*[2]*, Ramesh Raskar*[3]*;* [1]*Dept. of Electrical and Computer Engineering, Univ. of Maryland, USA,* [2]*Mitsubishi Electric Res. Labs, USA,* [3]*MIT Media Labs, USA.* We capture high-speed periodic events using a low-frame rate camera by temporally modulating the shutter (coded strobing) and demonstrate that the Nyquist rate constraint can be imposed on strobe-rate rather than the sensor-rate.

IWA3 • 9:00 a.m.

Rejecting out-of-Focus Attenuation, ***Keith J. Dillon****, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* We consider the confocal microscope for samples where there is predominantly attenuation. We derive a computational detection approach for rejection of attenuation away from the focal point which we compare to the conventional method.

IWA4 • 9:20 a.m.

Modeling the Performance of Turbulence Mitigation Algorithms in Targeting Imagers, ***Richard L. Espinola****, Jae Cha; US Army Night Vision and Electronic Sensors Directorate, USA.* Mitigation algorithms can improve the target acquisition performance of imaging systems in atmospheric turbulence. We quantify this improvement using perception tests and develop a model that predicts sensor/observer ID performance with software-based turbulence mitigation algorithms.

IWA5 • 9:40 a.m.

Restoration of Turbulence-Degraded Images Using Pixel Histograms, ***Guy Potvin****, Luc Forand, Denis Dion; DRDC Valcartier, Canada.* The most-common method of restoration of turbulence-degraded images restores the sharp edges of an image but makes them jagged. We raise the pixel histograms to a certain order, which creates sharp but straight edges.

Canyon I

Photonic Metamaterials and Plasmonics

8:00 a.m.–10:00 a.m.
MWA • Active Structures
Mikhail Noginov; Norfolk State Univ., USA, Presider

MWA1 • 8:00 a.m. Invited

Active Coated Nano-Particles for Localized Optical Sensors, ***Richard Ziolkowski****; Univ. of Arizona, USA.* Active spherical coated nano-particles have been considered for nano-laser, nano-sensor, and optical metamaterial applications. Excitation by plane waves and arbitrarily located electric Hertzian dipoles lead to a rich variety of amplification and cloaking phenomena.

MWA2 • 8:40 a.m. Invited

Deep Sub-Wavelength Plasmonic Lasers, ***Guy Bartal***[1]*, R. F. Oulton*[1]*, V. J. Sorger*[1]*, T. Zentgraf*[1]*, X. Zhang*[1,2]*;* [1]*Univ. of California at Berkley, USA,* [2]*Lawrence Berkeley Natl. Lab, USA.* We show that a hybrid of semiconductor nanowire and metallic surface modes produces an efficient laser device with λ2/100 mode area and discuss the broader impact of plasmon-based light sources and integrated optical components.

MWA3 • 9:20 a.m.

Paper Withdrawn

MWA4 • 9:40 a.m.

Compensation of Losses in Slow-Light Negative-Index Waveguides by Evanescent Pumping, ***Kosmas L. Tsakmakidis****, Edmund I. Kirby, Ortwin Hess; Advanced Technology Inst., UK.* Using full-wave simulations we show how the incorporation of thin layers made of an active medium adjacently to the core layer of a negative-index slow-light waveguide can completely remove dissipative optical losses.

Canyon III

Optics for Solar Energy

8:00 a.m.–10:00 a.m.
SWA • Light Trapping and Plasmonics
Allen Barnett; Univ. of Delaware, USA, Presider

SWA1 • 8:00 a.m. Invited

The Influence of the $4n^2$ Light Trapping Factor on Ultimate Solar Cell Efficiency, ***Eli Yablonovitch****, Owen Miller; Univ. of California at Berkeley, USA.* The standard Shockley-Queisser approach to ideal ultimate solar cell efficiency makes a number of idealistic assumptions. Under even slightly non-ideal conditions, the $4n^2$ light trapping factor already has a major role controlling the ultimate efficiency.

SWA2 • 8:40 a.m.

Optical Absorption Enhancement in Thin-Film Organic Photovoltaic Solar Cells through the Excitation of Plasmonic Modes in Metallic Gratings, *Changjun Min*[1]*, Jennifer Li*[1]*,* ***Georgios Veronis***[1]*, Jung-Yong Lee*[2]*, Shanhui Fan*[2]*, Peter Peumans*[2]*;* [1]*Louisiana State Univ., USA,* [2]*Stanford Univ., USA.* We theoretically demonstrate up to ~50% enhancement of the overall optical absorption in thin-film organic photovoltaic solar cells in which the top transparent electrode is partially substituted by a periodic metallic grating.

SWA3 • 9:00 a.m.

Optical Enhancement with Plasmonic Nanoparticles in Organic Bulk-Heterojunction Solar Cells, ***Wee Shing Koh***[1]*, Yuriy Akimov*[1]*, Yuning Li*[2]*, Mui Siang Soh*[2]*, Wei Peng Goh*[2]*, Hong Son Chu*[1]*;* [1]*Inst. of High Performance Computing, Singapore,* [2]*Inst. of Materials Res. and Engineering, Singapore.* This work discusses the enhancement of the optical absorption of the organic bulk-heterojunction solar cell with plasmonic silver nanoparticles.

SWA4 • 9:20 a.m. Invited

Randomly Textured Surfaces for Photon Management in Silicon Thin Film Solar Cells, ***Carsten Rockstuhl****, Stephan Fahr, Falk Lederer; Friedrich-Schiller-Univ., Germany.* Rigorous diffraction theory is used to reveal the peculiarities of randomly textured surfaces used for photon management. The effect of such surfaces in solar cells with an increasing complexity is analyzed to provide unprecedented insights.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits Open, *Pavilion*

Sonoran II

Imaging Systems

10:30 a.m.–11:50 a.m.
IWB • Computational Imaging II
Joyce Farrell; Stanford Univ., USA, Presider

IWB1 • 10:30 a.m. Invited
Superresolution Systems, *Ronald Driggers*[1], *Gisele Bennett*[2]; [1]*NRL, USA*, [2]*Georgia Tech Res. Inst., Georgia Tech, USA*. Abstract not available.

IWB2 • 11:10 a.m. Invited
Computational Photography, *Ramesh Raskar*; *MIT, USA*. Abstract not available.

Canyon I

Photonic Metamaterials and Plasmonics

10:30 a.m.–12:30 p.m.
MWB • Metamaterials III
Martin Aeschlimann; Univ. of Kaiserslautern, Germany, Presider

MWB1 • 10:30 a.m.
Optical Frequency Negative-Index Material Based on Silver Nanocluster Metamaterial, *Venkata A. Tamma*, *Saumil Joshi, Won Park; Univ. of Colorado, USA*. We present theoretical and experimental studies on a new negative-index material based on silver nanocluster metamaterial. A scalable bottom-up approach based on template directed self-assembly was used for fabricating the nanocluster material.

MWB2 • 10:50 a.m.
Optical Isotropic Negative Index Metamaterials, *Christoph Menzel*[1], *Thomas Paul*[1], *Carsten Rockstuhl*[1], *Rumen Iliew*[1], *Andrei Andryieuski*[2], *Radu Malureanu*[2], *Andrei V. Lavrinenko*[2], *Falk Lederer*[1]; [1]*Inst. of Condensed Matter Theory and Solid State Optics, Germany*, [2]*DTU Fotonik - Dept. of Photonics Engineering, Technical Univ. of Denmark, Denmark*. In the search for isotropic metamaterials we analyze isofrequency surfaces of the dispersion relation of highly symmetric metamaterials and show that they are optically anisotropic. Instead isotropic metamaterials are achieved by carefully designing multilayer structures.

MWB3 • 11:10 a.m.
Infrared Planar Zero Index Metamaterials, *Seokho Yun*, *Jeremy A. Bossard, Yan Tang, Douglas H. Werner, Theresa S. Mayer; Penn State Univ., USA*. An infrared planar Zero Index Metamaterial consisting of a Ag screen surrounded by a polyimide substrate and superstrate that was optimized using a genetic algorithm to have a low/zero refractive index with maximum transmission.

MWB4 • 11:30 a.m.
Multiplexed Plasmonic Nanostructure Metamaterial for Wide Spectral Band Perfect Light Absorption, *Junpeng Guo*, *Yi Zou, Hai S. Leong, Boyang Zhang; Univ. of Alabama at Huntsville, USA*. We will present a multiplexed plasmonic nanostructure which can perfectly absorb light over a wide spectral band in the infrared. The nanostructure can provides near 10% over 20 dB light absorption spectral band in infrared.

MWB5 • 11:50 a.m.
Metamaterial Immersion Lenses, *Changbao Ma*, *Zhaowei Liu; Univ. of California at San Diego, USA*. We propose and demonstrate metamaterial immersion lenses (MILs) by shaping the interfaces of plasmonic metamaterials. The MILs can achieve super resolution and can be easily integrated with conventional optical systems.

MWB6 • 12:10 p.m.
Silicon Nanorod Based Near-Infrared Ground Plane Cloak, *Venkata A. Tamma*[1], *John Blair*[2], *Christopher Summers*[2], *Won Park*[1]; [1]*Univ. of Colorado, USA*, [2]*Georgia Tech, USA*. An improved implementation of optical frequency ground plane cloak was demonstrated using silicon nanorod array. The cloak performance was directly visualized by the near-field scanning optical microscopy. The experimental data agreed well with numerical simulations.

Canyon III

Optics for Solar Energy

10:30 a.m.–12:30 p.m.
SWB • Light Management and Spectrum Splitting
Cesar Domínguez; Univ. Polytéchnica de Madrid, Spain, Presider

SWB1 • 10:30 a.m. Invited
High Efficiency, Spectrum Splitting Solar Cell Assemblies: Design, Measurement and Analysis, *Allen Barnett,* *Xiaoting Wang; Univ. of Delaware, USA*. A spectrum splitting photovoltaic architecture was proposed for high energy conversion efficiency. Assemblies of this architecture were constructed, measured and analyzed, which allow assessment of current assemblies and help identify pathways to higher efficiency.

SWB2 • 11:10 a.m.
Design, Assembly, and Testing of a Spectral Splitting Solar Concentrator Module, *Eric Christensen*, *Duncan Moore, Greg Schmidt, Blair Unger; Inst. of Optics, Univ. of Rochester, USA*. This paper describes the design, assembly, and testing of a concentrating photovoltaic module which uses spectral splitting to achieve high system power efficiency. An efficiency of 37.5% was measured on a prototype module.

SWB3 • 11:30 a.m.
Optimum Design and Performance Study of Near Infrared Emitting Quantum Dots Luminescent Solar Concentrators, *Chunhua Wang*[1], *Georgiy Shcherbatyuk*[1], *Richard Inman*[1], *Dave Pelka*[2], *Weiya Zhang*[1], *Yvonne Rodriguez*[3], *Sue Carter*[3], *Roland Winston*[1], *Sayantani Ghosh*[1]; [1]*Univ. of California at Merced, USA*, [2]*Pelka & Associate Inc., USA*, [3]*Univ. of California at Santa Cruz, USA*. We show the optimum design of near infra-red emitting PbS quantum dots luminescent solar concentrators, and experimentally compare their performance with visible quantum dots and organic luminescent solar concentrators.

SWB4 • 11:50 a.m. Invited
Nanoarrays for Light Management in Thin Film Solar Cells, *Jin Ji*[1], *Magued B. Nasr*[1], *Murray W. McCutcheon*[2], *Cy Herring*[3]; [1]*Lightwave Power, Inc., USA*, [2]*Harvard Univ., USA*, [3]*Sencera Intl., USA*. We report the use of plasmonic and photonic nanoarray to achieve light management in thin film solar cells. Theoretical and experimental data will be presented.

12:30 p.m.–2:00 p.m. Lunch Break *(on your own)*

Sonoran II

Imaging Systems

2:00 p.m.–4:00 p.m.
IWC • 3-D Imaging
Matthew A. Kupinski; Univ. of Arizona, USA, Presider

IWC1 • 2:00 p.m. Invited
3-D Imaging Using Helical Point Spread Functions, *Sean Quirin,* ***Rafael Piestun****; Univ. of Colorado at Boulder, USA.* We engineer three-dimensional point spread functions to collect the information required for depth recovery and imaging. We investigate computational imaging systems using helical point spread functions for 3-D passive imaging and compare with prevailing methods.

IWC2 • 2:40 p.m.
Computational 3-D Fluorescence Microscopy Imaging, *Amaradri Mukherjee,* ***Chrysanthe Preza****; Univ. of Memphis, USA.* We show cell images from two different approaches of computational 3-D fluorescence imaging integrated on a single wide-field fluorescence microscope system and discuss advantages and disadvantages of the two techniques under investigation.

IWC3 • 3:00 p.m.
High-Resolution, Superfast 3-D Imaging Using a Phase-Shifting Method, ***Song Zhang***[1]*, Yuanzheng Gong*[1]*, Jacob Laughner*[2]*, Qing Lou*[2]*, Igor R. Efimov*[2]*, Daniel van der Weide*[3]*;* [1]*Iowa State Univ., USA,* [2]*Washington Univ., USA,* [3]*Univ. of Wisconsin, USA.* We presents a system to realize 333 fps 3-D shape measurement speed at 768 X 768 resolution. It utilizes the DLP Discovery platform to realize 3-D shape measurement by using a defocusing method.

IWC4 • 3:20 p.m.
Depth Estimation with Locally Adaptive Support-Weight in a Thermographic Compound-Eye Camera, ***Keiichiro Kagawa****, Yasuhiro Fujiwara, Jun Tanida; Osaka Univ., Japan.* To obtain a smooth and edge-preserved depth from textureless thermal compound-eye image, combination of locally adaptive support-weight and joint bilateral filtering are proposed, which is demonstrated with a thermographic compound-eye camera with 3×3 aspherical lenses.

IWC5 • 3:40 p.m.
Robotic Surgery and the Opportunities for Advanced Imaging Modalities, ***Dave Scott****; Intuitive Surgical, Inc., USA.* Abstract not available.

Canyon I

Photonic Metamaterials and Plasmonics

2:00 p.m.–4:00 p.m.
MWC • Plasmonics V
Guy Bartal; Univ. of California at Berkeley, USA, Presider

MWC1 • 2:00 p.m. Invited
An Electrical Tuner to Command Optical Nanoantennas, ***Alexandre Bouhelier****; Univ. de Bourgogne, France.* Optical antennas are passive device where fabrication designs decide operating frequency, gain and emission diagram. By introducing an electrically controllable load medium for the antenna, these characteristics can be externally controlled.

MWC2 • 2:40 p.m. Invited
Fundamental Investigations and Applications of Gold Nanoparticles Interacting with Their Immediate Nanoenvironment, ***Thomas Klar****; Ilmenau Univ. of Technology, Germany.* Gold nanoparticles interact strongly with their immediate nanoenvironment. They manipulate their surrounding as fluorescence quenchers or local heaters. In turn, they are influenced by their surrounding, by the refractive index or by chemical surface damping.

MWC3 • 3:20 p.m. Invited
Acousto-Plasmonic Hot Spots: Driving Enhanced Raman Scattering in Metallic Nanoparticles ***Javier Aizpurua***[1]*, Nicolas Large*[1,2]*, Lucien Saviot*[3]*, Adnen Mlayah*[2]*;* [1]*Ctr. de Física de Materiales, CSIC, Spain,* [2]*CNRS-Univ. de Toulouse, France,* [3]*CNRS-Univ. de Bourgogne, France.* We study theoretically and experimentally the coupling of acoustic vibrations (phonons) and surface plasmons in metallic nano-objects. The modulation of the surface charge density allows for the interpretation of experimental Raman-Brillouin spectra in silver nanorods.

Canyon III

Optics for Solar Energy

2:00 p.m.–4:00 p.m.
SWC • Device and Module Characterization
Georgios Veronis; Louisiana State Univ., USA, Presider

SWC1 • 2:00 p.m. Invited
Advanced Aspects of Indoor Characterization of CPV Modules, ***César Domínguez****, Stephen Askins, Ignacio Antón, Gabriel Sala; Univ. Politécnica de Madrid, Spain.* A comprehensive characterization process for concentrator PV modules is presented, based on a commercial solar simulator. Advanced aspects about irradiance and spectrum conditions monitoring are introduced. Recommendations of the forthcoming IEC norm are addressed.

SWC2 • 2:40 p.m.
Real Time Optical Monitoring of Properties of Silicon Thin Film Solar Panels, ***George Atanasoff****; AccuStrata, Inc., USA.* Optical monitoring of silicon absorbers is performed during deposition inside the chamber during solar panel manufacturing, providing adaptive control of film quality in real time. Practical results are discussed and the monitoring benefits are demonstrated.

SWC3 • 3:00 p.m.
Photovoltaic Cell Texture Quantitatively Relates to Efficiency, ***Nelson Blewett****, Erik Novak; Veeco Metrology, Inc., USA.* This paper describes a set of experiments which quantify the relationship between surface texture and photovoltaic cell efficiency using three-dimensional surface parameters calculated from white-light interferometric measurements.

SWC4 • 3:20 p.m. Invited
A Semi-analytical Model and Characterization Techniques for Concentrated Photovoltaic Multijunction Solar Cells, ***Yong-Hang Zhang****, D. Ding, S. R. Johnson, S. H. Lim; Arizona State Univ., USA.* A semi-analytical model for multijunction solar cells is established by extending the detailed balance model to include nonradiative recombination and other aspects of actual devices. Novel characterization techniques for multijunction solar cells are described.

4:00 p.m.–4:30 p.m. Coffee Break/Exhibits Open, *Pavilion*

Sonoran II

Imaging Systems

4:30 p.m.–6:10 p.m.
IWD • Projective Imaging
David Brady; Duke Univ., USA, Presider

IWD1 • 4:30 p.m. Invited

DARPA Imaging System Research, ***Stuart Horn***; *Microsystems Technology Office (MTO), DARPA, USA.* Abstract not available.

IWD2 • 5:10 p.m.

Novel MEMS Deformable Mirror for Focus Control and Aberration Correction, ***Brant M. Kaylor***[1], *Peter Roos*[1], *Jeffrey Lutzenberger*[1], *Jason R. Dahl*[2], *David L. Dickensheets*[3]; [1]*Bridger Photonics, Inc., USA,* [2] *Spectrum Lab, Montana State Univ., USA,* [3] *Dept. of Electrical and Computer Engineering, Montana State Univ., USA.* Electrostatically actuated MEMS mirrors for focus control have been fabricated. Deflection over 7.3 µm has been achieved using closed-loop control. Low-order aberrations were corrected and the devices were utilized in an imaging system.

IWD3 • 5:30 p.m. Invited

Compressive Imaging: Hybrid Projection Design, ***Amit Ashok***, *Mark A. Neifeld; Univ. of Arizona, USA.* Compressive imaging/sensing employing a random measurement basis does not incorporate the specific object prior information available for natural images. An alternate hybrid measurement basis is proposed that yields improved reconstruction performance for natural images.

Canyon I

Photonic Metamaterials and Plasmonics

4:30 p.m.–6:30 p.m.
MWD • Toward 3-D Structures
Ekaterina Shamonina; Univ. of Erlangen-Nuremberg, Germany, Presider

MWD1 • 4:30 p.m.

Fabrication of Cubic Micron-Scale 3-D Metamaterial Resonators, *D. Bruce Burckel, Greg A. Ten Eyck, Joel R. Wendt, Igal Brener,* ***Michael B. Sinclair***; *Sandia Natl. Labs, USA.* We present a new fabrication technique called Membrane Projection Lithography for the production of three-dimensional metamaterials at infrared wavelengths. Using this technique, multilayer infrared metamaterials that include both in-plane and out-of-plane resonators can be fabricated.

MWD2 • 4:50 p.m.

Infrared Cubic Dielectric Resonator Metamaterial, ***James C. Ginn***, *Gregory A. Ten Eyck, Igal Brener, David W. Peters, Michael B. Sinclair; Sandia Natl. Labs, USA.* Dielectric resonators are an effective means to realize isotropic, low-loss optical metamaterials. As proof of this concept, a cubic resonator is analytically designed and then tested in the long-wave infrared.

MWD3 • 5:10 p.m.

3-D Optical Yagi-uda Nanoantenna Array, *Daniel Dregely, Richard Taubert,* ***Harald Giessen***; *Univ. of Stuttgart, Germany.* We fabricated three-dimensional arrays of optical Yagi-Uda nano-antennas. Due to the high directivity of the array structure the incoming light is received efficiently at the resonant wavelength in the near-infrared (around lambda = 1.3 micrometers).

MWD4 • 5:30 p.m.

Mid-Infrared Amplitude and Phase Measurement of Metamaterials Using Tandem Interferometry, ***Brandon S. Passmore***, *John Anderson, Greg A. Ten Eyck, Joel R. Wendt, Igal Brener, Michael B. Sinclair, Eric A. Shaner; Sandia Natl. Labs, USA.* A tandem interferometer system measuring the absolute phase and amplitude of planar split-ring resonators fabricated on a BaF2 substrate with a designed resonance at 10.5 µm is presented.

MWD5 • 5:50 p.m. Invited

Direct Probing of the Magnetic Field of Light at Optical Frequencies, ***Kobus Kuipers***; *FOM Inst. for Atomic and Molecular Physics (AMOLF), Netherlands.* Nanostructures can greatly affect the subwavelength structure of light fields. We map those vector fields, observe polarization singularities in the electric fields and, for the first time, visualize the magnetic component of light.

Canyon III

Optics for Solar Energy

4:30 p.m.–6:30 p.m.
SWD • Organic and Thin Film PV
Jin Ji; Lightwave Power, Inc., USA, Presider

SWD1 • 4:30 p.m. Invited

Nanoarchitectured Polymers and Polymer Nanocomposites for Photovoltaic Applications, ***Robert Norwood***; *Univ. of Arizona, USA.* Abstract not available.

SWD2 • 5:10 p.m.

Commercial CIGS Solar Cells for Concentrator Applications, ***Deming Zhang***[1], *Jose M. Castro*[1], *Raymond K. Kostuk*[1,2]; [1]*Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA,* [2]*College of Optical Sciences, Univ. of Arizona, USA.* We studied the effect of concentration on commercial CIGS solar cells. Measurement results indicate 23% improvement in efficiency can be achieved under 20X. Methods to optimize concentrator cells for higher irradiance levels are also discussed.

SWD3 • 5:30 p.m.

Evaluation of the Quality Factor of Microcrystalline Thin-Film Solar Cell, *Sheng-Hui Chen*[1], ***Ting-Wei Chang***[1], *Yi-Chan Chen*[2], *Yu-Hung Chen*[2]; [1]*Dept. of Optics and Photonics, Taiwan,* [2]*Photovoltaics Technology Ctr., Taiwan.* By dividing the absorption coefficient at 1.4eV with the value at 0.9eV, we could judge the quality of µc-Si:H and predict (V_{oc}*I_{sc}) of solar cell when using this layer as its intrinsic layer.

SWD4 • 5:50 p.m.

Novel Organic Solar Cell Design towards an Optical Control of the Exciton Diffusion Length, ***Jordi Martorell***, *Xavier Elias, Saverio Pasini, Rafael Betancur, Luat T. Vuong, Roberto Macovez; ICFO, Spain.* The exciton diffusion could be increased if highly fluorescent materials were used. We developed a kind of such material and studied the performance of solar cells where the electrodes form a cavity for fluorescence control.

SWD5 • 6:10 p.m.

Detailed Balance Solar Cell Efficiency Limits for Internal Fluorescence Yield Slightly Less than 100%, ***Owen D. Miller***, *Eli Yablonovitch; Univ. of California at Berkeley, USA.* The Shockley-Queisser approach to calculating solar cell efficiencies assumes 100% internal fluorescence yield. This is misleading, as even a slight drop in internal yield to 90% already causes a severe drop below the Shockley-Queisser limit.

Key to Authors and Presiders

(**Bold** denotes Presider or Presenting Author)

Imaging and Applied Optics Congress:
OSA Optics & Photonics Congress Update Sheet

Withdrawals:

DMA3
DMD3
JTuA12
MTuA1
SWB3

Presider Updates:

MWD will be presided over by *Martin Wegener; Karlsruhe Inst. of Technology. Univ. of Karlsruhe, Germany*
DMD will be presided over by *Khan Iftekharuddin; Univ. of Memphis, USA.*
DTuA will be presided over by *Chrysanthe Preza; Univ. of Memphis, USA*
The presider for **STuC** will be announced on-site.

Presenter Updates:

IMB4 will be presented by *David Brady; Duke Univ., USA*
SMB1 will be presented by *Chantal Arena; SOITEC, France*
STuA1 will be presented by *Marco Stefancich; MIT, USA*
PDOTuA2 will be presented by *Johannes Koeth; nanoplus Nanosystems and Technologies GmbH, Germany*

Presentation Time Updates:

OMA1 will be presented in two parts. The first part will be on Monday from 8:00 a.m.–8:20 a.m. The second part will be from 5:30 p.m.–5:50 p.m.
OMD2 will be presented from 4:50 p.m.–5:30 p.m.
OMD3 will be presented from 5:30 p.m.–5:50 p.m.
OMD4 will be presented from 5:50 p.m.–6:10 p.m.
MTuA2 will be presented from 9:20 a.m.–9:40 a.m. on Wednesday, June 9 in session **MWA**

Session Updates:

STuB will now start at 10:50 a.m.
ITuC will now end at 5:50 p.m.
PDOTuA will now end at 5:50 p.m.

Title Update:

The title for **MTuB5** should read **Cathodoluminescence Imaging of Plasmonic Modes of Ag Naostructures**

Abstract Update:

The abstract for **IWB1** should read Super-resolution is known to be a number of different processes. One is enhancing the resolution beyond the diffraction limit of an imaging system and another is enhancing the resolution beyond the sampling limits of an imaging system. These two processes will be discussed and described with application to appropriate military imaging systems.

Committee Member Update:

The affiliation for Bertrand S. Lanher is now Process Analytical Chemistry Services, USA

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Imaging Systems (IS) Abstracts

•Tuesday, June 8, 2010•

JTuA • Joint AIO/IS/META/ORS Poster Session

Pavilion
2:00 p.m.–4:00 p.m.

PDJTuA1
Variation of Optical Constants of Se_{85-x} Te_{15} In_x Glass System, *D. Sushama[1,2], **Ginjala R. C. Reddy**[1], Achamma George[1,3], P. Predeep[1]; [1]Natl. Inst. of Technology Calicut, India, [2]MSM College Kayamkulam, India, [3]St. Stephans' College, India.* Films of SeTeIn Chalcogenide glasses are prepared by melt quenching followed by flash evaporation. Their optical constants and variations in refractive index, extinction and absorption coefficients with energy of incident radiation are evaluated and discussed.

ITuC • Imaging Sensors III

Sonoran II
4:30 p.m.–5:50 p.m.
Michael Kriss; MAK Consultants, USA, Presider

PDITuC1 • 5:30 p.m.
Focal Length Invariance of Perceptual Image Quality for Long Range Imaging Applications, ***Joshua K. Lentz**, James E. Harvey; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* For long range imaging applications, perceptual image quality will not vary with focal length. Theoretical justification and Modulation Transfer Function (MTF) evidence are presented.

Optical Remote Sensing of the Environment (ORS) Abstracts

•Monday, June 7, 2010•

OMD • Littoral Applications of Remote Sensing

Finger Rock
4:30 p.m.–6:30 p.m.
Charles M. Bachmann; NRL, USA, Presider

PDOMD1 • 6:10 p.m.
Retrieval of Cloud Properties Using a Principal Component Based Physical Methodology, ***Wan Wu**[1], Xu Liu[2], Daniel K. Zhou[2], Allen M. Larar[2]; [1]Science Systems and Applications, Inc., USA, [2]NASA Langley Res. Ctr., USA.* We present here the study of cloud top height and microphysical properties retrievals from the Infrared Atmospheric Sounding Interferometer (IASI) simulation radiance data using the PCRTM physical inversion algorithm.

•Tuesday, June 8, 2010•

PDOTuA • Sensors and Methods III

Finger Rock
4:30 p.m.–5:30 p.m.
Robert Fusina; NRL, USA, Presider

PDOTuA1 • 4:30 p.m.
Fabry-Perot Sensors for Precision Trace Gas Measurement, ***William S. Heaps**[1], Elena Georgieva[2]; [1]NASA Goddard Space Flight Ctr., USA, [2]Univ. of Maryland, Baltimore County, USA.* Fabry-Perots are useful for remote sensing. They can operate at high resolution while maintaining high brightness. Instruments will be described to measure greenhouse gases on earth and to search for methane on Mars.

PDOTuA2 • 4:50 p.m.
DFB Lasers from 760 nm to 3400 nm for Sensing Applications, ***Lars Hildebrandt**, Wolfgang Zeller, Lars Naehle, Peter Fuchs, Christian Zimmermann, Johannes Koeth; Nanoplus Nanosystems and Technologies GmbH, Germany.* We describe the status quo concerning DFB laser diodes between 760 nm and 3400 nm as well as new developments aiming for up to 80 nm tuning range, high power and low linewidth in this spectral region.

PDOTuA3 • 5:10 p.m.

Developing Heavy Metal Pollution Map with Multifactor Contributed, ***Metin Altan****, Ömer Ayyildiz, Semra Malkoç, Berna Yazici, Savas Koparal; Anadolu Univ., Turkey.* Detailed investigation was conducted to understand contamination characteristics and distributions of heavy metal pollution in terms of contributions of the heavy metal concentrations as mg/kg in the urban soil and modelled in recoded digital map.

Optics for Solar Energy (SOLAR) Abstracts

•Tuesday, June 8, 2010•

STuB • Concentrator Design and Holographic Concentrator Systems

Canyon III
10:50 a.m.–12:30 p.m.
R. John Koshel; Univ. of Arizona, USA, Presider

PDSTuB1 • 10:50 a.m.

Nanosphere Scattering Simulations for Efficient Thin Film Solar Cells, ***Jagmeet S. Sekhon****, S. S. Verma; Sant Longowal Inst. of Engineering and Technology, India.* Suitability simulations of plasmonic materials were demonstrated to enhance the absorption efficiency of Si solar cells and summarized that Cu nanosphere could be more creditable for plasmonic solar cells in comparisons to Ag and Au.

STuE • Solar Poster Session

Canyon III
7:00 p.m.–8:30 p.m.

PDSTuE1

An Improved Charge Controller Model for Solar Powered Standalone Lighting Systems, ***Ajit P. S. Negi****, Deepak Bagai, Rita Mahajan; PEC Univ. of Technology, India.* The paper proposes an improved charge controller scheme for solar power based standalone lighting systems, by efficient charging and discharging of battery through a common controller circuit with a well known technique, Pulse Width Modulation.

•Wednesday, June 9, 2010•

SWB • Light Management and Spectrum Splitting

Canyon III
10:30 a.m.–12:30 p.m.
Cesar Domínguez; Univ. Polytéchnica de Madrid, Spain, Presider

PDSWB1 • 11:30 a.m.

Fundamental Limit of Nanophotonic Light-Trapping in Solar Cells, ***Zongfu Yu****, Aaswath Raman, Shanhui Fan; Stanford Univ., USA.* We use a rigorous electromagnetic approach to develop a light-trapping theory, which reveals that the conventional limit $4n^2$ can be substantially surpassed in nanophotonic regimes, opening new avenues for highly efficient solar cells.

Key to Authors and Presiders
(**BOLD** denotes Presenting Author or Presider)