Optics for Solar Energy (SOLAR)

2 November - 3 November 2011, Omni Austin Hotel Downtown, Austin, Texas, United States

Optics for solar energy

The focus is on the optical components including their design, modeling, integration of novel materials, manufacture, testing, deployment in the field, economic considerations, and field results.

All forms of solar energy generation, transmission, and storage; from thermal to photovoltaic to novel methods will be covered in this forum.

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

Dynamic Program

- **8 Plenary Speakers**
  - **New - Pathways to Ultra-Efficient Solid-State Lighting**
    Mary H. Crawford, Sandia National Laboratories, USA
  - **Applying Systems Analysis to Innovation: Solar Energy**
    Kevin DeGroat, Program Director, Antares Group, Inc., USA
    Joe Morabito, Director, Alcatel-Lucent, USA
  - **Theory and Practice for Nanophotonic Light Trapping**
    Shanhui Fan, Stanford University, USA
  - **Sustainable Energy & Optical Methods for Monitoring Air Pollution**
    Matthew Fraser, Global Institute of Sustainability, Arizona State Univ., USA
  - **Opportunities for Optical Designs in Driving Concentrating Photovoltaic Technology**
    Sarah Kurtz, Interim NCPV Director, Reliability Group Manager, NREL, USA
  - **Army S&T Development: Selected Energy Solutions**
    Ed Shaffer, Chief, Energy & Power Division, Army Research Laboratory, USA
Promises and Challenges in Light-Emitting Diodes for High-Power Lighting Applications

E. Fred Schubert and Jaehee Cho, Rensselaer Polytechnic Institute, USA

- 9 Expert invited speakers from academia, industry and government
- 10 Oral presentations on cutting edge research in the field
- Poster presentations
- Postdeadline paper sessions

Chairs

Joseph Ford, Univ. of California at San Diego, USA
Alan Kost, Univ. of Arizona, USA
Raymond Kostuk, Univ. of Arizona, USA

Papers are Published in Optics InfoBase. Here Are the Top 5 Downloaded 2010 SOLAR Meeting InfoBase Papers:

- High Efficiency, Spectrum Splitting Solar Cell...
- Design, Assembly, and Testing of a Spectral...
- Optical Absorption Enhancement in Thin-Film...
- Planar Holographic Solar Concentrators for Low...
- Randomly Textured Surfaces for Photon Management...

Go to Optics InfoBase for a listing of all meeting paper archives.

View the 2010 Meeting Archive containing the final program (pdf).

Sponsor:
Renewable Energy and the Environment

November 2-3, 2011, Omni Austin Hotel Downtown, Austin, TX, USA

Four Collocated Meetings Cover Optics and Photonics in Energy Generation and Conservation

NEW! Optical Instrumentation for Energy & Environmental Applications (E2)

Optical Nanostructures and Advanced Materials for Photovoltaics (PV)

Optics for Solar Energy (SOLAR)

Solid State and Organic Lighting (SOLED)

*Register for one meeting and attend any session in the Congress.

Wide Spectrum of Topics Present Optical Solutions for Renewable Energy

- Utilization of optical technologies to develop energy generation equipment
- Optical design and analysis of optics for solar and LED applications
- Instrumentation and optical sensors for energy management
- Methods to measure the impact on the environment
- Optical nanostructures and materials to improve efficiency of solar cells and solar concentrator systems
- Advances in solid state lighting in materials, devices and light management

Latest Advances in Solar and Solid-State Lighting

- **8 Plenary Speakers**
  - **New** - Pathways to Ultra-Efficient Solid-State Lighting
  - Mary H. Crawford, Sandia National Laboratories, USA
o Applying Systems Analysis to Innovation: Solar Energy  
Kevin DeGroat, Program Director, Antares Group, Inc., USA  
Joe Morabito, Director, Alcatel-Lucent, USA

o Theory and Practice for Nanophotonic Light Trapping  
Shanhui Fan, Stanford University, USA

o Sustainable Energy & Optical Methods for Monitoring Air Pollution  
Matthew Fraser, Global Institute of Sustainability, Arizona State Univ., USA

o Opportunities for Optical Designs in Driving Concentrating Photovoltaic Technology  
Sarah Kurtz, Interim NCPV Director, Reliability Group Manager, NREL, USA

o Army S&T Development: Selected Energy Solutions  
Ed Shaffer, Chief, Energy & Power Division, Army Research Laboratory, USA

o Promises and Challenges in Light-Emitting Diodes for High-Power Lighting Applications  
E. Fred Schubert and Jaehee Cho, Rensselaer Polytechnic Institute, USA

- 48 expert invited speakers from academia, industry and government
- 49 oral presentations on cutting edge research in the field
- 24 poster presentations
- Postdeadline paper sessions

Sponsor:

[OSA Logo]
Optics for Solar Energy (SOLAR)

2 November - 3 November 2011, Omni Austin Hotel Downtown, Austin, Texas, United States

Program

Agenda of Sessions, Abstracts and Key to Authors
Searchable Online Conference Program
Overview of Program
Conference at a Glance
Invited Speakers At-a-Glance

Program Overview

The focus of this meeting is on the optical components used to collect light and efficiently convert the collected light into usable forms of energy such as electricity or thermal energy for heating. Presentations at this meeting will cover the design of optical components and systems, modeling, integration of novel materials, manufacture, testing, field deployment, economic considerations, and application and test results. All forms of solar energy generation, transmission, and storage; from thermal to photovoltaic to novel methods will be covered in this forum.

Topics covered in this meeting include;

- Methods of energy generation (thermal, photovoltaic, solar hydrogen etc.)
- Concentrator photovoltaics (Fresnel lens, micro-optical, planar, cavity PV light guide, self-tracking, holographic concentrators, etc.)
- Energy storage technologies
- Tracking technologies
- Solar Cells and Materials used in solar energy applications
- Coatings: thin films and texturing
- Flexible and Conformal Optics
- Optics for spectrum splitting and holographic optics
- Solar Simulators/models
- Free form optics designs and other design approaches used in solar energy applications
- Optical effects in solar materials
- Energy generation /system cost

Online Conference Program

Searchable Conference Program Available Online!
• Browse speakers and the agenda of sessions.
• 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.

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.

Abstracts, Agenda of Sessions and Key to Authors

• Agenda of Sessions (pdf)
• Abstracts (pdf)
• Key to Authors and Presiders (pdf)

Special Events

Welcome Reception
Plenary Sessions
Poster Session
Post Deadline Sessions
Renewable Energy and the Environment

Optical Instrumentation for Energy & Environmental Applications (E2)
Optical Nanostructures and Advanced Materials for Photovoltaics (PV)
Optics for Solar Energy (SOLAR)
Solid State and Organic Lighting (SOLED)

2–3 November 2011
Omni Austin Hotel Downtown
Austin, Texas, USA
Welcome to the Optical Society of America's 2011 Renewable Energy and the Environment Optics and Photonics Congress (OPC) in Austin, Texas. This is the second year of this OPC, with the first being in Karlsruhe, Germany in 2010, but this year two meetings have joined the OPC. The four meetings being held at this Congress are:

- Solid State and Organic Lighting (SOLED; at Karlsruhe in 2010),
- Optics for Solar Energy (SOLAR; in Tucson in 2010),
- Optical Nanostructures and Advanced Materials for Photovoltaics (PV; at Karlsruhe in 2010), and
- Optical Instrumentation for Energy and Environmental Applications (E2; new meeting).

Though the primary focus of this meeting is renewable energy, especially solar, the topics are broadened to include solid-state and organic light sources and the connection between energy and the environment. In the solar arena the PV meeting presents how materials and nanostructures are being used to increase the efficiency of solar energy systems, while the SOLAR meeting addresses the optical design aspects of concentrators and similar optics for the generation of energy. SOLED tackles the source side of the efficient use of energy, including the materials, the optical design, and metrology of solid state and organic LEDs. Finally, E2 takes a look at how energy and environmental issues are intertwined, especially measurement methods, energy management, and the development of instrumentation.

The challenges for all energy optics fields are similar in a number of cases, so there are two joint plenary sessions with a total of seven speakers:

- **Applying Systems Analysis to Innovation: Solar Energy** – Kevin DeGroat, Program Director, Antares Group, Inc., USA and Joe Morabito, Director, Alcatel-Lucent, USA;
- **Theory and Practice for Nanophotonic Light Trapping** – Shanhui Fan, Stanford University, USA;
- **Sustainable Energy and Optical Methods for Monitoring Air Pollution** – Matthew Fraser, Global Institute of Sustainability, Arizona State Univ., USA;
- **Opportunities for Optical Designs in Driving Concentrating Photovoltaic Technology** – Sarah Kurtz, Interim NCPV Director, Reliability Group Manager, NREL, USA;
- **Energy & Power Science and Technology: An Army Perspective** – Ed Shaffer, Chief, Energy and Power Division, Army Research Laboratory, USA; and
- **Promises and Challenges in Light-Emitting Diodes for High-Power Lighting Applications** – E. Fred Schubert and Jaehee Cho, Rensselaer Polytechnic Institute, USA.

As can be seen, these speakers range from industry to academia to government, which gives an excellent overview of the burgeoning energy in optics field. These plenary sessions bring together all attendees of the OPC to present the current challenges for given topic areas, while also encouraging cross-development in other fields. In addition there are 48 invited speakers and 49 contributed papers. In the joint poster session there will be 24 presentations. Finally, postdeadline paper sessions are planned, for which the details will be provided in your registration packets.
We are already planning the 2012 through 2014 Renewable Energy and the Environment OPCs. In 2012 we will be meeting in Eindhoven, The Netherlands. If you are interested in assisting or have ideas for this OPC, please contact the meeting chairs, program committees, OSA staff or me.

Personally, I thank the chairs of the four collocated meetings (see below for a listing), their program committees, and the OSA staff. It could not have been done without your tireless efforts. A final thank you to you, the attendees – this conference is for you – I know that you will enjoy your stay to Austin, Texas.

Regards,

R. John Koshel
OSA Board of Meetings, Chair Elect
jkoshel@optics.arizona.edu

E2
John Koshel, Photon Engineering and Univ. of Arizona, USA, General Chair
Joseph A. Shaw, Montana State Univ., USA, General Chair

PV
Thomas Krauss, Univ. of St. Andrews, UK, General Chair
Ralf Wehrspohn, Fraunhofer Inst. for Mechanics of Materials and Martin-Luther-Univ. Halle- Wittenberg, Germany, Program Chair

SOLAR
Joseph Ford, Univ. of California at San Diego, USA, General Chair
Alan Kost, Univ. of Arizona, USA, General Chair
Raymond Kostuk, Univ. of Arizona, USA, General Chair

SOLED
Bernard Kippelen, Georgia Tech, USA, General Chair
Jiangeng Xue, Univ. of Florida, USA, General Chair
Ulrich Lemmer, Univ. Karlsruhe, Germany, Program Chair
Joachim Wagner, Fraunhofer Inst. for Applied Solid State Physics IAF, Germany, Program Chair
Dongxue (Michael) Wang, OSRAM, USA, Program Chair
Renewable Energy and the Environment Program Committee

Optical Instrumentation for Energy and Environmental Applications (E2)

General Chairs
John Koshel, Photon Engineering and Univ. of Arizona, USA
Joseph A. Shaw, Montana State Univ., USA

Committee Members
Ian Ashdown, ByHearts Consulting, Canada
Zuguang Guan, ALOMAR Observatory, Andoya Rocket Range AS, Norway
Mark Phillips, Pacific Northwest Natl. Lab, USA
R. Sai Santosh, Center for Nano Science and Technology, Italy
Greg Smestad, Sol Ideas, USA
Jeffrey R. Taylor, National Ecological Observatory Network (NEON), USA
Blair Unger, BLU Optics, USA
Michael Wojcik, Energy Dynamics Lab, USA
Gerard Wysocki, Princeton Univ., USA

Optical Nanostuctures and Advanced Materials for Photovoltaics (PV)

General Chair
Thomas Krauss, Univ. of St. Andrews, UK

Program Chair
Ralf Wehrspohn, Fraunhofer Inst. for Mechanics of Materials and Martin-Luther-Univ. Halle- Wittenberg, Germany

Committee Members
Lucio Claudio Andreani, Univ. degli Studi di Pavia, Italy
Kylie Catchpole, Australian Natl. Univ., Australia
Ihab El-Kady, Sandia Natl. Labs, USA
Falk Lederer, Friedrich-Schiller-Univ. Jena, Germany
Joachim Loos, Univ. of Glasgow, UK
Albert Polman, FOM Inst. AMOLF, Netherlands
Johannes Upping, Martin Luther Univ., Germany (Chair Helper)

Optics for Solar Energy (SOLAR)

General Chairs
Joseph Ford, Univ. of California at San Diego, USA
Alan Kost, Univ. of Arizona, USA
Raymond Kostuk, Univ. of Arizona, USA

Committee Members
Allen Barnett, Univ. of Delaware, USA
Kylie Catchpole, The Australian Natl. Univ., Australia
Martha Symko Davies, Natl. Renewable Energy Lab, USA
César Domínguez, Univ. Politécnica de Madrid, Spain

Solid State and Organic Lighting (SOLED)

General Chairs
Bernard Kippelen, Georgia Tech, USA
Jiangeng Xue, Univ. of Florida, USA

Program Chairs
Ulrich Lemmer, Univ. Karlsruhe, Germany
Joachim Wagner, Fraunhofer Inst. for Applied Solid State Physics IAF, Germany
Dongxue (Michael) Wang, OSRAM, USA

Committee Members - OLED
Chihaya Adachi, Kyushu Univ., Japan
Klaus Bonrad, Merck KGaA, Germany
Brian d’Andrade, Exponent, USA
Anil Duggal, GE, USA
Russell Holmes, Univ. of Minnesota, USA
Ioannis (John) Kymissis, Columbia Univ., USA
John de Mello, Imperial College London, UK
Hideyuki Murata, Japan Advanced Inst. of Science and Technology (JAIST), Japan
Franky So, Univ. of Florida, USA

Committee Members - LED
Hiroshi Amano, Nagoya Univ., Japan
Norbert Linder, OSRAM/Siemens, China
Yongio Park, Samsung LED, South Korea
U. T. Schwarz, Univ. Regensburg / Fraunhofer IAF, Germany
Seth Coe Sullivan, QD Vision, USA
C.C. Yang, National Taiwan Univ., Taiwan

Committee Members - Lighting Systems
Mike Lu, Acuity Brands Lighting, USA
Special Events

Opening Plenary Session
Wednesday, 2 November 2011, 08:00-10:00
Capital Ballroom A

Army S&T Development: Selected Energy Solutions

Future forces need alternatives and efficient conversion for resilient operations. Alternative energy, energy storage, and conversion technologies provide higher efficiency, higher density solutions adaptable to military requirements.

Ed Shaffer, Chief, Energy & Power Division, Army Research Laboratory, USA

Dr. Edward Shaffer is currently Director for the Sensors & Electronic Devices Directorate, Army Research Lab, overseeing development efforts in power and energy, electronics, and sensor technologies. Dr. Shaffer received the B.S. degree from the US Military Academy; the M.S. and E.E. degrees from the Massachusetts Institute of Technology; and the Ph.D. in Electrical Engineering from Auburn University. He served in a variety of technical and leadership positions as a US Army officer, including tours in Germany, Korea and the United Kingdom, and as an Associate Professor in the Department of Electrical Engineering & Computer Science at the US Military Academy.

Dr. Shaffer was also a Senior Design Engineer with Solectria Corporation in Woburn, MA. As Chief of the Energy & Power Division at ARL, he supervised efforts in high energy batteries, fuel cells, and continuous and pulsed wideband gap power electronic materials and devices. He is currently Lead of the US Army RDECOM Power and Energy Technology Focus Team, serves as senior Army representative on the OSD Energy and Power Community of Interest, and is Chair of the Interagency Power Group Steering Committee. His awards include the Legion of Merit; he is a Senior Member of IEEE and is a licensed Professional Engineer.

Pathways to Ultra-Efficient Solid-State Lighting

In this presentation, we review materials and device roadblocks to achieving ultra-efficient lighting based on inorganic LEDs. We present emerging research approaches for overcoming these roadblocks and enabling new functionality in lighting.

Mary H. Crawford, Sandia National Laboratories, USA

Mary Crawford is a Senior Scientist in the Semiconductor Material and Device Sciences Department at Sandia National Laboratories in Albuquerque, NM. She received a Ph.D. degree in physics from Brown University with a focus on excitonic effects and gain in ZnSe-based quantum wells and laser diodes. She joined Sandia National Laboratories in 1993 and worked on the development of novel vertical-cavity surface-emitting lasers (VCSELs), including AlInGaP red VCSELs and intracavity frequency-doubled VCSELs, and wide-bandgap nitride materials for UV LEDs.

In 2000, Dr. Crawford embarked on a two-year entrepreneurial leave and worked as Senior Scientist and Director of Research and Development at Uniroyal Optoelectronics in Tampa, FL. There she was involved in epitaxial growth and characterization of InGaN-based near-UV, blue, and green LEDs and led R&D to support new LED products. She returned to Sandia in 2002 and has continued research and development of nitride-based materials and optoelectronic devices. Her most recent studies involve AlGaN deep UV (< 340 nm) LEDs and laser diodes for applications including bioagent sensing and water purification, and spectroscopic studies of radiative and nonradiative processes in blue/green InGaN materials for solid-state lighting. She is presently on the senior leadership council of Sandia’s Energy Frontier Research Center on Solid-State Lighting Science and has co-authored more than 100 publications.
Applying Systems Analysis to Innovation: Solar Energy

A Systems Analysis for photovoltaics identifies positive reinforcements for solar development (global solar value creation). There are three high leverage points: photovoltaics and smart grids, photovoltaic industry supply chains, and pressure for sustainable development.

Joe Morabito, Director, Alcatel-Lucent, USA

Joe Morabito received his training in Materials/Engineering Science at Notre Dame with honors (B.S. 1963) and his Ph.D. from the University of Pennsylvania (1967). He then went, as a postdoctoral fellow, to the University of California at Berkeley (1968) and as a visiting scientist (1969) to the Philips Research Laboratories, Eindhoven, The Netherlands. He joined Bell Laboratories in 1970 and is the author of 81 publications and six patents covering a broad range of technology development for advanced telecommunications systems, business development, environmental sciences, and renewable energy. He received the Bell Labs Fellow Award in June, 2005. He has served on the editorial boards of Thin Solid Films and the Journal of Surface and Interface Science. He has also been active as a consultant to the National Science Foundation, the Electrical Power Research Institute (EPRI) and the Department of Energy in the area of solar energy, a member of the Industrial Advisory Council at Penn State, a member of the Advisory Committee of the EPA National Pollution Prevention Center at the University of Michigan, and the Advisory Committee on Environmental Health and Safety issues at the Oak Ridge National Laboratory and on the internal research programs at the National Renewable Energy Laboratory (NREL), the Board of Directors of the Research and Development Council of New Jersey, the Selection Committee for Industrial Ecology Grants by the AT&T Foundation and on the Advisory Board of the Multi-Lifecycle Engineering Research Center at the New Jersey Institute of Technology (NJIT). He is currently Senior Director of Integrated Robust Design and Compliance Engineering Center for Alcatel-Lucent - Bell Laboratories. He recently served as 2008 Chairman of the DOE Solar Energy Program.

Kevin DeGroat, Program Director, Antares Group, Inc., USA

Kevin DeGroat is Program Director for the Antares Group, Inc., a clean energy engineering firm in business since 1992. Mr. DeGroat has been a consultant on clean energy and environmental policy and research programs since 1985. His primary clients have been in the US Department of Energy Office of Energy Efficiency and Renewable Energy and the Office of Electricity Delivery and Energy Reliability, including the Solar Energy Technology Program, the Federal Energy Management Program, the Geothermal Technology Program, the Building Technologies Program and the Biomass Program. He has also worked with Sandia National Laboratory, the National Renewable Energy Laboratory and the California Energy Commission with a focus on research and development program planning and budgeting, research peer review, renewable energy market analysis, and technology roadmapping. His educational background includes graduate work at the University of Minnesota HHH Institute of Public Affairs focused on public policy with an energy and environmental technology core, and undergraduate study in Public Administration at Hamline University.
Introduction to Energy and Environmental Optics

10:30-11:15
Overview of Optical Remote Sensing Systems for Environmental Studies

Joseph A. Shaw, Electrical and Computer Engineering Department, Montana State University, USA.

Joseph Shaw is the Director of the Optical Technology Center, Professor of Electrical and Computer Engineering, and Affiliate Professor of Physics at Montana State University (MSU) in Bozeman, Montana. Previously he worked at the National Oceanic and Atmospheric Administration (NOAA) Environmental Research Labs in Boulder, Colorado. He earned a Bachelor of Science degree in electrical engineering from the University of Alaska – Fairbanks, a Master of Science degree in electrical engineering from the University of Utah, and a Master of Science and Ph.D. in Optical Sciences from the University of Arizona.

Dr. Shaw conducts research developing optical remote sensing systems and using them to study climate, weather, and atmospheric optical effects. His current research focuses on polarimetric and radiometric spectral imaging and lidar measurements of the natural Earth environment. He enjoys photographing natural optical phenomena and using his photos to understand and teach about optics and nature. Recognition for his work includes the Presidential Early Career Award for Scientists and Engineers and the Vaisala Award from the World Meteorological Organization. Dr. Shaw is a Fellow of both the Optical Society of America (OSA) and SPIE.

11:15 -12:15
Applied Photometry, Radiometry, and Measurements of Optical Losses: Systems, Methods, Techniques for Energy and Environmental Applications

Part 1, Direct Approaches 11:15-11:45
Part 2, Remote Studies 11:45-12:15

Michael A. Bukshtab, Michael A Bukshtab Consulting, USA.

Michael A Bukshtab received M.S. and Ph.D. degrees in Optical Design and Spectroscopy and in Physical Optics from The Technical University of Fine Mechanics & Optics and from Vavilov’ State Optical Institute, and had post-doctoral tenure analyzing high-purity silica glasses & specialty fibers in The Institute of Silicate Chemistry, Academy of Sciences - all in St. Petersburg (Leningrad), Russia. His M.S thesis received Best-Diploma award among nearly 30 Leningrad's technical universities and was published in “Measurement Techniques” in 1978. Michael's monograph “The Low Loss Measurement Techniques”, was published in 1988 by Energoatomizdat, Moscow-Leningrad. Another book: M.A. Bukshtab, A. S. Doynikov, and V. N. Koromischenko, "Photometry and Radiometry for Engineers" (editors M. A. Bukshtab and A. A. Wolkenstein) by Polytechnika, Leningrad (St. Petersburg), 1991, was announced for publication, proofs were printed, but manuscript was left unpublished, as Michael immigrated to the USA. Michael was elected by employees the Board Chairman of Leningrad Institute of Telecommunications, where he served from 1989 until immigrating in 1991. In USA Michael worked on design, development, and fabrication of optical systems and components for such companies as Sandoz, Corning, Pirelli, Kodak, CIENA, Lucent, and GE Advanced Materials. Michael latest experience via Michael A Bukshtab Consulting includes investigation of various optical properties: detection of color-shifting, polarization-dependent, backreflection, backscattering and other low-loss related phenomena, designing all-optical wavelength-switching and cross-connect systems and OADM networks, working on terabit optical routers and fiber backplanes, investigating EUV lithography systems, interferometric and diffraction-based positioning sensors, improving fiber-laser and EDFA-based air-to-ground ranging lidars. Michael has either authored or co-authored more than 30 Patents or Invention Certificates and participated in more than 70 Scientific Publications and Conference Presentations: book Applied Photometry, Radiometry, and Measurements of Optical Losses is being published in Springer Series in Optical Sciences.
Shanhui Fan is an Associate Professor of Electrical Engineering at the Stanford University. He received his Ph.D in 1997 in theoretical condensed matter physics from the Massachusetts Institute of Technology (MIT), and was a research scientist at the Research Laboratory of Electronics at MIT prior to his appointment at Stanford. His research interests are in computational and theoretical studies of solid state and photonic structures and devices, especially photonic crystals, plasmonics, and meta-materials. He has published over 220 refereed journal articles that were cited over 13,000 times, has given over 170 invited talks, and was granted 39 US patents. Prof. Fan received a National Science Foundation Career Award (2002), a David and Lucile Packard Fellowship in Science and Engineering (2003), the National Academy of Sciences Award for Initiative in Research (2007), and the Adolph Lomb Medal from the Optical Society of America (2007). Dr. Fan is a Fellow of the American Physical Society, the Optical Society of America, the SPIE, and the IEEE.

Prof. Matt Fraser is the Director of Research Development in the Global Institute of Sustainability (GIOS) at Arizona State University (ASU) as well as an Associate Professor in the School of Sustainability (SOS) at ASU. In leading the research development team at GIOS, Dr. Fraser is directly involved in initiating and promoting interdisciplinary research projects across ASU and building teams of researchers to respond to the grand challenges of global sustainability. The research portfolio at GIOS is valued at approximately $10M per year and spans renewable energy and energy efficiency, water sustainability and climate, urban ecology and ecosystem services and international development and social sustainability.

As a faculty member, Dr. Fraser directs his own research projects on urban air quality. Dr. Fraser’s research focuses on using organic speciation and receptor modeling to apportion ambient pollutants to their original source. To tackle this complex problem, Dr. Fraser’s research group has been involved in field monitoring programs, source characterization studies, emission inventory preparation, and analytical method and instrument development projects.

Recently, Prof. Fraser has worked to initiate a series of research grants on the sustainability of energy systems, including:

- **Energize Phoenix** – a $25M collaborative effort between the City of Phoenix, Arizona State University and Arizona Public Service to catalyze an energy efficient culture in central Phoenix (funded by US Dept. of Energy)

- **The Green Apple Study** investigating the indoor air quality and health outcomes of energy efficiency retrofits with the specific goal of quantifying how sealing a building envelope impacts indoor air pollution and associated health effects (funded by US Dept. of Housing and Urban Development)

Dr. Fraser received his Bachelors of Science (with University Honors) in Chemical Engineering from Carnegie Mellon University and his Masters and Ph.D. in Environmental Engineering Science from Caltech. Prior to joining the School of Sustainability at ASU, Prof. Fraser was on the faculty of Rice University in the Department of Civil and Environmental Engineering.
Special Events continued

09:00
Opportunities for Optical Designs in Driving Concentrating Photovoltaic Technology

Sarah Kurtz; Interim NCPV Director, Reliability Group Manager, NREL, USA.

Sarah Kurtz obtained her PhD in 1985 from Harvard University and has worked since then at the National Renewable Energy Laboratory, in Golden, CO. She is best known for her contributions to developing multijunction, GaInP/GaAs solar cells and for supporting the Concentrator Photovoltaic (PV) industry. Currently, she is managing the Reliability Group at NREL and working to facilitate the growth of the PV industry through improved performance of PV in the field.

09:30
Promises and Challenges in Light-Emitting Diodes for High-Power Lighting Applications

E. Fred Schubert; Rensselaer Polytechnic Institute, USA.

E. Fred Schubert is the Wellfleet Senior Constellation Professor at Rensselaer Polytechnic Institute. He made pioneering contributions to the field of compound semiconductor materials and devices, particularly to the doping of compound semiconductors and to the development and understanding of light-emitting diodes. He authored the books *Doping in III–V Semiconductors* (1992), *Delta Doping of Semiconductors* (1996), and *Light-Emitting Diodes* (1st edition 2003 and 2nd edition 2006). He is co-inventor of more than 30 US patents and co-authored more than 300 publications. He is a Fellow of the APS, IEEE, OSA, and SPIE and has received several awards.

Postdeadline Papers Presentations

The committees of E2, SOLAR and SOLED accepted post-deadline papers for presentation. The purpose of postdeadline session is to give participants the opportunity to hear new and significant materials in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timelines were accepted.

For more information, including the schedule and locations see the Update Sheet with copies of the Postdeadline papers attached.

Joint Postdeadline Paper Session
Wednesday, 17:00-18:00
Senate Room
**Agenda of Sessions — Wednesday, 2 November**

<table>
<thead>
<tr>
<th>Time</th>
<th>Senate</th>
<th>Austin North</th>
<th>Capital Ballroom A</th>
<th>Austin South</th>
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<tr>
<td>07:00–18:00</td>
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<td>Registration Open</td>
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<tr>
<td>08:00–10:00</td>
<td>JWA • Renewable Energy Plenary Session, Capital Ballroom A</td>
<td>Esther Hoffman Beller Award Presentation</td>
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<tr>
<td>10:00–10:30</td>
<td>Coffee Break, Capital Ballroom Foyer</td>
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<tr>
<td>10:30–12:30</td>
<td>SRWB • CPV Systems (Ends at 12:00)</td>
<td>SDWB • Novel OLED Materials</td>
<td>PWB • Photon Management in Solar Cells: Dielectric Nanostructures I</td>
<td>EWB • Introduction to Energy and Environmental Optics TUTORIAL (Ends at 12:15)</td>
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<tr>
<td>12:30–14:00</td>
<td>Lunch (on your own)</td>
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<tr>
<td>14:00–16:00</td>
<td>SRWC • CPV Design and Components</td>
<td>SDWC • OLED Device Physics</td>
<td>PWC • Photon Management in Solar Cells: Dielectric Nanostructures II</td>
<td>EWC • Sensors for Atmospheric Trace Gases and Aerosols</td>
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<tr>
<td>16:00–16:30</td>
<td>Coffee Break, Capital Ballroom Foyer</td>
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<tr>
<td>16:30–18:00</td>
<td>Joint Postdeadline Paper Session (Starts at 17:00)</td>
<td>SDWD • Quantum Dot LED's (Ends at 17:30)</td>
<td>PWD • Photon Management in Solar Cells: Plasmonic Nanostructures</td>
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<tr>
<td>18:00–19:00</td>
<td>JWE • Joint Poster Session, Capital Ballroom B</td>
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<td>19:15–20:30</td>
<td>Conference Reception, Six Lounge</td>
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**Key to Conference Abbreviations**

- **E2** Optical Instrumentation for Energy & Environmental Applications
- **PV** Optical Nanostructures and Advanced Materials for Photovoltaics
- **SOLAR** Optics for Solar Energy
- **SOLED** Solid State and Organic Lighting
# Agenda of Sessions — Thursday, 3 November

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<tr>
<th>Time</th>
<th>Senate</th>
<th>Austin North</th>
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<tr>
<td>07:00–17:00</td>
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<tr>
<td>8:00–10:00</td>
<td>JThA • Joint Congress Plenary Session, Capital Ballroom A</td>
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<td>10:00–10:30</td>
<td>Coffee Break, Capital Ballroom Foyer</td>
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<tr>
<td>10:30–12:30</td>
<td>SRThB • Planar Optical Concentrators and High Efficiency Concepts</td>
<td>SDThB • LED Materials and Devices</td>
<td>PThB • Nanostructured Materials with Enhanced Efficiency</td>
<td>ETHB • Optical Design of Components and Subsystems for Energy and Environment (Ends at 12:15)</td>
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<td>12:30–14:00</td>
<td>Lunch (on your own)</td>
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<td>14:00–16:00</td>
<td>See Joint PV/Solar Capital Ballroom A</td>
<td>SDThC • Novel Devices and Lighting Systems (Ends at 15:30)</td>
<td>JThC • Joint PV/Solar Concepts of Light Trapping and Photon Transport</td>
<td>ETHC • Laser Systems for Trace Gas Sensing and Combustion Diagnostics (Ends at 16:15)</td>
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<td>16:00–16:30</td>
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<td>16:30–18:30</td>
<td>PThD • Photon Management in Organic Solar Cells</td>
<td>EThD • Testing and Development of Solar Energy Systems and Materials</td>
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## Key to Conference Abbreviations

- **E2**  Optical Instrumentation for Energy & Environmental Applications
- **PV**  Optical Nanostructures and Advanced Materials for Photovoltaics
- **SOLAR** Optics for Solar Energy
- **SOLED** Solid State and Organic Lighting
A new technology, Luminescent Solar Concentrators (LSCs), has emerged as a promising alternative to traditional solar panels. While solar panels convert sunlight directly into electricity, LSCs use a thin film of luminescent material to concentrate sunlight and absorb the energy before converting it into electricity. This technology has the potential to increase energy efficiency by up to 100% and is particularly useful in areas with low sunlight intensity.

Recent advancements in this field have focused on improving the efficiency and performance of LSCs. One notable development is the use of quantum dots (QDs) as the luminescent material in LSCs. QDs are nanoscale crystals that can absorb and emit light with high efficiency. By using QDs, researchers have been able to achieve higher optical yields and improved energy conversion rates.

Another area of progress is in the development of new luminescent materials that can absorb a broader range of wavelengths, allowing LSCs to capture more sunlight and increase their energy yield. Scientists are also exploring the use of self-assembly techniques to create highly efficient and stable LSCs.

In addition to these advances, there is a growing interest in integrating LSCs into building materials, such as windows and roofing, to create sustainable and energy-efficient structures. The modular design of LSCs also makes them suitable for retrofitting existing buildings, offering a cost-effective and scalable solution for renewable energy generation.

Overall, the progress in Luminescent Solar Concentrators is encouraging, and these technologies have the potential to revolutionize the field of renewable energy. As research continues, we can expect to see further improvements in efficiency, cost-effectiveness, and the integration of LSCs into everyday applications.
SRWB • CPV Systems—Continued

High Efficiency Solar Cells at Solar Junction, Human Yuens1; Solar Junction, USA. Solar Junction has adopted the lattice matched dilute nitride material system to overcome today's multi-junction technology limitations. Advantages of this technology to CPV systems and the achievement of 43.5% efficiency will be discussed.

SRWB3 • 11:30  Invited

Homan Yuen1; High Efficiency Solar Cells at Solar Junction, Solar Junction, USA.

*Continued*
Wednesday, 2 November

## Senate

### Optics for Solar Energy

14:00–16:00

**SRWC • CPV Design and Components**

Raymond Kostuk; University of Arizona, United States, Presider

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## Austin North

### Solid State and Organic Lighting

14:00–16:00

**SDWC • OLED Device Physics**

Bernard Kippelen; Georgia Tech, United States, Presider

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## Capital Ballroom A

### Optical Nanostructures and Advanced Materials for Photovoltaics

14:00–16:00

**PWC • Photon Management in Solar Cells: Dielectric Nanostructures II**

Thomas Krauss; University of St. Andrews, United Kingdom, Presider

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## Austin South

### Optical Instrumentation for Energy & Environmental Applications

14:00–16:00

**EWC • Sensors for Atmospheric Trace Gases and Aerosols**

Joseph Shaw; Montana State University, United States, Presider

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### Notes

- **SRWC1 • 14:00** Invited
  - A CPV Thesis, David Schultz; Banyan Energy, Inc., USA. The viability of a concentrator modular scale technology is determined by five interrelated factors: economic benefit, cell performance under concentration, thermal management, optical performance and manufacturability.

- **SRWC2 • 14:30**
  - Lenticulated Köhler Integrator for a Utility-Scale CPV System, Brian Wheeler; College of Optical Sciences, University of Arizona, USA. This paper presents a novel design of a solar secondary optics used in a dish-based HCPV system with 1D and 2D photonic patterns. Absorbance and short-circuit current density are calculated with scattering matrix formalism and compared with Lambertian limits.

- **SRWC3 • 14:45**
  - Design, Optimization and Characterization of Secondary Optics for a Dish-Based 1000x HCPV System, I. Guillaume Bui; Tom Connor, Blake Coughanour, and Roger Angel; College of Optical Sciences, University of Arizona, USA; Steward Observatory, University of Arizona, USA. This paper presents a novel design of a solar secondary optics used in a dish-based HCPV system at 1000x. Different optimizations were conducted as well as experiments to determine its optimum configuration.

- **SRWC4 • 15:00** Invited
  - Materials for Fresnel Lenses in Concentrating Photovoltaics, Balf Leutz; Concentrator Optics, GMBH, Germany. Abstract Fresnel lenses for CPV are made of PMMA or silicone-on-glass (SOG). We discuss these optical materials in terms of spectral transmissivity, refractive index, longevity, bankability and cost. Thermal expansion is most critical.

- **SDWC1 • 14:00** Invited
  - Organic Electronics: A World of Interfaces, Antonio Kahle; Princeton University, USA. The talk gives an overview of the definition and measurement of molecular energy levels that are central to carrier injection into and, transport through, organic-based devices. [1] J. Hwang et al. Materials Science and Engineering, R 64, 1-31 (2009)

- **SDWC2 • 14:30**
  - Multiperiod Gratings in a High Reflective Index Material for Enhanced OLED Outcoupling, Arfat Pradana; Integrated Systems and Photonics, Christian-Albrechts-Universität zu Kiel, Germany. We produce multiperiod gratings in Ta2O5 using nanoimprint lithography in combination with RIE. The photoluminescence spectrum of an emitter layer on a multiperiod grating is demonstrated to exhibit multiple peaks of enhanced emission.

- **SDWC3 • 14:45**
  - Highly Efficient Blue Electrophosphorescent Device Using a Weak Electron Transporting Material, Lixin Xiao; Boyuan Qi; Xing Xing; Zhiqian Chen; Bo Qi; Qihuang Gong; Peking University, China. Over 30% external quantum efficiency of blue electrophosphorescence is achieved by employing a weak electron transporting material. It shows an alternative way to design materials for blue electrophosphorescent devices.

- **SDWC4 • 15:00**
  - Conductive Low-Index Layer: A New Opportunity for Outcoupling Enhancement in OLEDs, SeungHyup Yoo; Electrical Engineering, Korea Advanced Institute of Science and Technology, Republic of Korea. A novel electrode structure utilizing low-index properties of conductive polymers is explored for outcoupling enhancement in OLEDs.

- **PWC1 • 14:00**
  - Light Trapping in Thin Film Silicon Solar Cells with Mono and Bidimensional Photonic Patterns, Angelo Bozoko; Marco Luciscio; Lucio C. Andreani; University of Pavia, Italy. We investigate light trapping in thin film silicon solar cells with 1D and 2D photonic patterns. Absorbance and short-circuit current density are calculated with scattering matrix formalism and compared with Lambertian limits.

- **PWC2 • 14:15**
  - Optimization of Silicon Solar Cells using Backside Diffraction Gratings, Markus Wellenzohn; Rainer Haineberger; Health & Environment Department, Nano Systems, AIT Austrian Institute of Technology GmbH, Austria. This numerical study investigates the influence of backside diffraction gratings on the efficiency of silicon solar cells. In particular, the dependence of the optimum grating period and modulation depth on the silicon thickness is determined.

- **PWC3 • 14:30** Invited
  - Decreasing the Thickness of Crystalline-Silicon Solar Cells below 40 µm and Increasing their Light Absorption with Surface Nanостructures, Valérie Depauw; Ounsi El Daif; Dries Van Gestel; Pieter Bienstman; Thomas Apedaile; Malaysia. The thickness of crystalline silicon solar cells thinner than 40 µm down to 1 µm are presented, together with the integration of three nanostructuring schemes - texturing, photonic crystals, plasmons - to boost their light absorption.

- **PWC4 • 15:00**
  - Combining Front and Back Grating Structures for Broadband Absorption Enhancement in Thin-Film Silicon Solar Cells, Atos Abass; Khae Q. Le; Peter Bienstman; Andrea Als; Bjorn Maex; Marc Bergelman; Department of Electronics and Information Systems, Ghent University, Belgium; Department of Electrical and Computer Engineering, The University of Texas at Austin, USA; Department of Information Technology, Ghent University-imec, Belgium; Department of Physics, University of Mons, Belgium. We investigate the possibilities of enhancing absorption in thin-film silicon solar cells with grating structures on the front ITO and back Ag contacts simultaneously. Broadband enhancement from complementary effects of each grating is demonstrated.

- **EWC3 • 14:30** Invited
  - Spectroscopic Instruments for Airborne Measurements of Atmospheric Trace Gases, Alan Fried; Dirk Richter; Peter Weibring; James Marple; Scott Spuler; Matthew Teichmann; National Center for Atmospheric Research, USA; Applied Physics Group, National Security Division, Pacific Northwest National Laboratory, USA. Investigators at the National Center for Atmospheric Research have developed and deployed a state-of-the-art instrument based upon difference frequency generation absorption spectroscopy to carry out such investigations on various airborne platforms.

- **EWC4 • 15:00**
  - Atmospheric Vertical Profiling of Multiple Chemicals with an External Cavity Quantum Cascade Laser Heterodyne Radiometer, Tracy Teat; Damien Wiedmann; Neil Nadon; Rebecca Ruse; Gerard Wysokki; Electrical Engineering, Princeton University, USA; Space Science and Technology, STFC Rutherford Appleton Laboratory, United Kingdom. We present a 60 MHz resolution ground-based EC-QCL heterodyne radiometer capable of spectroscopic sensing of five molecules. High spectral resolution allows for retrieval of vertical atmospheric concentration profiles from transition lineshapes.
SRWC • CPV Design and Components—Continued

SRWC5 • 15:30
Defining System Conversion Efficiency for Dish-Based Solar Concentrator PV, Blake Coughenour1, Guillaume Butel1, Roger Angel1,2; 1College of Optical Sciences, The University of Arizona, USA; 2Steward Observatory, The University of Arizona, USA. Concentrator system conversion efficiency may be characterized by using measurements of the optical components. Techniques of characterizing radiometric throughput via geometric ray shadowing, optical efficiency, and cell efficiency are presented.

SDWC • OLED Device Physics—Continued

SDWC5 • 15:30
Efficient Green and Blue Electrophosphorescent Light Emitting Diodes using a Combination of Solution and Vacuum-Processed Materials, Wojciech Haskó1, Sung-Jin Kim1,2, Denie Cal1,2, Ehsan M. Najafabadi1,2, Canek Fuentes-Hernández1,2, Bernard Kippelen1,2, Julie Leroy1,2, Carlos Zuniga1,2, Yadong Zhang1,2, Annabelle Scarpaci1,2, Huifang Li1,2, Lingyun Zhu1,2, John S. Sears1,2,3, Stephen Barlow1,2,3; 1School of Electrical and Computer engineering, Georgia Institute of Technology, USA; 2School of Chemistry and Biochemistry, GA Institute of Technology, USA; 3Center for Organic Photonics and Electronics, GA Institute of Technology, USA. We report two efficient white OLED structures with efficacy up to 100 lm/W. One structure involves using three different emitters in the same emitting layers, while the other integrates a blue-emitting OLED with down-conversion phosphors.

SRWC6 • 15:30
Concentrating Photovoltaic Systems Using Micro-Optics, William Sweatt1, Greg Nielson1,2, Marat Okandan1; 1Sandia National Lab, USA; 2Sandia National National Lab, USA. Molded plastic micro-opts with 100x solar gain are described. A ±40 acceptance cone is allowed so the lens arrays can be mounted on one-axis heliostats and give achromatic, stationary images on photo-voltaic cells.

SDWC6 • 15:30
High Efficiency White Organic Light-Emitting Devices, Sang-Hyun Eom1,2, Edward Wrzesinski1,2, Jaewon Lee1, Neetu Chopra1, Debasis Bera1, Paul Holloway1, Franky So1, Jangseong Xue1,2; 1Materials Science and Engineering, University of Florida, USA. We report two efficient white OLED structures with efficacy up to 100 lm/W. One structure involves using three different emitters in the same emitting layers, while the other integrates a blue-emitting OLED with down-conversion phosphors.

PWC • Photon Management in Solar Cells: Dielectric Nanostructures II—Continued

PWC5 • 15:15
A Full Scalar Scattering Model for Nano-Textured Interfaces, Klaus Jäger1, René van Swaaij1, Miro Zeman1, Miro Zeman; 1Photovoltaic Devices and Materials, Delft University of Technology, Netherlands. We present a full scattering model for nano-textured interfaces as they are present in thin film silicon solar cells. The model is based on the scalar scattering theory and predicts measured scattering parameters well.

PWC6 • 15:30
Invited
Advanced Nanostructured Materials for Pushing Light Trapping Towards the Yablonovitch Limit, Moritz Schröder1,2,3,4,5,6; 1Center for Organic Photonics and Electronics, GA Institute of Technology, USA; 2School of Chemistry and Biochemistry, GA Institute of Technology, USA; 3Center for Organic Photonics and Electronics, GA Institute of Technology, USA; 4Center for Organic Photonics and Electronics, GA Institute of Technology, USA; 5Center for Organic Photonics and Electronics, GA Institute of Technology, USA; 6Center for Organic Photonics and Electronics, GA Institute of Technology, USA. We present a full scattering model for nano-textured interfaces as they are present in thin film silicon solar cells. The model is based on the scalar scattering theory and predicts measured scattering parameters well.

EWC • Sensors for Atmospheric Trace Gases and Aerosols—Continued

EWC5 • 15:15
Environmental Ammonia Monitoring for Urban and Rural Areas of Texas using an EC-QCL based Sensor Platform, Rafal Lewicki1, Longwen Gong1, Robert Griffin1, Timothy Day2, Frank K. Tittel1; 1Electrical and Computer Engineering, Rice University, USA; 2Civil and Environmental Engineering, Rice University, USA. Results of continuous, recent, long-term atmospheric ammonia measurements obtained in Houston and a rural area of Dallas/Fort Worth with a 10.4 μm EC-QCL based amplitude modulated photo-acoustic spectroscopy sensor platform, will be reported.

EWC6 • 15:30
Invited
Measuring Atmospheric Carbon Dioxide from Space: The GOSAT and OCO-2 Missions, David Crisp1,2; 1Jet Propulsion Laboratory, California Institute of Technology, USA; 2Jet Propulsion Laboratory, California Institute of Technology, USA; 3Center for Ocean-Land-Atmosphere Studies, United States of America. The NASA Orbiting Carbon Observatory-2 Mission will build on this record with increased sensitivity, resolution and coverage.
16:30–17:30
SDWD • Quantum Dot LEDs
Seung-Hyo Yoo; Korea Advanced Institute of Science and Technology, South Korea, Presider

SDWD1 • 16:30
Steady Progress of Collodion Quantum Dot LED (QLED) Technologies, Vladimir Bulovic1; Electrical Engineering and Computer Science, M.I.T., USA. State of the art collodion quantum dot LED structures are advancing both the QLED efficiencies and the operating lifetimes. The talk will contrast advantages of DC-driven and AC-driven QLED structures.

SDWD2 • 17:00
Quantum Dot Based Light Emitting Diodes, Changhee Lee1; Seoul National University, Democratic People's Republic of Korea. Quantum dots (QDs) have attractive properties for full-color displays and solid-state lightings. Here, we present several approaches for improving the performance of QD-LEDs. In addition, we present a versatile QD patterning method that can allow well-defined 1nm-scale patterns, leading to the realization of high-resolution, full-color QD displays.

17:00–18:00 JWD • Joint E2/SOLAR/SOLED Postdeadline Session, Senate (see page 25)

Capital Ballroom A

16:30–18:00
PWD • Photon Management in Solar Cells: Plasmonic Nanostructures
Thomas Krauss; University of St. Andrews, UK, Presider

PWD1 • 16:30
Plasmonic and High Dielectric Constant Nanostructures for Light Trapping, Mark Brongersma1; Stanford University, USA. Nanometric and high index dielectric nanostructures have gained significant interest for their ability to boost the energy conversion efficiency of photovoltaic cells. I will discuss recent progress in the development of such structures.

PWD2 • 17:00
A Polarization-Independent Wavelength-Tuned Metamaterial for Solar Energy Applications, Eli Lansey1, Jonah Gollub2, Thomas L. James1, David T. Crouse1; Physics, GC and CCNY, City University of New York, USA; Phonon Optoelectronics, USA; Electrical Engineering, The City College of New York, USA. We present simulations of a polarization-independent, L-shaped cavity metamaterial using finite element techniques. These structures concentrate light in the cavities and have applications in high-efficiency solar energy devices.

PWD3 • 17:15
Absorption Enhancement in Guided-Mode Resonant Hydrogenated Amorphous Silicon Thin-Film Solar Cells, Tszinna Khaleque1, Jaewoong Yoon1, Wenhua Wu1, Robert Magnusson1; Electrical Engineering, University of Texas at Arlington, USA. We present measured absorption characteristics of GMR hydrogenated amorphous silicon (a-Si:H) thin-film solar cells. About 22% integrated absorption enhancement compared to planar reference solar cell is observed for 450-730nm wavelength range.

PWD4 • 17:30
Role of Nanostructures on the Performance of a Si:H Solar Cells, Jeevun Kwon1, IBM T.J. Watson Research Center, USA. This paper represents a method to enhance efficiency of a-Si:H solar cells by using nanostructures. The role of plasmonic nanoparticles as well as nanotemplates on the performance of a-Si:H solar cell will be discussed.

18:00–19:00 JWE • Joint Poster Session

Capital Ballroom B

JWE1 Solar Energy Concentrators and their Optimization and Analysis with the OptisWorks Solar Package, Günther Hasn1; OPTIS, France. Optis has developed tools put together in the OptisWorks Solar Package which can change the sun position by macros calculating and optimizing the efficiency of such concentrators based on reflective or refractive materials.

JWE2 LED Phosphor Modeling and Color Optimization in OptisWorks, Günther Hasn1; OPTIS, France. OPTIS has developed in OptisWorks an editor for LED phosphor dyes which take into account physics based measureable spectra information as well as the volume scattering by the Hyeney-Greenstein equations.

JWE3 Design Method of High Efficient LED Freeform Optical System for Aeronautical Ground Light, Shang Wang1, Fei Chen1, Quan Chen1, Zhili Zhao1, Zong Qin1, Sheng Liu1; State Key Laboratory of Solid State Lighting, University of Electronic Science and Technology of China. We propose an optimization method of optical design in brief. A high-efficient LED chip array packaging (LCAP) based freeform optical system of runway center line light which can fully comply with the ICAO regulation has been design.

JWE4 Process Development for Carbothermal Reduction and Nitridation Synthesis of alpha-SiAlON Phosphor, Shyan-Lung Chung1, Shu Chi Huang1; Chemical Engineering, National Cheng Kung University, Taiwan. When doping with Eu2+ as an activator, optical adsorption from 420 to 650nm was observed. By using a light at 380 nm as an excitation source, a luminescent radiation from 220 to 500nm.

JWE5 13.6-N-sulfanylacetamidopentacene based Fully Encapsulated Low Voltage Vertical Short Channel OFET, Munish Puri1, Sanjukta Bhanja1; 1Ming Hsieh Department of Electrical Engineering, University of Southern California, USA. We study broadband absorption in semiconductor nanowire arrays made of several common photovoltaic materials. We optimize the structural parameters to determine how the maximum achievable efficiency depends on nanowire height.

JWE6 Broadband Absorption Enhancement in Vertical Silicon Nanowire Arrays with Random Position for Photovoltaic Applications, Qing Guo Du1, Chunlin Kim1, Xiaowei Sun1; Nanyang Technological University, Singapore. The optical properties of ordered and random silicon nanowire arrays are investigated using finite-difference time-domain method. Position randomization with filling ratio larger than 36% renders better absorptance than regular structures.

JWE7 Surface Passivation of Black Silicon by Thermal ALD Deposited Aluminum Oxide, Martin Otto1, Matthias Kroll1, Thomas Käsebier1, Marcus Ernst1, Roland Salzer1, Ralph W. Welzphon1; µMD group - Institute of Physics, Martin Luther University Halle-Wittenberg, Germany; Institute of Applied Physics, Friedrich Schiller University Jena, Germany; Institut für Solarenergieforschung Hameln ISFH, Germany; Fraunhofer Institute for Mechanics of Materials IWM, Germany. Black silicon (bSi) surfaces can be effectively passivated by thermal ALD. The nanowires with aspect ratios up to 10 show excellent anti-reflective and light-trapping properties with absorption in the visible spectrum of over 97%.

JWE8 Scattering Loss Reduction in Sub-wave Length Gratings for Solar Cell Applications, Emiliano R. Martin1, Juntao Li1, Abdul Shakoor1, Thomas Krauss1; Physics and Astronomy, University of St. Andrews, United Kingdom. We propose a simple post-fabrication treatment aiming at scattering loss reduction in silicon sub-wave length gratings. The gratings lines are smoothed by the treatment and the measured responses indicate a reduction in the scattering losses.

JWE9 Optimization of Broadband Absorption in Semiconductor Nanowire Arrays for Photovoltaic Applications, Ningfeng Huang1, Chanhin Kam1, Xiaowei Sun1; Energy Science and Technology, University of Southern California, USA. We study broadband absorption in semiconductor nanowire arrays made of several common photovoltaic materials. We optimize the structural parameters to determine how the maximum achievable efficiency depends on nanowire height.
NEON’s Fundamental Instrument Unit must be implemented. A wave-length interrogation system using a micro-ring resonator device and based on a time interval between peaks method is presented experimentally using a tunable laser source. A simulation is also presented which agrees with experimental results.

JWE19 Wireless Sensor Networks for Monitoring of Atmospheric Chemicals, Won Wang1, Clinton Smith2, Stephen Seo1, Egie Bou-Zeid1, Gerard Wysocki1; 1Electrical Engineering, Princeton University, USA; 2Sentinel Photonics Inc., USA; 1Environmental Engineering, Princeton University. USA. To study the transport of trace gases in the atmosphere, a wireless sensor network (WSN) of chemical sensor nodes can be implemented. In this work we present a basic three-node WSN for atmospheric CO2 monitoring.

JWE20 Efficiency of Wide-Angle Lens as a Virtual Tracking System, Sébastien Bouchara1, Simon Thibault1; 1COFI, Université Laval, Canada. We simulated a wide-angle lens to act as a “virtual” tracker and a lens having a very narrow field of view to obtain boundaries for the efficiency of an arbitrary optical tracker.

JWE21 Trap-states Influence on Transient Electroluminescence of CBP(1rppy)(3)-based Organic Light Emitting Diodes, Kenichi Kasaahara1, Takeaki Saito1, Akira Yamazaki1; 1Ritsumeikan University, Japan. The overshoot of CBP(1rppy)(3)-based phosphorescent organic light emitting diodes was large under a negative bias voltage, different from previously reported results. This was probably caused by trap states formed in carrier-injecting organic layers.

JWE22 Cu, CaO, and Cu2O Nanoparticle Plasmons for Enhanced Scattering in Solar Cells, Jagmeet S. Sekhon1; 1Physics, SLIET Longowal, India. Copper oxide (Cu) nanosphere compete with Cu for better scattering response under some parametric conditions viz. size, embedding medium, and localized surface plasmon resonance wavelength region for plasmonic solar cells.

JWE23 Transfer-Matrix Method for Optical Multilayer Systems: Application to Solar Cells, Nikolai I. Petrov1, Victor Danilov2, Boris Ustievich1; 1Russia R&D Lab, LG Electronics, Russian Federation; 2General Physics Institute, Russian Federation; 3Physics Faculty, Moscow State University, Russian Federation. Electromagnetic simulations of multilayer structure are carried out using the transfer-matrix method. Reflectance, quantum efficiency and short-circuit current density for periodic and random boundary surfaces are calculated.

JWE24 Spectroscopic Investigation of Nd3+-doped ZBLAN Glass for Solar Pumped Lasers, Takemori Suzuki1, Hiroki Kaway1, Hiroki Naou1, Shintaro Mizuno1, Hiroshi Itu2, Kazuo Hasegawa2, Yutaka Ohishi3; 1Toyota Technological Institute, Japan; 2Toyota Central R&D Labs. Inc., Japan. We clarified that Nd3+-doped ZBLAN glass would be a promising material for solar pumped laser applications due to its high quantum efficiency for sunlight, large stimulated emission cross-section, long emission lifetime and broad absorption bands.
08:00-10:00  JThA • Joint Plenary Session  
Bernard Kippelen; Georgia Tech, United States, Presider

JThA1 • 08:00  
Theory and Practice for Nanophotonic Light Trapping, Shanhui Fan; Stanford University, USA. We present studies of light management in solar cells from a rigorous electromagnetic perspective. We discuss the statistical temporal couple theory formalism, and the practical considerations to achieve simultaneously light trapping and anti-reflection.

JThA2 • 08:30  
Sustainable Energy & Optical Methods for Monitoring Air Pollution, Matthew Fraser; Global Institute of Sustainability, Arizona State University, USA. Development of optical sensors capable of rapid quantification of pollutants that today are measured through slow responding instruments will be discussed.

JThA3 • 09:00  
Opportunities for Optical Designs in Driving Concentrating Photovoltaic Technology, Sarah Kartz; Interim NCPV Director, Renewable Energy Group, NREL, USA. The photovoltaic industry has grown dramatically; concentrating photovoltaic products are generating interest, but would benefit from optical techniques developed for other industries. This talk will give an overview and highlight the opportunities.

JThA4 • 09:30  
Promises and Challenges in Light-Emitting Diodes for High Power Lighting Applications, E. Fred Schubert; Joohee Cho; Rensselaer Polytechnic Institute, USA. This presentation will discuss one of the formidable challenges of LED technology: We will discuss the origin of the efficiency droop as well as ways to reduce the droop.

10:00–10:30  Coffee Break, Capital Ballroom Foyer

Senate

Optics for Solar Energy

Solid State and Organic Lighting

Optical Nanostructures and Advanced Materials for Photovoltaics

Optical Instrumentation for Energy & Environmental Applications

Austin North

Capital Ballroom A

Austin South

Senator

10:30–12:30  SRThB • Planar Optical Concentrators and High Efficiency Concepts  
Raymond Kostuk; University of Arizona, United States, Presider

SRThB1 • 10:30  A Review of Photovoltaic Cavity Converter Optics and Its Impact on Multi-junction and Multi-bandgap Systems, Ugur Ortabasi; United Innovations, Inc., USA. PVCC is a novel HCPV receiver that recycles reflected photons trapped within the cavity. Thus, cell series resistance can be lowered while effective shadowing loss is minimized. The paper focuses on optical issues and achievable efficiencies.

SRThB2 • 10:45  Real-Time Sensing of Fluorocarbons Using an External Cavity Quantum Cascade Laser, Mark C. Phillips; Bruce E. Bernacki; Matthew S. Taubman; B. D. Cannan; J. T. Schiffern; T. L. Myers; ‘ESRL, NOAA/GMD, USA. To identify and quantify major methane sources in Boston and Indianapolis, measurements of CH4 concentrations were made using a vehicle mounted cavity ringdown analyzer with Global Positioning Device capabilities along with plume transport models.

10:30–12:30  PThB • Nanostructured Materials with Enhanced Efficiency  
Dietmar Knipp; University of Bremen Germany, Presider

PThB1 • 10:30  A Relation Between a Filling Ratio and a Length of Silicon Nano Wires on their Solar Cell Performances, Jin-Young Jung; Keya Zhou; Hae-Don Um; Sang-Won Jee; Kwang-Tae Park; 1Stony Brook University, USA; 2Department of Geography and Environmental Sciences, Boston University, USA; 3ESRL, NOAA/GMD, USA. The relation between filling ratio and length of Si nano wires was investigated via characterizing the optical and electrical performances of solar cells. To enhance photovoltaic performances, we suggest the optimal parameters in nano wired solar cell.

PThB2 • 10:45  Optimal Design of Aperiodic, Vertical Silicon Nanowire Structures for Photovoltaics, Chenxi Lin; Michelle L. Povinelli; 1Ming Hsieh Department of Electrical Engineering, University of Southern California, USA. We use electromagnetic simulations to design an aperiodic, vertically-aligned silicon nano wire array that maximizes solar absorption. We achieved a 2.35 times enhancement in ultimate efficiency compared to a periodic array.

10:30–12:30  ETHB • Optical Design of Components and Subsystems for Energy and Environment  
Jeffrey Taylor; National Ecological Observatory Network, United States, Presider

ETHB1 • 10:30  Identification and Quantification of Methane Emissions in an Urban Setting, Eric Cannan; Nathan Phillips; Jocelyn Turnbull; CTG, Picarro, USA; Department of Geography and Environment, Boston University, USA; ESRL, NOAA/GMD, USA. To identify and quantify major methane sources in Boston and Indianapolis, measurements of CH4 concentrations were made using a vehicle mounted cavity ringdown analyzer with Global Positioning Device capabilities along with plume transport models.

ETHB2 • 10:45  Real-Time Sensing of Fluorocarbons Using an External Cavity Quantum Cascade Laser, Mark C. Phillips; Bruce E. Bernacki; Matthew S. Taubman; B. D. Cannan; J. T. Schiffern; T. L. Myers; Pacific Northwest National Laboratory, USA. We present results demonstrating real-time sensing of fluorocarbons at ppb-levels using an external cavity quantum cascade laser.
SRThB • Planar Optical Concentrators and High Efficiency Concepts—Continued

Concentrators and High SRThB • Planar Optical diffraction-based, is discussed as well. Another type of lightguide-based concentrators, mized. New phosphors and filters facilitate this. losses by reabsorption and escape could be mini-

Dick de Boer1,2; Philips Research; 2Eindhoven University of Technology, The Netherlands. Concentrators: Challenges and Progress, Dick de Boer1; Philips Research; 2Eindhoven University of Technology, The Netherlands. Luminescent and Non-Luminescent Solar Concentrators: Challenges and Progress, Dick de Boer1; Philips Research; 2Eindhoven University of Technology, The Netherlands. Luminescent concentrators allows for high concentration if diode, which cannot be achieved with the conventional techniques.

Another type of lightguide-based concentrators, diffusion-based, is discussed as well.

A novel light extraction technique based on coupling of evanescent waves in a ridge structure is reported. This technique can extract directly light outside the escape cone, which cannot be achieved with the conventional techniques.

A novel LED Light Extraction Technique Based on Evanescent Wave Coupling, Xia-Lun Yang1, Guo-Dong Hao1, Tokio Takahashi1; 1Nanosystem Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), Japan. A novel light extraction technique based on coupling of evanescent waves in a ridge structure is reported. This technique can extract directly light outside the escape cone, which cannot be achieved with the conventional techniques.

MOEMS, Wuhan National Laboratory for Optoelectronics, China; 3School of Mechanical Science and Engineering, Huazhong University of Science & Technology, China; 4School of Optoelectronics Science and Engineering, Huazhong University of Science & Technology, China. In this paper, relation of transmittance of prism sheets used in bottom-lit LED backlight on the direction of incident light was studied. Freeform lens was utilized to enhance the efficiency to make displays more energy-saving.

Energy-Saving Bottom-Lit LED Backlight with Angle-Control Freeform Lens, Zeng Qiu1,2, Kai Wang1, Shang Wang2, Sheng Liu1,2; 2Division of MOEMS, Wuhan National Laboratory for Optoelectronics, China; 3School of Mechanical Science and Engineering, Huazhong University of Science & Technology, China; 4School of Optoelectronics Science and Engineering, Huazhong University of Science & Technology, China. In this paper, relation of transmittance of prism sheets used in bottom-lit LED backlight on the direction of incident light was studied. Freeform lens was utilized to enhance the efficiency to make displays more energy-saving.

Absorption of Silicon Nanowire Arrays on Silic- con and Silica Substrates, Björn C. Starnberg1, Kokoa B. Dossou1, Lindsay C. Botten1, Ana A. Anthony1, Christopher G. Poulton2, C. Martijn de Sterke2, Raj C. McPhedran2; 1CUDOS and IPOMS, School of Physics, University of Sydney, Australia; 2Centre for Innovation Competence SilS-nana, University of Halle-Wittenberg, Germany. 5m3+-doped barium borate glasses are investigated for their potential as superstrate for CdTe solar cells. A 3.2 mm thick, 1 mol% Sm3+-doped glass superstrate enables an increase in the external quantum efficiency of approximately 2%.

NOTES

12:00–12:15 Lunch (on your own)

12:30–14:00 Lunch (on your own)
Joint Optical Nanostructures and Advanced Materials for Photovoltaics/Optics for Solar Energy

Raymond Kostuk; University of Arizona, United States, President

All new: New Photonic Materials and Devices for Solar Energy Conversion, Harry A. Atwater1; Renmin Institute and Key Laboratory of Low-Dimensional Quantum Structure, University of Science and Technology of China. I will describe approaches to control of light-matter interactions leading to enhanced light-trapping and absorption, as well as increased open circuit voltage and enhanced quantum efficiency in low-cost flexible thin film photovoltaic structures.

Efficient LED Design, Young (pronounced Young) Duang1, Darren McCoid2; Illumintes, USA. LED Lighting systems are making their way into all aspects of illumination. Efficiently manipulating the intensity distribution of these systems remains a challenge as the industry transitions from using traditional sources to LEDs. LEDs offer the possibility for high luminous per watt, but more importantly, they offer the ability to precisely control the intensity distribution. Ultimately, this improved optical beam control leads to more lumens at the task plane. While high lumens per watt at the LED package offers the possibility for high lumens per watt, but more importantly, they offer the ability to precisely control the intensity distribution. Plasmonic Photovoltaics: Linking Nanophotonics with Carrier Transport Considerations, Stefan Maier1; Imperial College London, United Kingdom. The direct linking of electrodynamic with carrier transport in plasmonic solar cells offers the possibility of high efficiency and high performance in three dimensions if one can accurately predict the properties of plasmonic solar cells. Examples for both the III/V and the Si materials system will be presented.

Photon Transport in Luminescent Solar Concentrators based on Semiconductors Nanoparticles, Derya Sahnin1, Boaz Ilan1, David F. Kelley1; UC Merced, USA. Photons transport in luminescent solar concentrators using semiconductors nanoparticles is modeled by Monte Carlo simulations. Using quantum dots proves to be highly efficient, while using aligned nanorods reduces the escape of light significantly.

Near-field Light Focusing by Wavelength-sized Dielectric Spheroids for Photovoltaic Applications, Manuel J. Mendes1, Ignacio Tolón1, Antonio Martín2, Antonio Luque2; ETSI Telecommunication, Instituto de Energía Solar, Universidad Politécnica de Madrid, Spain. We explore the near-field concentrating properties of dielectric spheroidal scatterers with wavelength sizes, using a separation-of-variables method. Such “mesoscopic lenses” are optimized for maximum light enhancement in photovoltaic applications.
Thursday, 3 November

16:30–18:30
PThD • Photon Management in Organic Solar Cells
Mark Brongersma; Stanford University, United States, Presider

PThD1 • 16:30
Constructing Precise Morphology for High Performance Printable Polymer Solar Cells, Xiaoniu Yang; 'Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China. Hereby we present a few approaches to construct precise morphology towards high-performance device for printable polymer solar cells based mainly on P3HT:PCBM composite, which could be potentially produced by using roll-to-roll technique.

PThD2 • 17:00
Morphology and Performance of Polymer-Based Solar Cells, Michael E. Mackay; University of Delaware, USA. Excitons in polymer-based solar cells are short lived placing great emphasis on construction of a nanoscale morphology of electron donor and acceptor. Here we discuss how processing affects the morphology and subsequent performance.

PThD3 • 17:30
Using Localized Plasmon Resonances to Enhance Absorption Efficiency in Thin-film Organic Solar Cells, Khan Q. Le1, Aimi Abass2, Bjorn Madsen2, Peter Bienstman3, Andrea Alu4; Electrical and Computer Engineering, The University of Texas at Austin, USA; 2Ghent University, Belgium; 3University of Mons, Belgium. We propose the use of localized surface plasmon modes excited by square metallic gratings to enhance the optical absorption of thin-film organic solar cells. Broadband absorption enhancement of up to 29% is theoretically demonstrated.

16:30–18:30
EThD • Testing and Development of Solar Energy Systems and Materials
Ralf Leutz; Concentrator Optics, GMBH Germany, Presider

EThD1 • 16:30
Spectroscopic Techniques to Probe the Charge Generation and Recombination in Solid-State Dye Sensitized Solar Cells, Sai Santosh Kumar Raavi; Istituto Italiano di Tecnologia, Italy. We elucidate the use of various spectroscopic tools from femtosecond to quasi-cw regime for complete characterization of charge generation and recombination dynamics in polymer based solid-state dye sensitized solar cells for good device optimization.

EThD2 • 17:00
Using Sunlight for Affordable Indoor Illumination, Lorne Whitehead; University of British Columbia, Canada. Emerging technologies make it practical to affordably deliver sunlight deep into buildings to deliver energy-efficient, high quality natural illumination whenever the sun shines.

EThD3 • 17:30
Rapid and Nondestructive Testing of Solar Cells for Manufacturing Environment, Richard K. Ahrenkiel; National Renewable Energy Laboratory, NREL, USA. The carrier recombination lifetime is a critical parameter in photovoltaic performance. A description of current nondestructive, laboratory techniques, and the potential adoption for the production line will be the focus of this presentation.

EThD4 • 18:00
Testing of Solar Thermal Systems, Saranpal “Sunny” Rai; Intertek, USA. A description of standards & certifications available for Solar Thermal products and a detailed examination of the Solar Rating & Certification Corporation (SRCC) certification, which is currently the most recognized standard in the US.

16:30–18:30
PThD • Using Localized Plasmon Resonances to Enhance Absorption Efficiency in Thin-film Organic Solar Cells, Khan Q. Le1, Aimi Abass2, Bjorn Madsen2, Peter Bienstman3, Andrea Alu4; Electrical and Computer Engineering, The University of Texas at Austin, USA; 2Ghent University, Belgium; 3University of Mons, Belgium. We propose the use of localized surface plasmon modes excited by square metallic gratings to enhance the optical absorption of thin-film organic solar cells. Broadband absorption enhancement of up to 29% is theoretically demonstrated.

PThD5 • 18:00
Using Localized Plasmon Resonances to Enhance Absorption Efficiency in Thin-film Organic Solar Cells, Khan Q. Le1, Aimi Abass2, Bjorn Madsen2, Peter Bienstman3, Andrea Alu4; Electrical and Computer Engineering, The University of Texas at Austin, USA; 2Ghent University, Belgium; 3University of Mons, Belgium. We propose the use of localized surface plasmon modes excited by square metallic gratings to enhance the optical absorption of thin-film organic solar cells. Broadband absorption enhancement of up to 29% is theoretically demonstrated.

PThD6 • 18:15
Improved Performances in Annealed P3HT-Based Dye Sensitized Solar Cells (DSSC): A Detailed Morphological and Spectroscopic Investigation, Sai Santosh Kumar Raavi; Giulia Grasshini; Agnese Abruzzi; Henry Smith; ‘Center for Nano Science and Technology of BTi@PoliMi, Italy; ‘Dipartimento di Fisica, Politecnico di Milano, Italy; ‘Oxford University, Department of Physics, Clarendon Laboratory, United Kingdom. We employ femtosecond transient absorption spectroscopy and atomic force microscopy on operating hybrid solid-state DSSC with P3HT as the hole transporter, to probe the effect of annealing on charge transfer dynamics and nanoscale morphology.
Key to Authors

Liu, Fang - JWE11
Liu, Sheng - JWE3, SDThB6
Liu, Yikun - PWB5
Loescher, Henry W - JWE16
Lofgren, L - PWC6
Lu, Chih-Feng - SDThB2
Lu, Yen-Cheng - SDThB2
Luo, Hongyan - JWE16
Luske, A - JThC5, PWB2
Iwin, Maung - JWE15

M
Ma, Dongge - SDWB3
Mackay, Michael E - PThD2
Macleod, Neil - EWC4
Maes, Bjorn - PThD3, PWC4
Magnusson, Robert - PWD3
Maier, Stefan - JTHC2
Marchant, Alan - EWC2
Marder, Seth R - SDWC5
Martins, Emiliano Rezende - JWE8, PWB5
Martí, Antonio - PWB2, JThC5
McClosky, Darren - SDThC3
McGovern, Ryan M - EThC2
McGrouther, D - PWB3
McManus, John Barry - EThC2
McPhedran, Ross C - PThD5
McPheeters, Claiborne Ott - JThC3
McPhedran, Ross C - PThB5
McGovern, Ryan M - EThC2
McCosky, Darren - SDThC3
Martí, Antonio - PWB2, JThC5

N
Najafabadi, Ehsan M - SDWC5
Nam, Yoon-Ho - PThB1
Narayanaswamy, Arvind - JWE13
Nasu, Hirofumi - JWE24
Neely, Tyler W - EThC1
Nelson, David D - EThC2
Nerves, A. J - PWB3
Nicolay, S - PWB3
Nielson, Greg - SRWC6
Nikodem, Michal - EWC1
Nugent-Glandorf, Lora - EThC1

O
Ohishi, Yasutake - JWE24
Okandan, Marat - SRWC6
Orsal, G - PWB3
Ortubasi, Ugur - SRThB1
Otto, Martin - JWE7
Ouagazzaden, A - PWB3

P
Padmaperma, Asanga - SDWB2
Panepucci, Roberto B - JWE18
Parascandolo, G - PWC6
Park, Kwang-Tae - PThB1
Peres, M - PWB3
Petrov, Nikolai I - JWE23
Phillips, Mark C - EThB2
Phillips, Nathan - EThB1
Poortmans, Jef - PWC3
Popov, Vladimir - JWE23
Postigo, Pablo Aitor - JWE12
Poulson, Christopher G - PThB5

Povinelli, Michelle L - JWE9, PThB2
Pradana, Arifianto - SDWC2
Pruner, Valerio - SDWB4
Puri, Munish - JWE5
Qi, Boyuan - SDWC3
Qin, Zong - JWE3, SDThB6
Qu, Bo - SDWB5, SDWC3
Qu, Ji - JWE3

R
Raavi, Sai Santosh Kumar - EThD1, PThD6
Rai, Sarampal "Sunny" - EThD4
Razeghi, M - PWB3
Ren, Libing - JWE17
Richter, Dirk - EWC3
Rockstuhl, Carsten - PThB4
Rogers, Dave - PWB3
Rose, Rebecca - EWC4
Rosenberg, Glenn - SRThB3
Roy, Sukesh - EThC4
Russo, Juan Manuel - SRThB3, SRThB5
S
Sahin, Derya - JHC4
Saitoh, Takashi - JWE21
Salvador, Michael - PThD5
Salzer, Roland - JWE7
Sandana, V - EWB3
Sasihi, Karthik - JWE13
Scarpaci, Annabella - SDWC5
Schaudt, Daniel M - JThC3
Schiffer, J. T - EThB2
Schubert, E. Fred - JTHA4
Schultz, David - SRWC1
Schweizer, Stefan - PThB6
Sears, John S - SDWC5
Selkon, Jagmeet Singh - JWE22
Shaffer, Edward - JWCA
Shakoor, Abdul - JWE8
Shaw, Joseph A - EThB6, EWB1, EWC
Shen, Kun-Ching - SDThB2
Shin, Sun-Mi - PThB1
Shi, Rui - PWB3
Smith, Clinton - JWE19
Snith, Henry - PThD6
So, Franky - SDWC6
So, Stephen - EThB5, JWE19
Soares, M. J - PWB3
Soderstrom, K - PWC6
Spuler, Scott - EWC3
Stauffer, Hans U - EThC4
Steudel, Franziska - PThB6
Stuckelberger, M. - PWC6
Sturmberg, Björn C. P - PThB5
Sun, Xiaowei - JWE6
Suzuki, Takenobu - JWE24
Swaett, William - SRWC6

T
Takahashi, Tokio - SDThB5
Taubman, Matthew - EThB2, EWC3
Taylor, Jeffrey R - EThB, JWE16
Teherani, F. Hossein - PWB3
Thibaudeau, Simon - JWE20
Thomay, David - EThB5
Ting, Shao-Ying - SDThB2
Tittel, Frank K - EWC5
Tobias, Ignacio - JThC5
Trovimov, Igor - EThB5
Trompoukis, Christos - PWC3
Troyon, M - PWB3

U
Um, Han-Don - PThB1
Upping, Johannes - PWB4
Usievich, Boris - JWE23

V
Van Gestel, Dries - PWCD3
Van Nieuwenhuyzen, Kris - PWCD3
van Swaaij, René - PWCD5
Vargas, German - JWE18
Varghese, Philip - EThB7
Verma, Alok - EThB3
Vorndran, Shelby - SRWB5

W
Walega, James - EWC3
Wang, Dong-Xue (Michael) - SDThB, SDThB4
Wang, Jyh-Yang - SDThB2
Wang, Kai - SDThB6
Wang, Shang - JWE3, SDThB6
Wang, Wen - JWE19
Wang, Xue - SDThB5
Wang, Dongxue - SDThC6
Wehrspohn, Ralf B. - JWE7, PWB, PWB4
Wei, Haojun - JWE17
Wehring, Petter - EWC3
Weida, Miles - EThC5
Weidmann, Damien - EWC4
Welleznohn, Markus - PWCD2
Wheelwright, Brian - SRWC2
Whitehead, Lorne - EThD2
Wichmann, Steve - JWE1, JWE2, PThD6
Wiesendanger, Sami - PWB3
Wojcik, Michael - EThB4, JWE15
Wolf, S. De - PWCD6
Wranzewski, Edward - SDWC6
Wu, Wenhua - PWD3
Wysocki, Gerard - EThC, EWC1, EWC4, JWE19

X
Xiao, Lixin - SDWB5, SDWC3
Xie, Wanliu - JWE11
Xing, Xing - SDWC3
Xu, Qi - JWE11
Xue, Jangeng - SDWB, SDWC6,

Y
Yamazaki, Akira - JWE21
Yang, Chih-Chung (C.-C.) - SDThB2, SDThB
Yang, Xiaojiao - PThD1
Yee, Brandon - EThC5
Yeh, Dong-Ming - SDThB2
Yip, Hin-Lap - PThD5
You, Mi-Yeon - JWE10
Yoo, SeungHyup - SDWC4, SDWD
Yoon, Jaewoong - PWCD3
Yu, Edward T - JTHC3

Z
Zahniser, Mark - EThC2
Zarse, Osttin - SRThB5
Zeman, Miro - PWCD5
Zhang, Deming - SRThB5
Zhang, Yadong - SDWC5
Zhang, Yong - PThD5
Zhao, Zhili - JWE3
Zhou, Jianying - PWB5
Zhou, Keya - PThB1
Zhu, Lingyun - SDWC5
Zuniga, Carlos - SDWC5

Wednesday, 2 November, 17:00–18:00

JWD • E2/SOLAR/SOLED
Postdeadline Session
Joseph Ford; Univ. of California at San Diego, United States, Presider

JWD1 • 17:00
Numerical Simulation of Micro-optical Structures for Enhancing Efficiency of Solar Panels, R. Dey1, E.Y. Bordatchev1, M. Taushiduzzaman1, H. Reshef1; Centre for Automotive Materials and Manufacturing, National Research Council of Canada, Canada. Four types of elongated planar arrays of micro-optical structures (triangular, rectangular, concave and convex) are numerically simulated. The results allow comprehensive understanding how the photovoltaic performance of solar panels can be improved.

JWD2 • 17:15
AGILE: Axially Graded Index Lens as a non-tracking solar concentrator, O. Solgaard1, R. Dauskardt2; Electrical Engineering, Stanford Univ., USA, Material Science and Engineering, Stanford Univ., USA. The Axially Graded Index Lens (AGILE) explicitly takes advantage of the fact that the density of electromagnetic radiation modes is proportional to the square of the Refractive Index to create non-tracking solar concentrators.

JWD3 • 17:30
An Airborne Spectrometer and Retrieval Development Project for Air Quality Measurements, J. Leitch1, T. Valle1, C. Hardesty1, T. Delker1, B. Baker1, J. Eskin1, K. Chance2, X. Liu1, S. Janz1, K. Pickering3, J. Wang4; Ball Aerospace, USA; Smithsonian Institution/Smithsonian Astrophysical Observatory, USA; NASA/Goddard Space Flight Center, USA; University of Nebraska, USA. The NASA-funded GeoTASO Instrument Incubator project will develop an airborne spectrometer, participate in field campaigns, and test trace gas and aerosol retrieval performance in support of a proposed space-based air quality sensor in orbit.

JWD4 • 17:45
Efficiency Improvement in Top-Emitting Organic Light Emitting Diodes Using Color Conversion Layer, T. Schwab1, S. Hofmann1, M. Thomschke1, K. Leo1, B. Lüssem1; TU Dresden, Institut für Angewandte Photophysik, Germany. We present top-emitting organic light emitting diodes (OLEDs) using internal color conversion layers (CCL). It is shown that pure conversion is realized with CCLs inside the electron transport layer of the OLED providing enhanced efficiency.

(Note: pdp papers are located on the Technical Digest CD Rom)

Postdeadline Key to Authors and Presiders

B
Baker, B.-JWD3
Bordatchev, E.V.-JWD1

C
Chance, K.-JWD3

D
Dauskardt, R.-JWD2
Delker, T.-JWD3
Dey, R.-JWD1

E
Eskin, J.-JWD3

F
Ford, Joseph-JWD

H
Hardesty, C.-JWD3
Hofmann, S.-JWD4

J
Janz, S.-JWD3

L
Leitch, J.-JWD3
Leo, K.-JWD4
Liu, X.-JWD3
Lüssem, B.-JWD4

P
Pickering, K.-JWD3

R
Reshef, H.-JWD1

S
Schwab, T.-JWD4
Solgaard, O.-JWD2

T
Taushiduzzaman, M.-JWD1,
Thomschke, M.-JWD4

V
Vaidya, N.-JWD2
Valle, T.-JWD3

W
Wang, J.-JWD3
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Renewable Energy and the Environment 2012
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Optical Instrumentation for Energy and Environmental Applications (E2)

Optical Nanostructures and Advanced Materials for Photovoltaics (PV)

Optics for Solar Energy (SOLAR)

Solid State and Organic Lighting (SOLED)

Paper Submission Deadline:
8 July 2012 (12:00 EDT; 16:00 GMT)