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# 2012 Optics+ Photonics

12–16 August 2012

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## Technical Program

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### Location

San Diego Convention Center  
San Diego, California, USA

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### Conferences and Courses

12–16 August 2012

### Exhibition

14–16 August 2012

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### Technologies

- NanoScience+Engineering
- Solar Energy+Technology
- Organic Photonics+Electronics
- Optical Engineering+Applications

# Conference 8495 · Room: Conv. Ctr. 5A

Monday-Thursday 13-16 August 2012 • Proceedings of SPIE Vol. 8495

## Reflection, Scattering, and Diffraction from Surfaces III

Conference Chair: **Leonard M. Hanssen**, National Institute of Standards and Technology (USA)

*Program Committee:* **Gérard Berginc**, Thales Optronique S.A. (France); **Andrea M. Brown**, The Johns Hopkins Univ. Applied Physics Lab. (USA); **Michael G. Dittman**, Ball Aerospace & Technologies Corp. (USA); **Aristide C. Dogariu**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **John C. Fleming**, Ball Aerospace & Technologies Corp. (USA); **Greg Gbur**, The Univ. of North Carolina at Charlotte (USA); **Hsueh-Mei W. Graham**, Lockheed Martin Aeronautics Co. (USA); **Brian G. Hoover**, Advanced Optical Technologies (USA); **Danhong Huang**, Air Force Research Lab. (USA); **Alexei A. Maradudin**, Univ. of California, Irvine (USA); **Richard N. Pfisterer**, Photon Engineering LLC (USA); **Arne Roos**, Uppsala Univ. (Sweden); **Hendrik Rothe**, Helmut-Schmidt Univ. (Germany); **Shouhong Tang**, KLA-Tencor Corp. (USA); **Benjamin K. Tsai**, National Institute of Standards and Technology (USA)

### Monday 13 August

#### POSTERS-MONDAY

Room: Conv. Ctr. Exhibition Hall B2 . Mon. 5:30 to 7:30 pm

Conference attendees are invited to attend the poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Poster authors, view poster presentation guidelines at <http://spie.org/x30293.xml>.

**Roughness evaluation of very smooth surfaces using a novel method of scatter measurement**, Romuald Synak, Włodzimierz Lipinski, Marcin Pawelczak, Institute of Mathematical Machines (Poland) . . . . . [8495-38]

**Thin metal film thickness detection method based on surface plasmon resonance effect**, Qinggang Liu, Chao Liu, Tianjin Univ. (China) . . . . . [8495-39]

**Reflectance variability of surface coatings reveals characteristic eigenvalue spectra**, Jose M. Medina, Univ. do Minho (Portugal); José Antonio Diaz, Univ. de Granada (Spain); Rui Barros, Univ. do Minho (Portugal) [8495-40]

**Self focusing transmittances.**, Javier Muñoz-Lopez, Gabriel Marínez-Niconoff, Patricia Martínez-Vara, Javier Silva-Barranco, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [8495-41]

**Structural features of the diffraction field**, Gabriel Marínez-Niconoff, Javier Muñoz-Lopez, Patricia Martínez-Vara, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [8495-42]

**Homogeneity measurements of hardness standards with a non-destructive optical method**, José G. Suárez-Romero, Eduardo Hernández-Gómez, Instituto Tecnológico de Querétaro (Mexico); Juan B. Hurtado-Ramos, Ctr. de Investigación en Ciencia Aplicada y Tecnología Avanzada (Mexico) . . . . . [8495-44]

**A fast and accurate surface plasmon resonance system**, Yuliana M. Espinosa Sánchez, Donato Luna Moreno, Ctr. de Investigaciones en Óptica A.C. (Mexico); Enrique Noe Arias, Juan G. Garnica Campos, Centro de Investigaciones en Óptica, A.C. (Mexico) . . . . . [8495-45]

**Electromagnetic scattering in the open elliptic quantum billiard**, Hipolito Garcia-Gracia, Julio C. Gutiérrez-Vega, Tecnológico de Monterrey (Mexico) . . . . . [8495-46]

### Tuesday 14 August

#### SESSION 1

Room: Conv. Ctr. 5A . . . . . Tues. 8:30 to 10:00 am

#### Scattering Theory I

*Session Chair:* **John C. Fleming**, Ball Aerospace & Technologies Corp. (USA)

8:30 am: **Domain of validity of the equation for total integrated scatter (TIS) (Invited Paper)**, James E. Harvey, Narak Choi, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Andrey Krywonos, Univ. of Central Florida (USA) . . . . . [8495-01]

9:00 am: **Upper roughness limitations on the TIS/RMS relationship**, John C. Stover, The Scatter Works Inc. (USA); Sven Schroeder, Angela Duparré, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [8495-02]

9:20 am: **Comparison of the domain of validity of several approximate surface scatter theories**, Narak Choi, James E. Harvey, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [8495-03]

9:40 am: **Converting surface roughness data into PSD and BSDF**, Richard N. Pfisterer, Photon Engineering LLC (USA) . . . . . [8495-04]

Coffee Break . . . . . 10:00 to 10:30 am

#### SESSION 2

Room: Conv. Ctr. 5A . . . . . Tues. 10:30 to 11:30 am

#### Imaging Methods and Applications I

*Session Chair:* **Richard N. Pfisterer**, Photon Engineering LLC (USA)

10:30 am: **Design of combined microscopical and scatterometrical imaging devices for surface inspection**, Wenjing Zhao, Helmut-Schmidt-Univ. (Germany); Cornelius F. Hahlweg, Hendrik Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [8495-05]

10:50 am: **Backscatter-based projectile trajectory measurement in ballistics under daylight conditions**, Uwe Chalupka, Hendrik Rothe, Helmut-Schmidt-Univ. (Germany) . . . . . [8495-06]

11:10 am: **Surface characterization using combined analysis of original and scatter images**, Wenjing Zhao, Helmut-Schmidt-Univ. (Germany); Cornelius F. Hahlweg, Hendrik Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [8495-08]

Lunch/Exhibition Break . . . . . 11:30 am to 1:20 pm

#### SESSION 3

Room: Conv. Ctr. 5A . . . . . Tues. 1:20 to 3:30 pm

#### Optical Properties: Theory and Measurement

*Session Chair:* **Brian G. Hoover**, Advanced Optical Technologies (USA)

1:20 pm: **Inter-laboratory comparison using integrating sphere spectrophotometers to measure reflectance and transmittance of specular, diffuse, and light-redirecting glazing products (Invited Paper)**, Jacob C. Jonsson, Charlie Curcija, Lawrence Berkeley National Lab. (USA) . . . . . [8495-09]

1:50 pm: **Comparison of NRC goniometric and integrating sphere methods for realizing an absolute diffuse reflectance scale**, Réjean Baribeau, Joanne C. Zwinkels, National Research Council Canada (Canada) . . . . . [8495-10]

2:10 pm: **Establishing infrared reflectance standards with micro-manufactured surfaces**, Sergey N. Mekhontsev, Leonard M. Hanssen, National Institute of Standards and Technology (USA); Vladimir B. Khromchenko, Space Dynamics Lab. (USA) . . . . . [8495-11]

2:30 pm: **Effective medium analysis on the optical properties of silicon nanowire arrays**, Han Wang, Georgia Institute of Technology (USA) and Harbin Institute of Technology (China); Xianglei Liu, Liping Wang, Zhuomin M. Zhang, Georgia Institute of Technology (USA) . . . . . [8495-12]

2:50 pm: **Temperature-dependent emissivity model using DC-resistance and reflectance measurements**, Andrea M. Brown, Michael E. Thomas, John J. Orndorff, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8495-13]

3:10 pm: **Coherent backscattering cone from superdiffusive media**, Jacopo Bertolotti, Univ. Twente (Netherlands) and Univ. Florence (Italy); Matteo Burresi, European Lab. for Non-linear Spectroscopy (Italy); Vivekananthan Radhakrishmi, European Lab. for Non-linear Spectroscopy (Italy) and Univ. Florence (Italy); Romolo Savo, European Lab. for Non-linear Spectroscopy (Italy); Kevin Vynck, European Lab. for Non-linear Spectroscopy (Italy) and Univ. Florence (Italy); Diederik S. Wiersma, European Lab. for Non-linear Spectroscopy (Italy) . . . . . [8495-14]

Coffee Break . . . . . 3:30 to 4:00 pm

## PLENARY SESSION

Room: Conv. Ctr. 6A ..... Tues. 4:00 to 5:35 pm

### Optical Engineering

Session Chairs: **Jose Sasian**, College of Optical Sciences, The Univ. of Arizona (USA); **R. John Koschel**, Photon Engineering LLC (USA) and College of Optical Sciences, The Univ. of Arizona (USA)

4:00 pm: **Welcome and Opening Remarks**

4:05 pm: **A New Job for Telescopes: Making Solar Electricity**  
**J. Roger P. Angel**, Steward Observatory Mirror Lab., The Univ. of Arizona College of Optical Sciences (USA) and REhnu LLC (USA)

4:50 pm: **From Titanic to the Tiny: Three Decades of Underwater Optical Imaging**  
**Jules S. Jaffe**, Scripps Institution of Oceanography (USA)

See page 14 for details.

## PANEL DISCUSSION

### Methods and Applications of Deflectometry

Date: **Tuesday 14 August**; Time: **8:00 to 10:00 PM**  
 Room: **Marriott Hotel, Oceanside**

#### Moderators:

**Peng Su**, College of Optical Sciences, The Univ. of Arizona (USA);  
**Jan Burke**, Bremer Institut für angewandte Strahltechnik (Germany)

#### Panelists:

**Christian Faber**, Univ. Erlangen-Nuremberg (Germany); **Robert E. Parks**, College of Optical Sciences, The Univ. of Arizona (USA)

Further panelists to be confirmed.

Large or very large optical components, aspherics, and freeform optics have proven very difficult and expensive to measure with interferometry. As the interest and market for such components continues to grow, the need has become apparent to complement (and sometimes even replace) interferometry with a technique that is more versatile and less sensitive to misalignments. Simply and inexpensively measuring the distortion of a reflected fringe pattern (e.g. from a computer screen), a technique known as deflectometry, is capable of stunning sensitivity, since it is a gradient technique - however the calculation of the absolute shape is an unsolved problem. The question is, how urgently do we need the absolute shape? Could the slope data be sufficient? Also, there are numerous applications besides precision optics where deflectometry excels by its versatility - portable systems could be realized with as little as a laptop with web cam, or even a smartphone, and still function as serious measurement equipment.

We invite anyone working in deflectometry to come along, share their latest research and applications with a brief presentation, and point out the problems yet to solve. Interferometrists looking for solutions (or picking on the weaknesses of deflectometry) are also invited. We are hoping to get an idea of where we are, where the gaps and show-stoppers are, and come up with a roadmap for technical development and industrial implementation that we could use to set up meaningful collaborations and develop the full potential of this emerging discipline.

## Wednesday 15 August

### SESSION 4

Room: Conv. Ctr. 5A ..... Wed. 8:40 to 10:30 am

### Scattering Theory II

Session Chair: **Alexei A. Maradudin**, Univ. of California, Irvine (USA)

8:40 am: **Estimating hemispherical scatter from incident plane measurements of isotropic samples** (*Invited Paper*), John C. Stover, The Scatter Works Inc. (USA); Sven Schroeder, Angela Duparré, Alexander von Finck, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) ..... [8495-15]

9:10 am: **A BRDF model for scratches and digs**, Gary L. Peterson, Breault Research Organization, Inc. (USA) ..... [8495-16]

9:30 am: **Wavelength-dependent resonant surface-plasmon mediated light scattering by a slit array filled with different dielectrics**, Danhong Huang, Air Force Research Lab. (USA) ..... [8495-17]

9:50 am: **How accurate is the Kubelka-Munk theory of diffuse reflection? a quantitative answer**, Michael E. Thomas, Richard I. Joseph, Johns Hopkins Univ. Applied Physics Lab. (USA) ..... [8495-18]

10:10 am: **Coherence model for laser and solar scattering from diffuse metals**, Brian G. Hoover, David E. Talianferro, Advanced Optical Technologies (USA); L. David Wellemans, David L. Bowers, Applied Technology Associates (USA) ..... [8495-19]

Coffee Break ..... 10:30 to 11:00 am

### SESSION 5

Room: Conv. Ctr. 5A ..... Wed. 11:00 am to 12:20 pm

### Measurement Instrumentation and Applications I

Session Chair: **Hsueh-Mei W. Graham**, Lockheed Martin Aeronautics Co. (USA)

11:00 am: **BRDF measurements using a tunable supercontinuum fiber laser source designed for the STARR II gonireflectometer**, Heather J. Patrick, National Institute of Standards and Technology (USA); Clarence J. Zarobila, Jung Research and Development Corp. (USA) and National Institute of Standards and Technology (USA); Thomas A. Germer, Catherine A. Cooksey, Benjamin K. Tsai, National Institute of Standards and Technology (USA) ..... [8495-20]

11:20 am: **Quantification of the systematic and random measurement uncertainty of a polarimetric scatterometry system designed for enhanced e-field device characterization**, Thomas M. Fitzgerald, Univ. of Dayton Research Institute (USA); Michael A. Marciniak, Air Force Institute of Technology (USA); Stephen E. Nauyoks, Air Force Institute of Technology (USA) .. [8495-21]

11:40 am: **Scatterometer basing on a STAR GEM idea for optical measurements of micro-lenses**, Etsuo Kawate, National Institute of Advanced Industrial Science and Technology (Japan); Miroslav Hain, Institute of Measurement Science (Slovakia); Fumiko Hiwatashi, Systems Engineering Inc. (Japan) ..... [8495-22]

12:00 pm: **The Southwest Research Institute Ultraviolet Reflectance Chamber (SwURC): a far ultraviolet reflectometer**, Gregory S. Winters, Kurt D. Retherford, Michael W. Davis, Stephen M. Escobedo, Edward L. Patrick, Eric Bassett, Maggie E. Nagengast, Matt H. Fairbank, Paul F. Miles, Joel W. Parker, Randall Gladstone, Alan Stern, Southwest Research Institute (USA) .. [8495-23]

Lunch/Exhibition Break ..... 12:20 to 2:20 pm