Optical Radiation News

Published by the COUNCIL for OPTICAL RADIATION MEASUREMENTS (www.cormusa.org) to report items of interest in optical radiation measurements. Inquiries may be directed to the Editor, John D. Bullough, Lighting Research Center, Rensselaer Polytechnic Institute, 21 Union St., Troy, NY 12180. Tel: 518-687-7100 Fax: 518-687-7120 e-mail: bulloj@rpi.edu.

NUMBER 97 SPRING 2012

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CORM 2012 Annual Technical Conference and Business Meeting

National Research Council Canada
Ottawa, Ontario
May 29 – June 1, 2012

Tuesday, May 29	Evening Welcome Reception
Wednesday, May 30	AM: NRC Session I on Current Research Activities at NRC PM: NRC Lab Tour
Thursday, May 31	AM/PM: CORM 2012 Conference-Sessions II & III 6:00 PM: Reception at the Canadian Museum of Civilization 7:00 PM: Franc Grum Memorial Lecture and Banquet *Guest Speaker:* Dr. Henry Buijs (One of the original founders of Bomem, now part of ABB)
Friday, June 1	AM: CORM 2012 Conference-Session IV PM: CORM Technical Committee Meetings PM: CORM BOD Meeting

Registration: To register, visit http://www.cormusa.org/CORM2012.html The registration fee includes one year CORM membership, an electronic copy of presentation materials, lunches, refreshment breaks, bus transportation to/from the NRC lab tours and the Museum of Civilization; the Grum banquet and lecture is also included or a separate fee, dependent upon registration category. **Early bird discount:** Save $100 by registering before Monday, April 30.

Proceedings: CORM provides PDF copies of Annual Conference presentations to attendees on USB drives at the CORM Annual Conference. CORM sees that placing the presentations on its website, www.cormusa.org, would be of interest to the optical radiation measurement community and in keeping with CORM's mission to disseminate information on optical radiation metrology.

Want to Exhibit Your Products or Services? This year's CORM Conference will include exhibit opportunities. Attendees can reserve a 6' table with power to exhibit their products or services. There will be time for all attendees to visit the exhibits during breaks and at lunch. Add the exhibit table to your registration for only $300. Contact Tim Moggridge with your exhibit questions.

Preliminary Program:

29 May

6:00-8:00 PM, Welcome Reception

30 May

8:30-9:00 AM

- **Welcome** by Dr. Alan Steele, General Manager, NRC Measurement Science and Standards
- Short Introduction by Organizing Committee (J. Zwinkels, T. Moggridge)

9:00-12:15 PM *(coffee break and vendor exhibit 10:30-11 AM)*

- **Session I: Recent Research Activities at NRC in Photometry and Radiometry** (Session Chair: Joanne Zwinkels, NRC)
    - **Overview of NRC photometry and radiometry measurement services**, Nelson Rowell
    - **New developments in radiometry,** Charles Bamber
    - **Quantum radiometry research activities,** Jeff Lundeen
    - **Spectroradiometry/photometry research activities,** Arnold Gaertner
    - **Extension of NRC fluorescence measurement capabilities,** Joanne Zwinkels, Mario Noël and Bill Neil
    - **Gonioreflectometry of diffusely reflecting and regularly reflecting surfaces,** Réjean Baribeau
    - **Infrared spectroscopy research activities,** Li-Lin Tay and Nelson Rowell
    - **Radiation thermometry research activities,** Andrew D.W. Todd, Donald J. Woods and Kenneth D. Hill

12:15-1:30 PM

- **Lunch (provided) in vendor exhibit area**

1:30-4:30 PM

- 1:30 PM, Buses depart for NRC Montreal Road campus
- 2:00-4:15 PM, Tour of the NRC Photometry and Radiometry Labs
- 4:30 PM, Buses depart for return to NRC Sussex

31 May

8:30 AM-12:45 PM *(coffee break and vendor exhibit 10:30-11 AM)*

- **Session II – New Metrological Tools and Applications with Emphasis on SSL** (Session Chair: Yuqin Zong, NIST)
    - **Colour-tunable LED office lighting: harnessing new capabilities while saving energy,** Jennifer A. Veitch, Erhan E. Dikel, Gregory J. Burns, Sandra Mancini, and Guy R. Newsham (NRC, Canada)
    - **Method for measurement of LEDs at elevated temperature of 85 C in production,** Ralph Tuttle (Cree, USA)
    - **LED lifetime testing,** Jeff Hulett (Vektrex, USA)
    - **Mesopic photometry,** Tatsu Uchida (Panasonic, Japan)

- **Pulse-to-cw laser convertor and its application in the new spectral responsivity calibration facility at PTB,** Stefan Winter (PTB, Germany)
- **Measurement of OLEDs,** Tokihisa Kawabata (Minolta, Japan, NIST guest researcher)
- **Methods for estimating junction temperature of AC LEDs,** Asiri Jayawardena and Nadarajah Narendran (Lighting Research Center, USA)
- **Measurement of LEDs at wafer level,** Peiting Chou (ITRI, Taiwan)
- **LED lifetime estimate method,** Andrew D. Jackson (Philips Lighting, USA)
- **Quantifying stroboscopic effects from flickering light sources,** John Bullough (Lighting Research Center, USA)
- **Thermal characterization of LEDs,** Andras Poppe (Mentor, Hungary)
- **Standardization and measurement of optical radiation related to photobiological safety,** Prof. Tongsheng Mou (Zhejiang University, China)

12:45-2:00 PM

- **Lunch (provided) in vendor exhibit area**

2:00-5:00 PM (*Coffee break and vendor exhibit 3:30-4:00 PM*)

- **Session III – Advances in Environmental Radiometry**
  (Session Chair: Nelson Rowell, NRC)
  - **STARR II: Progress towards a new UV-SWIR gonioreflectometer with climate science applications,** Heather J. Patrick (NIST, Gaithersburg)
  - **Laser-induced incandescence for the measurement of atmospheric black carbon,** Greg Smallwood (NRC, Canada)
  - **LWIR hyperspectral differential imaging for gaseous and liquid contaminations scattering,** Jean-Marc Theriault (Defence Research and Development Canada)
  - **Overview of the NIST program for Green House Gas and Climate Science Measurements,** James Whetstone (NIST, Gaithersburg)
  - **Automated measurement and shape recognition techniques applied to atmospheric particulate matter,** James Sloan, Igor Grishin, and Thomas Kuhn (University of Waterloo, Canada)
  - **Differential absorption LIDAR for green house gas measurements,** Stephen Maxwell (NIST, Gaithersburg)
  - **Use of UV/VIS/FTIR spectroscopy to measure atmospheric composition,** Kimberly Strong (University of Toronto, Canada)

6:00-7:00 PM

- Reception and Dinner at Canadian Museum of Civilization

7:00 PM

- **Franc Grum Memorial Dinner and Lecture**
  Guest Speaker: Dr. Henry Buijs
  (One of the founders of Bomem, now part of the ABB Group)
  "**Spectral Infrared Radiation Measurement from Space"**

1 June

8:30 – 11:30 AM *(Coffee break and vendor exhibit 10:30-11:00 AM)*

- **Session IV: Other Developments in Optical Radiation Measurements**
  (Session Chair: Richard L. Austin, Gamma Scientific)
  - **Adapting conventional laser power meter measurements to terahertz frequencies,** John Lehman, Marla Dowell, Erich Grossman, and Malcolm White (NIST, Boulder and NPL)
  - **New automated laser facility for detector calibrations,** Yuqin Zong (NIST, Gaithersburg)
  - **New tools for laser pulse energy measurement,** Malcolm White (NPL) and John Lehman (NIST, Boulder)
  - **Cross-referencing lighting standards in a photometric laboratory,** K. Frank Lin (Lighting Sciences Canada Ltd.)
  - **IR enhanced Si photodiode for spectral responsivity transfer between 300 nm and 1000 nm,** G.P. Eppeldauer and T.C. Larason (NIST, Gaithersburg)
  - **Bi-spectral LED phosphor emission characterization system**, Richard Austin (Gamma Scientific)

11:30 AM-12:00 PM

- **CORM Business Meeting**

12:00-1:30 PM

- **Lunch (provided) in vendor exhibit area**

1:30-5:00 PM

- 1:30-3:30 PM, **CR8: Solid State Lighting Technical Committee Meeting** (Chair: Yoshi Ohno, NIST)
- 3:30-4:00 PM, **Coffee break and vendor exhibit**
- 4:00-5:00 PM, **CORM Board of Directors meeting**

List of Exhibitors at CORM 2012:

Avian Technologies
Delta Photonics
Gamma Scientific
Gigahertz-Optik Inc.
Labsphere
The Optikon Corp. Ltd.
Westboro Photonics

Conference Coordinators:

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NIST NEWS FROM THE SENSOR SCIENCE DIVISION

Most of the work at NIST in the Sensor Science Division on the topic of optical radiation measurements was reported at the 11th International Conference on New Developments and Applications in Optical Radiometry (NEWRAD 2011), convened at The Grand Wailea Resort on the island of Maui, Hawaii. The program and extended abstracts are available for a limited time at http://newrad2011.aalto.fi/. Highlights of a few presentations are described in this ORN edition. Please go to the website to see all the NIST contributions among the international work.

NIST Efforts for Calibrations in Earth Observation Programs

National standards laboratories such as NIST are responsible for realizing and maintaining fundamental radiometric scales and developing the means to disseminate them to the user community by use of calibrated artifacts. Artifacts such as FEL-type lamp standards of spectral irradiance, diffuse reflectance standards, lamp-illuminated integrating spheres, detectors, apertures, and contact thermometers are utilized at the user facility in various schemes to establish the traceability of values for the reflected-solar and emitted thermal spectral regions of the Earth's surfaces and atmosphere generated or measured by various sources and radiometers, including space-borne sensors.

A significant aspect of establishing traceability is in the uncertainty estimation for the resultant values. It is often difficult to assess the veracity of these values. For remote sensing programs with the objective to detect subtle changes in the Earth's physical properties over decadal time scales, the uncertainty requirements are stringent and the effort to validate the results is therefore critical. One part of the solution, advocated by NIST and the international metrology community, is to perform intercomparison activities. In the early 1990s NIST, with NASA support, began to execute spectral radiometric comparisons. This required the development of field-deployable transfer radiometers (XRs) and integrating sphere sources (ISSs).

It was found that complete characterization of the XRs or ISSs represents the majority of the effort to understand these artifacts and estimate uncertainties; absolute calibration is the assignment of an overall scale factor to the full measurement equation that describes all possible influencing parameters. Also, along the way, novel ideas and advances have been realized, and NIST efforts have expanded to include participation in programs beyond the scope of what was imagined at the beginning.

As the program has matured, NIST involvement has grown from review of cal/val plans and execution of intercomparisons to involvement at a more fundamental level. Examples include participation in sensor design and characterization, transfer of the techniques to related fields such as stellar radiometer and medical imaging, and efforts to determine the spectral radiance of the moon, for use as an on-orbit standard. The objective continues to be to reduce our uncertainties in order to meet program requirements, and to design artifacts that are least sensitive to systematic effects.

Contact: Carol Johnson (cjohnson@nist.gov)

Characterizing Silicon Photodiodes using Spectroscopic Ellipsometry for High Accuracy Radiometry

In high-accuracy radiometry, the silicon photodiode is the foundation for radiation detection throughout the near infrared to ultraviolet. The response of a silicon photodiode is determined by two factors; the internal quantum efficiency and reflection loss due to the optical structure of the photodiode. The latter not only affects the responsivity but also the wavelength dependent uniformity of the photodiode. Here, we show how a fast and easy to use ellipsometer can accurately determine the optical structure of a photodiode throughout its active detection area. Such diagnostic information allows one to predict the response and spatial uniformity throughout the wavelength range. We discuss the technique and compare the prediction based on ellipsometry with monochromatic light measurements from ultraviolet to near infrared.
Contact: Ping Shaw (ping.shaw@nist.gov)

NIST – PTB Joint Study of Far Infrared Selected Black Coatings

NIST and PTB are pursuing an investigation of selected black coatings for multiple applications including reflectance and emittance standards, cavity coatings for blackbody sources and radiometers, and coatings for baffles and temperature controlled shrouds in background controlled chambers. The investigation consists of spectral reflectance and emittance measurements, at temperatures from near ambient to several hundred degrees Celsius, over the mid and far infrared range of 2 μm to 50 μm. Implementation of these coatings and accurate knowledge of their optical properties should ultimately benefit calibration support of a number of remote sensing satellite programs.

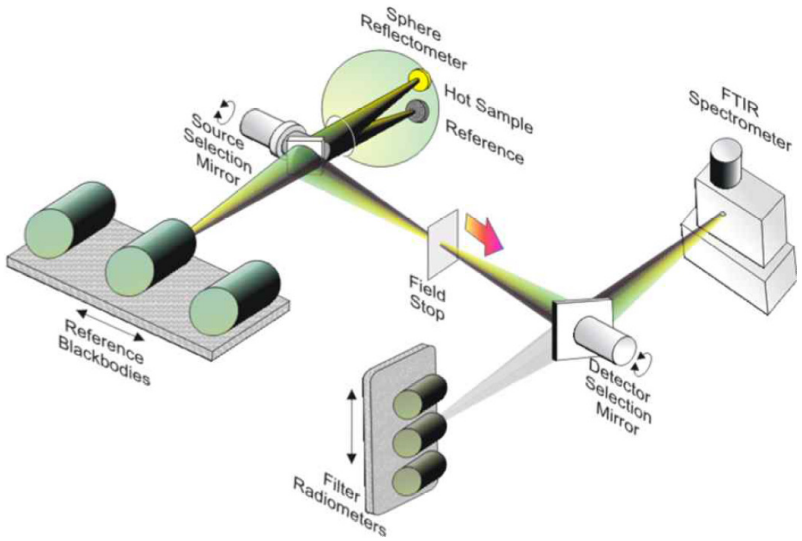


Diagram of the NIST Facility for infrared spectral emittance.

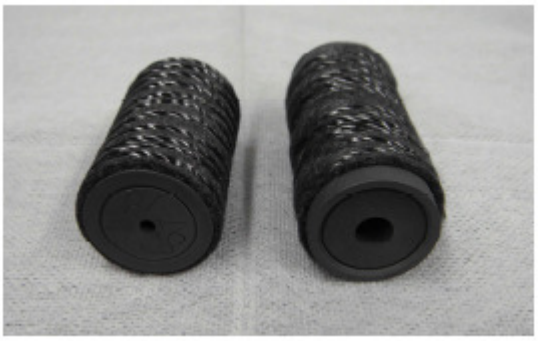
Both PTB and NIST are in the process of establishing additional emittance and reflectance measurement capabilities employing vacuum and controlled / cooled background to enable characterization at lower temperatures for wavelengths up to 100 μm.

C. Monte, B. Gutschwager, S. P. Morozova, and J. Hollandt, "Radiation Thermometry and Emissivity Measurements Under Vacuum at the PTB." Int. J. Thermophys. 30, 203-219 (2009).

Contact: Leonard Hanssen (leonard.hanssen@nist.gov)

BRDF Measurements of Graphite Used in High-Temperature Fixed Point Blackbody Radiators: A Multi-Angle Study at 405 nm and 658 nm

The eutectic alloys Co-C, Pt-C and Re-C are being considered as reference points for the dissemination of temperature at 1597 K, 2011 K, and 2747 K, respectively. A critical issue in their use is the knowledge of the emissivity of the graphite blackbody radiator cavities used in the measurement. Modeling of the emissivity requires characterization of the reflectance of the cavity, ideally as a function of incident angle, scattering angle, polarization, wavelength and temperature, which is described by BRDF of the graphite walls. The cavity reflectance is then input to Monte Carlo based ray tracing models to obtain the effective emissivity. In current models, the BRDF of the graphite is approximated either as Lambertian, or as a generalized specular plus diffuse (GSD) function.



Blackbody cavities, with two aperture sizes and protective sleeves. Photo courtesy Y. Yamada.

In this work, we utilized two laser sources at 405 nm and 658 nm, to measure full angle-and polarization-resolved, hemispherical BRDF for graphite samples illuminated at angles of incidence varying from normal incidence to 70°.

The wavelengths were chosen for their proximity to two common operating wavelengths for filter radiometers used in radiation thermometry, 400 nm and 650 nm. The measurements were performed at ambient temperature using the NIST Goniometric Optical Scatter Instrument (GOSI). The measurements show that the graphite used is not well-described by either the Lambertian or GSD models. Nonisotropic scattering, including enhanced forward scatter at high incident angles, was seen for all of the samples. The results of this study will be used to guide further emissivity model development, and where possible, as inputs to current emissivity models to better estimate cavity contributions to the uncertainty in radiation thermometry.
Contact: Heather Patrick (heather.patrick@nist.gov)

New Method for Spectral Irradiance and Radiance Responsivity Calibration using Pulsed Tuneable Lasers from 210 nm to 2500 nm

Continuous wave (CW) tunable lasers have been used for spectral irradiance and radiance responsivity calibrations for over 10 years. The CW laser-based calibration facility is capable of achieving the lowest uncertainty for spectral irradiance and radiance responsivity calibrations. However, CW tunable lasers are expensive and difficult to operate and maintain. Furthermore, CW tunable lasers typically have extremely narrow bandwidths; interference fringes from optical elements of detectors (e.g. windows) and instruments (e.g. filters) can result in large calibration errors if not properly mapped out.

The newly developed 1000 Hz repetitive rate optical parametric oscillator (OPO) tunable lasers are affordable and easy to operate compared to CW tunable lasers. However, the pulse duration of this type of OPO tunable lasers is only a few nanoseconds and thus its duty cycle is extremely small. The small duty cycle causes problems in a conventional measurement system consisting of a detector, a transimpedance amplifier, and a digital multimeter. To avoid saturation at the peak laser power, the averaged signal from the detector must be low, and the gain of the transimpedance amplifier and the range of the digital multimeter must be set to be several orders of magnitude

higher than that for the corresponding DC signal which results in a large measurement uncertainty. Furthermore, a significant error may be introduced when a multimeter is used to measure the extremely spiky signals from the kHz laser system in DC mode.

A new, electric charge measurement-based method for spectral irradiance and radiance responsivity calibrations was developed at NIST. This method is immune to the systematic errors from the current integrator and integration timer which are dominant uncertainty factors for a charge based measurement system, and thus small calibration uncertainties can be achieved. Based on the new technique, a fully automated calibration system using a 1000 Hz OPO tunable laser with a continuous tunable range from 210 nm to 2500 nm is being developed. The estimated relative expanded uncertainty for spectral irradiance and radiance responsivity calibration is expected to be below 0.1 % (with a coverage factor k=2). This system can be used to calibrate detectors for spectral irradiance and radiance responsivities. It can also be used to perform detector-based calibrations for spectroradiometers and imaging instruments over a wide spectral region, from 210 nm to 2500 nm. We are exploring the use of this technique with cryogenic radiometers for the calibration of trap detectors.
Contact: Yuqin Zong (yuqin.zong@nist.gov)

Development of New-Generation Transfer-Standard Pyroelectric Radiometers for Monochromator Use

There are no room-temperature detectors available with low enough noise-equivalent-power (NEP) to measure less than 1 mW radiant-power levels of monochromators in the infrared range. Radiometers with NEP of about 1 nW/Hz$^{1/2}$ are needed for the spectral responsivity scale extension (without any wavelength gaps) to 25 µm. Pyroelectric trap detectors (both wedge and dome versions) developed earlier have high NEPs (larger than 40 nW/Hz$^{1/2}$) and cannot be used at monochromator outputs. They need laser sources. Tuned-laser calibrations are slow and expensive. The earlier developed cryogenic bolometers are not user friendly.

Transfer standard pyroelectric radiometers with NEPs close to 1 nW/Hz$^{1/2}$ have been developed for monochromator-use to extend the NIST spectral power responsivity scale for routine calibrations to 25 µm. The main steps to obtain low NEP, without using liquid-nitrogen cooled quantum detectors, was to increase the overall responsivity.. Since the low-NEP single-element pyroelectric hybrid detectors have structured spectral responsivities, dome-input radiometers with low-NEP have been developed. The infrared spectral responsivity scale uncertainty has been decreased to less than 1 % (k=2).
Contact: George Eppeldauer (george.eppeldauer@nist.gov)

2012 Spectroradiometry Short Course – April 17-20, 2012 and 2012 Radiation Thermometry Short Course – June 4-8, 2012

The Spectroradiometry Short Course covers the fundamentals of spectroradiometry including radiometry fundamentals, radiometric properties of sources and detectors, spectroradiometric techniques, reflectance properties of materials, and handling and determination of measurement uncertainties.
Contact: Howard Yoon (howard.yoon@nist.gov)

The Radiation Thermometry Short Course covers the fundamentals of radiation physics and instrumentation associated with determining temperature from observations of thermal radiation from materials.
Contact: Carol Johnson (cjohnson@nist.gov)

These courses are offered every two years. http://www.nist.gov/pml/div685/sc/

NATIONAL RESEARCH COUNCIL OF CANADA

NRC · CNRC National Research Council Canada Conseil national de recherches Canada

REPORT FROM THE PHOTOMETRY AND RADIOMETRY GROUP

Upgrade of the NRC Primary Radiometric Standard

We have undertaken a program of phased upgrade of our primary standard, the cryogenic radiometer. In the first phase the monochromator is being replaced with a McPherson 2035D double monochromator in subtractive mode. This phase is in progress, and a characterization of the wavelength accuracy will be performed before the first run to calibrate primary standards, which is scheduled for May 2012.

For further information contact: Charlie Bamber, 613-990-8990 or Jeff Lundeen, 613-993-8913.

Update on NRC Quantum Candela Research Project

As outlined in the previous issue, a technique to directly measure the wavefunction of a quantum system was developed. We applied this technique by performing a series of measurements of the transverse wavefunctions of single photons. The technique and this example application were published in the June 9th, 2011 issue of *Nature* (*Nature*, pp. 188-190, vol. 474 (2011)). This work was elected 2nd most important physics breakthrough of 2012 by the editors of *Physics World*.

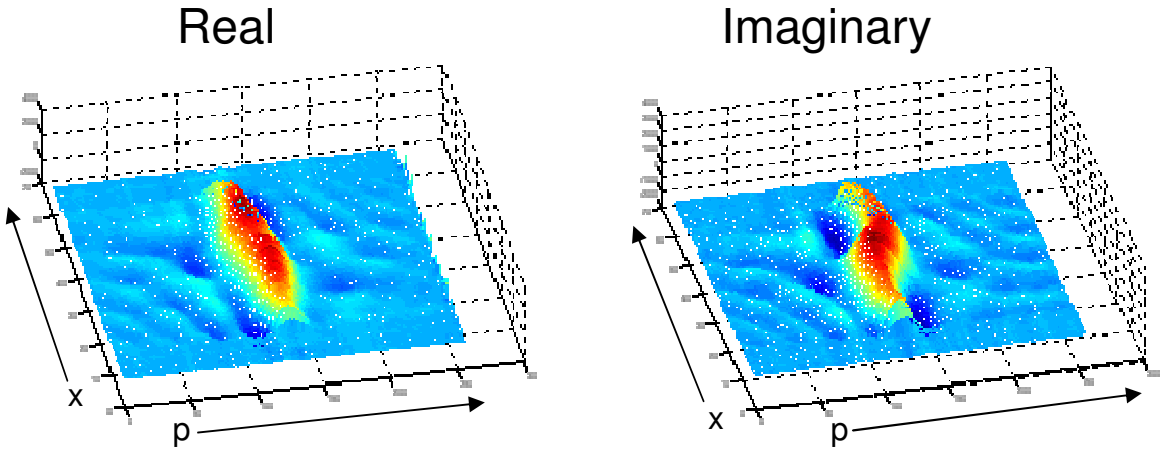


Figure: The real and imaginary components of the Dirac distribution of the transverse quantum state of a photon. The Dirac distribution is a representation of a general quantum state in terms of x and p. Here, these are the photon's transverse position and momentum, respectively. Classically this technique will completely characterize a light beam with partial spatial coherence.

In new theoretical work (*Phys. Rev. Lett.*, p. 070402, 108 (2012)), we have extended this technique to 'mixed states.' These are a generalization of the wavefunction that can incorporate classical noise and entanglement with other systems. They are used in statistical mechanics, quantum computing, and to model the propagation of partially coherent light. Preliminary experimental data demonstrating our extension is shown below for the transverse position quantum state of a photon. Additionally, in the paper we show how to directly measure any element in the density matrix corresponding to a mixed state.

We have also developed a classical analogy (Optics Express, p 2034, vol. 20 (2012) to our direct measurement technique. This analogous technique measures the transverse optical mode of a beam of light, including its phase and magnitude. It is unique in its ability to retrieve the phase directly without an external phase reference. In contrast, competing techniques (e.g. the Shack-Hartmann Wavefront Sensor) measure phase gradients or curvatures.

For further information contact: Charlie Bamber, 613-990-8990 or Jeff Lundeen, 613-993-8913.

Collaboration with Mid Sweden University on Goniospectrophotometer Project

Drs. Réjean Baribeau and Joanne Zwinkels, are members of a reference group of scientific experts that are overseeing a Spectral Goniophotometer Research Project in the Paper Optics and Color Group of the Digital Printing Center at Mid Sweden University. The objective of this project is to develop the infrastructure, a state-of-the-art spectral goniophotometer, and the knowledge for performing high-accuracy angularly resolved spectral measurements on paper and print. This Spectral Goniophotometer research project is being funded by the Swedish Knowledge Foundation for 3 years until the end of 2012. As part of this collaboration, Dr. Baribeau will attend the 3rd reference group meeting to review the project status on March 22, 2012 and to give an invited presentation on relevant NRC measurement capabilities. He will also be discussing topics of mutual interest, including the accuracy of goniophotometer measurements, surface reflection models, anisotropy of fluorescence, and harmonization of goniophotometric measurements with standard measurement geometries. NRC will also be contributing to the calibration and inter-instrument comparison activities.

For further information contact: Réjean Baribeau, 613-993-9351 or Joanne Zwinkels, 613-993-9363.

Update on Goniospectrofluorimeter Project

The characterization and testing of a refurbished goniospectrofluorimeter facility originally constructed for 3M Corporation is well-advanced. This instrument is based on the two monochromator method and has sampling capabilities for total hemispherical, bidirectional (45:0), and gonioreflectance geometries. The instrument control electronics and software have been updated and the system throughput has been significantly improved by a factor of 5 to 20 depending on wavelength through several measures including improved optical alignment, recoating of mirrors, and optimization of PMT operating parameters. The wavelength scale for both excitation and emission monochromators has been calibrated and the spectral responsivity calibration of the emission channel on the detection side is presently being carried out with a spectral radiance standard (sphere source) illuminating a pressed polytetrafluoroethylene powder reflectance standard

which, in turn, has been calibrated at several bidirectional geometries using the new NRC robot-based BRDF facility.

This new goniospectrofluorimeter will extend the NRC fluorescence calibration capabilities to gonioapparent fluorescent colours, e.g. for security applications, as well as provide a new research tool for investigating the nature of the geometric correction between bidirectional and hemispherical geometries for measuring optical properties of fluorescent samples such as paper and textiles which have their direct traceability to a reference instrument with a bidirectional geometry (45:0) but are typically used in commercial instruments with a sphere geometry (d:0).

For further information contact: Joanne Zwinkels, 613-993-9363.

2012 NRC Measurement Course on Photometry and Radiometry

A short course on photometry and radiometry will be held at the National Research Council of Canada (NRC) in Ottawa on 24-26 October 2012 and is one of an ongoing series of measurement courses presented by the NRC concerning the metrology of basic physical quantities. This 2.5-day Photometry and Radiometry course will provide up-to-date information on the basic concepts, terminology, instrumentation, measurement procedures, standards, and uncertainty analysis used in the fields of photometry and radiometry. The last half-day will be devoted to advanced topic areas including BRDF and fluorescence measurements, applications of Raman spectroscopy, quantum-based radiometry and radiation thermometry. There will also be an accompanying exhibition of photometric and radiometric instrumentation and a tour of the NRC photometry and radiometry laboratories.

The course is limited to 60 participants. It is designed for those concerned with accurate and precise measurement of photometric and radiometric properties in research, development or industrial applications. The course will finish at noon on the last day.

For updates on this measurement course, visit the webpage:
http://www.nrc-cnrc.gc.ca/eng/events/inms/2012/10/24/radiometry.html

For further information contact: Charlie Bamber, 613-990-8990 or Jeff Lundeen, 613-993-8913.

New Organizational Structure for NRC

Effective 1 April 2012, the NRC will have a new organizational structure. Currently, the NRC has an Institute or discipline-based structure with the Institute for National Measurement Standards (INMS) being one of about 20 Institutes and National programs across Canada. This will change to a portfolio structure with three Divisions: Engineering, Emerging Technologies, and Life Sciences. Within each Division there will be several portfolios that will carry out industry-focused programs and projects. Within the Emerging Technologies Division, one of these portfolios is entitled: "Measurement Science and Standards" which will include all of the scientific and technical staff of the existing INMS as well as small programs from several other NRC Institutes, including for example Marine CRMs from the current NRC Institute for Marine Biosciences. Dr. Alan Steele, who is currently the Director of Metrology within INMS, has been appointed to the role of General Manager for the Measurement Science and Standards portfolio.

For further information, contact Nelson Rowell, 613-993-2377.

Proficiency Test Demand Increases in Mexico

During last November, a proficiency test for the brightness meters calibration has been conducted under special requirement of the Mexican accreditation body. This proficiency test's range included several typical values reachable with traditional high brightness standards; around 90 to 100 brightness units, for measurement geometries of 20º, 60º and 85º.

Also as a special request of Exacolor Laboratories, by the end of 2011 two proficiency tests for the measurement of a source produced illuminance; and for the color meters calibration was carried out at CENAM.

In December, a proficiency test for UV-Visible spectrophotometers calibration started with the participation of the Spectrophotometry and Colorimetry Laboratory of the National Institute for Astrophysics, Optics and Electronics; and under the requirement of the Mexican accreditation body.

Fluorescent Compact Lamps Study

A recent study on a small sample of commercially available fluorescent compact lamps was carried out by the *Laboratorio de Fotometría*, in order to know their typical color matching coefficients. This study also allowed to verify the typical self-absorption coefficients and provided with interesting information on the nominal values for total luminous flux declared by the manufacturers in their commercial products; which could be contrasted with the luminous efficacy limits established by the Mexican regulation concerning these products.

FCL ID	CCT, (K)	Φ_v, (lm)	α, (1)	ccf^*, (1)
01	5 894	613.70	0.997 1	1.012
02	2 934	598.18	0.996 8	1.027
03	3 012	1 367.87	0.997 0	1.007
04	NA	NA	0.997 1	NA
05	2 777	409.78	0.996 3	1.022
06	6 196	1 339.42	0.997 4	0.998
07	2 774	686.03	0.998 8	1.030
08	6 072	950.36	0.997 8	1.010
09	2 862	813.10	0.996 8	1.031
10	5 569	1 404.68	0.968 2	1.016

Table: Summary of the measured quantities in the studied FCLs.

Figure: Two of the studied FCLs.

New Mexican regulation for LED lamps and LED Based Luminaires

The Mexican authority, though the Mexican agency for the efficient energy use promotion, the *Comisión Nacional para el Uso Eficiente de la Energía*, recently finished two new regulations drafts, establishing the minimum acceptable energy efficiencies of LED sources and LED based luminaries to be produced, commercialized and used in Mexico.

Those two new regulations will be issued in the following months under the codes NOM-030-ENER-2011 and NOM-031-ENER-2011; and will include higher accuracy requirements for the total luminous flux, correlated color temperature, and color rendering index measurements.

Establishing a New Solid State Lighting Facility

In response to the increasing applications the LEDs are finding in solid state lighting products, lamps, modules and integrated luminaries in Mexico; CENAM has starting with the development of a new measurement system devoted to these specific applications.

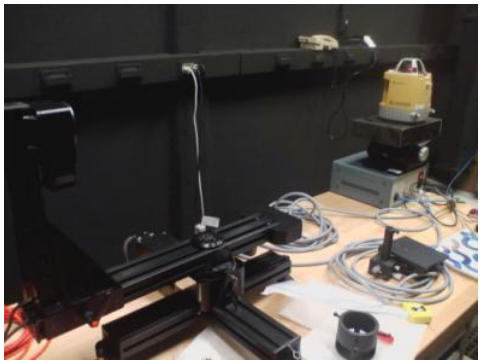


Figure: Solid State Lighting Laboratory goniophotometer.

The new measurement system includes a recently installed 1 m goniofotometer with integrated spectrorradiometer for the visible range, a couple of integrating spheres, and the required power supplies and electronic instrumentation for LEDs. This measurement system will be completed with a set of standard LEDs, which construction and characterization is expected to be finished by the end of this year.

SAE NEWS

Technical Committee A-20 Aircraft Lighting

The SAE A-20 Aircraft Lighting committee addresses all facets of aircraft lighting equipment–design, manufacture, operation, maintenance, and in-service experience. It is responsible for standards pertaining to aircraft lighting and lighting emission sources which will fulfill the needs and requirements of operational control and utility, including all lighting on and in an aircraft and under its control. The group is comprised of committees dedicated to creating, preparing, and maintaining all relevant specifications, standards, and requirements for aircraft lighting systems. These committees include:

- A-20A Crew Station Lighting
- A-20B Exterior Lighting
- A-20C Interior Lighting

Participants in the SAE A-20 committee include OEMs, system suppliers, aircraft lighting companies, consulting firms, government and others across the aerospace and defense industries.

Ongoing standards development/revision activities include:

- AS5452B - Night Vision Goggles (NVG) Compatible Lighting for Civil Aircraft
- ARP4168B - Night Vision Goggle (NVG) Compatible Light Sources

- ARP1782B – Photometric and Colorimetric Measurement Procedures for Airborne Direct View CRT Displays
- ARP4169B – Night Vision Goggle (Nvg) Filters
- ARP924B – Specification and Inspection of Glass for Integrally Lighted Aerospace Instruments
- AS25027A – Light Assembly, Cockpit, Fixed
- AIR1106BB – Some Factors Affecting Visibility of Aircraft Navigation and Anti-Collision Lights
- ARP4392A - Lighting, Aircraft Exterior, Night Vision Imaging System (NVIS) Compatible
- ARP5637A – Design and Maintenance Considerations for Aircraft Exterior Lighting Plastic Lenses
- ARP5825A - Design Requirements and Test Procedures for Dual Mode Exterior Lights
- ARP694C – Aerial Refueling Lights – Design Criteria
- AIR512E - Aircraft Cabin Illumination
- ARP1283B – Cargo Compartment Lighting for Transport Category Aircraft and Rotorcraft
- ARP5563 - Measurement of Aircraft Passenger Cabin LED Luminaires

Recently published documents include:

- ARP6161 – Flight Compartment Glare
- ARP1088B – Aircraft Indicating Systems
- AS50571A - Lights, Instrument, Individual, General Specification For
- ARP693D – Landing and Taxiing Lights – Design Criteria for Installation
- ARP6402A – LED Landing, Taxiing, Runway Turnoff, and Recognition Lights
- ARP4087C - Wing Inspection Lights - Design Criteria
- AS8017C – Minimum Performance Standard for Anti-Collision Light Systems
- AS8037B – Minimum Performance Standard for Aircraft Position Lights
- ARP1798A - Portable Emergency Lighting Systems for Airline Crew Members
- AS4914C – Aircraft Fluorescent Lighting Ballast/Fixture Safety Design Standard
- ARP711B – Illuminated Signs
- ARP5297A – Recommended Qualification Tests for Halogen Miniature Lamps Less Than 35 Watts for Aircraft Applications
- ARP6253 – LEDs and Aircraft Applications

Chester F. Carlson Center for Imaging Science
Munsell Color Science Laboratory

NEWS FROM THE RIT MUNSELL COLOR SCIENCE LABORATORY

Munsell Color Science Laboratory Industrial Short Courses 2012

The Rochester Institute of Technology's Munsell Color Science Laboratory (MCSL) is offering the following Industrial Short Courses in 2012:

- Fundamentals of Color Science, June 5-6, 2012 ($1,200)
- Advanced Topics in Color and Imaging, June 7, 2012 ($600)
- Instrumental-Based Color Matching, June 7, 2012 ($600)

The 2012 MCSL Fundamentals of Color Science is a two-day short course composed of eight lectures, all designed to teach you the theory and application of modern color science. The faculty and staff of MCSL are your teachers, all experts in these many facets of color.

Also offered are two one-day courses, offered simultaneously, so you will have to choose! Advanced Topics in Color and Imaging consists of four lectures in topical areas where MCSL faculty have had significant impact in imaging technology. Instrumental-Based Color Matching is a hands-on course with both lectures and laboratories where you will gain a deeper understanding of what goes on "under the hood" of commercial matching systems.

Registration begins January 2012. For more information and to register, visit http://www.cis.rit.edu/mcsl/SSC.

Lighting Research Center

NEWS FROM RENSSELAER'S LIGHTING RESEARCH CENTER

13th International Symposium on the Science and Technology of Lighting

The 13th International Symposium on the Science and Technology of Lighting (LS13) – an elite forum of scientists and engineers sharing the most recent research and development in the science and technology of light sources, lighting systems, and their key application fields – will take place June 24-29, 2012 at Rensselaer Polytechnic Institute in Troy, NY. The event is hosted by Rensselaer's Lighting Research Center (LRC), the world's leading university-based research and education organization devoted to lighting.

LS13 is designed to provide a stimulating and informed environment for scientists and engineers to discuss all aspects of fundamental and applied research on thermal, discharge, and plasma technologies, as well as solid-state lighting (SSL).

Each meeting in the LS series has special features inspired by the local planning committee. As such, LS13 will include the following unique sessions and events.

- ASSIST-sponsored session **-** The Alliance for Solid-State Illumination Systems and Technologies (ASSIST), now in its 10th year, is sponsoring a session where member organizations will present their latest technical developments.
- CTO session **-** Chief technology officers (CTOs) of leading lighting companies will provide their visions for the future of light source and system developments.
- Lighting metrics session **-** This discussion will focus on how light sources affect visual and non-visual functions such as color rendering and circadian stimulation.
- Tour of LRC facilities **-** Attendees can tour the LRC, a 30,000-square-foot facility with state-of-the-art equipment where leading scientists perform research and conduct advanced simulations and testing in diverse areas of lighting. The LRC is the only university-based lighting laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP), the highest accreditation available in the field. (NVLAP lab code: 200480-0)

Similar to previous LS meetings in the series, LS13 will also feature these key components:

- Invited speakers providing topical, in-depth overviews of progress in areas of interest to the community at large;
- Contributed papers (due April 23), for details visit http://www.lrc.rpi.edu/ls13/submit.asp;
- Poster sessions where all papers given at the meeting are presented to promote open discussion among the delegates; and a
- Proceedings volume published by FAST-LS, an independent foundation supporting the LS series, that is provided to all participants and whose content is abstracted by leading search engines.

Registration, Accommodations, and Venue: There is a discount for those registering for LS13 by April 16. LS13 accommodations are available on the Rensselaer campus at very attractive rates. Conference activities will be held at Rensselaer's Experimental Media and Performing Arts Center (EMPAC), a showcase work of architecture and a unique technological facility that boasts unrivaled presentation and production capabilities for art and science.

To learn more and to register, visit the LS13 website at http://www.lrc.rpi.edu/ls13.

UPCOMING IES MEETINGS CALENDAR

The IES is sponsoring the following meetings and conferences in 2012:

2012 LIGHTFAIR International
May 9-11, 2012
Las Vegas Convention Center
Las Vegas, NV

2012 IES Street and Area Lighting Conference
September 9-12, 2012
Intercontinental Miami Hotel
Miami, FL

2012 IES Annual Conference
November 11-13, 2012
Minneapolis Marriott City Center Hotel
Minneapolis, Minnesota

For more information, please visit http://www.ies.org/programs/meetings_calendar.cfm.

A REQUEST FOR INFORMATION

C. S. McCamy, a member of CORM, submitted the following request. If you are able to provide him with further information, please feel free to contact him directly:

> "Although I have been inactive in standards work for years, I recently received a request for information, from people revising an ASTM Standard. Having been inactive so long, I can't access Journal articles etc. on the web. I need to know what technical society or national or international organization sponsored a conference cited as: '7th International Conference on Color, Florence, Prato, and Padua, Italy; 2-7 May 1963.' If I can get access to the proceedings and get a paper by Macbeth and Reese, it might answer the question being asked. My email address is: csmccamy@comcast.net. My address is 617 Barton Road, Edgewater, MD 21037."

Purpose of the Council for Optical Radiation Measurements (CORM)

The Council for Optical Radiation Measurements is a non-profit organization with the following aims:

1. To establish and publish consensus among interested parties on national, industrial and academic requirements for physical standards, calibration services, and inter-laboratory collaboration programs in the fields of optical radiation measurement, including measurement of the transmittance and reflectance properties of materials, measurement of radiant sources, and characterization of optical detectors used for the measurement of these properties.
2. To establish national consensus on the priorities for these requirements.
3. To maintain liaison with the National Institute of Standards and Technology (NIST) and The National Research Council Canada (NRC) and to advise the Institute(s) of requirements and priorities.
4. To cooperate with other organizations, both public and private, to accomplish these objectives for the direct and indirect benefit of the public at large.
5. To assure that information on existing or proposed standards, calibration services, collaboration programs, and its own activities is widely disseminated to interested parties.
6. To answer inquiries about such standards activities or to forward such inquiries to the appropriate agencies.

Optical Radiation News Editorial Policy

Optical Radiation News (ORN) is published semi-annually in the April and October of each year. ORN reports upcoming technical meetings and news from NIST and other national metrology laboratories. News relating to the status and progress in optical radiation metrology from affiliated organizations, including, but not limited to, the *Commission International De Éclairage* (International Commission on Illumination, CIE), Inter-Society Color Council (ISCC), Lamp Testing Engineers Conference (LTEC), etc., is welcome. No commercial advertising, endorsements, or contributions with commercial content are included in ORN. Unsolicited contributions are subject to review and approval by the editor, CORM publications committee, and /or executive board prior to publication. Anonymous contributions will not be accepted. Contact information for a submission is required and will be published. ORN is included free with CORM membership.

Instructions for Contributing Authors

ORN is published in English. Deadlines for submission of News items and announcements concerning optical radiation metrology are 1 March and 1 September. Items may be submitted to the editor in via fax or e-mail attachments in plain ASCII text or common electronic word processing file formats, preferably Microsoft Word® or Corel WordPerfect®. Contributions should be in 12 point Times New Roman font with simple formatting, e.g., the "Normal" style and template in Word. *Use of complex style templates and formatting is strongly discouraged*. Submissions with high quality pertinent electronic graphics are welcome, however digital photographs and graphics will be reproduced in black-and-white or grayscale. Graphics included in hardcopy submissions via fax will not be reproduced. Submissions are credited to organizations, rather than individuals.

Policy on Commercial Activities at CORM Conferences

The Council for Optical Radiation Measurements (CORM) does not permit commercial activities in conjunction with technical sessions of CORM conferences and CORM workshops. Commercial activities include, but are not limited to, product exhibition and dissemination or display of advertising in any format. Speakers at CORM conferences and workshops may not use talks for overt commercialization of products. Commercial activities as defined above are permitted for a fee for defined periods prior to social activities associated with the conference or workshop at the discretion of the CORM Board of Directors. Registration requirements, details of the structure of the allowed activities and fees are (event and site) specific.

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