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 98 FALL 2012

ARTICLE CONTENTS PAGE

UPCOMING IES MEETINGS CALENDAR (continued)

NEWS FROM THE CIE

RECENT PUBLICATIONS FROM RENSSELAER'S LIGHTING RESEARCH CENTER

CORM Council for Optical Radiation Measurements

CORM 2013 Annual Technical Conference

Preliminary Announcement and Call for Papers

May 7 - 9, 2013

The CORM 2013 conference will be held in Gaithersburg, Maryland at the Holiday Inn Gaithersburg. In addition, a tour of NIST laboratories will be offered to conference attendees that includes some new exciting stuff at NIST. The conference topics include:

- 3D Display Technology, Measurements, and Metrology
- Correct Measurement Instruments to Use
- Solid State Lighting (SSL) Technology, and Metrology
- New SSL Measurement Standards (e.g., IES LM-79, -80, -82, -84, & -85, and CIE TC2-71)
- OLEDs Technology, Measurements, and Metrology

The 2013 Annual CORM Technical Conference is structured to provide interaction between the optical radiation industry and National Metrology Institutes (NMIs) (e.g., National Institute of Standards and Technology [NIST], National Research Council [NRC] of Canada, and National Center for Metrology [CENAM] of Mexico).

Early conference registration begins in February 2013.

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

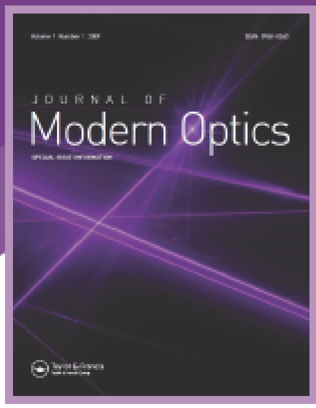
As such, CORM is asking your permission to save and publish your CORM 2013 presentation in pdf format on its website. A CORM Presentation Release Request Form will be supplied to all presenters.

Contact the conference coordinators if you have any questions about the CORM 2013 Conference:

Dr. Kathleen Muray
INPHORA Inc.
4425C Treat Blvd. #244
Concord, CA 94521
Ph: 925-689-2039
Fx: 925-689-2788
murayk@aol.com

Mr. Massy Anaya
The Boeing Company
PO BOX 3707, MC 19-RU
Seattle WA 98124-2207
Ph: 206-544-1677
massy.anaya@boeing.com

JOURNAL OF **Modern Optics**



CALL FOR PAPERS

Special Issue

Photometry, Colorimetry and Radiometry: Issues and Applications

Guest Editors: John Bullough and Joanne Zwinkels

Following on the *Council for Optical Radiation Measurement's* (CORM) successful May 2012 conference in Ottawa, Canada on the topics of photometry, radiometry and colorimetry, the editors of the ***Journal of Modern Optics*** are inviting papers from conference attendees and non-attendees alike that touch on these topics.

If you are interested in contributing a manuscript related to the measurement or characterization of light, optical radiation and color, or on the application of light and optical radiation to practical problems in vision, lighting, colors and dyes or related topics, please contact John Bullough at bulloj@rpi.edu with your title/topic by **November 15, 2012.**

Papers will be peer-reviewed, and accepted papers are planned to be published in a special issue of the ***Journal of Modern Optics*** in 2013.

For more information:

- about CORM visit: **www.cormusa.org**
- about the *Journal of Modern Optics* visit: **www.tandfonline.com/jmo**

Date

Final manuscripts will be due on **February 15, 2013.**

All submissions should be made at ***Journal of Modern Optics*** ScholarOne Manuscripts™ site: **http://mc.manuscriptcentral.com/tmop**

For further information, visit the journal's homepage and click on 'Authors and submissions / Instructions for authors' or contact John Bullough at: bulloj@rpi.edu

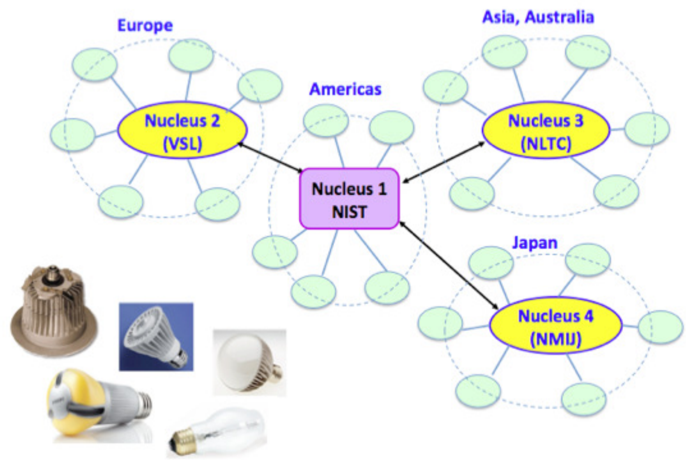
Manuscripts can be up to 8 print pages long.

www.tandfonline.com/jmo

Taylor & Francis
Taylor & Francis Group

NEWS FROM THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

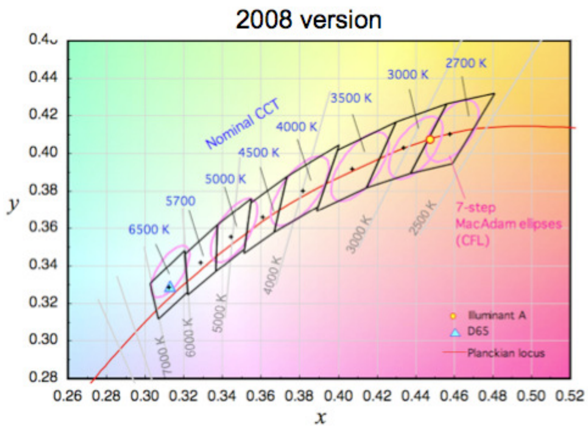
NIST Leading the Worldwide SSL Interlaboratory Comparison by IEA

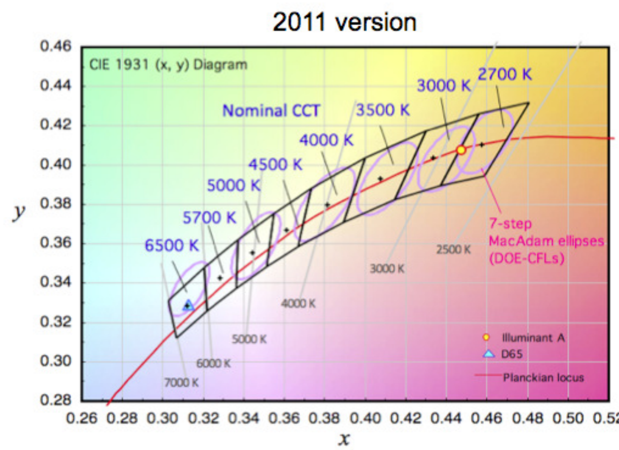


The International Energy Agency (IEA) started a project to promote Solid-State Lighting (SSL) with internationally harmonized regulatory efforts by country governments. The project is called SSL Annex, under IEA 4E (Energy-Efficient End-use Equipment). Ten countries are now participating including the USA (see http://ssl.iea-4e.org). The U.S. Department of Energy represents the USA. Y. Ohno and C. Miller of NIST are participating as technical expert members. Task 2 (SSL Testing) is led by NIST and is about to launch the SSL Annex 2013 Interlaboratory Comparison of SSL products. This worldwide intercomparison campaign will be piloted by four Nucleus Laboratories, NIST (USA), VSL (the Netherlands), NMIJ (Japan) and NLTC (China), to cover possibly over 100 participants from various countries worldwide. Task 2 has already completed an intercomparison among the four Nucleus Laboratories on SSL testing (report available at http://ssl.iea-4e.org/task-2-ssl-testing), establishing the equivalence of these four laboratories and providing the basis for the 2013 Interlaboratory Comparison. This Comparison is aimed at promoting SSL testing accreditation worldwide to support SSL regulations, following the model of the NVLAP SSL testing program support to the ENERGY STAR program for SSL. The 2013 IC is designed to be used as SSL proficiency testing to be accepted by accreditation bodies worldwide, who wish to establish SSL testing programs. NIST is leading the efforts of the 2013 Interlaboratory Comparison, which will run from October 2012 to June 2013.
(Contact: Yoshi Ohno, ohno@nist.gov)

NIST Contributed to Revision of ANSI C78.377

ANSI C78.377, Specifications for the Chromaticity of Solid State Lighting Products, was first published in 2008 with NIST's leadership within the ANSI committee. This standard is widely accepted worldwide, as there are no international or other national standards of this kind for SSL products. Many LED manufactures revised their binning specifications of white LEDs based on this standard, but there were some inconveniences, for which small improvements were needed. NIST made a major contribution again to this revision. The curves of the upper and lower Duv limits of the quadrangles in the chromaticity diagram had small discontinuities between some quadrangles (see the left figure below), which caused inconsistencies in the binning specification of white LEDs. It also caused inconsistency with the Flexible CCT specification recommended in the same standard. The specification of C78.377 was modified to specify the shifts of the chromaticity of the





center points of the quadrangles in a smooth function, thus the curves of the Duv limits appear as smooth curves (see the right figure above). This new standard (2011 version) was published in spring 2012. In addition, some practical conversion formulae to calculate Duv have also been added, and also the expected future version for narrower tolerances based on 4-step MacAdam ellipses is presented in the Annex. There is another proposal to move all the center points of quadrangles on to the Planckian locus, for which vision experiments are needed and being prepared at NIST.
(Contact: Yoshi Ohno, ohno@nist.gov)

LED Life Test Research Facility Installed at NIST

A novel facility for testing LED luminous flux maintenance has been developed and installed at NIST's photometry laboratory. This work was done in collaboration with Vektrex (San Diego, CA), with support from the Department of Energy. This facility was built to provide data on LED luminous flux and color maintenance under and beyond the LM-80 conditions for research purposes. Obtained data will be made publicly available. In addition, this new system implements a novel approach for LED lifetime testing. The luminous flux maintenance of high-power LED packages is normally tested with the LEDs aged in thermal chambers; at certain scheduled times the LED boards are moved to a photometry laboratory and measured. Such operations for measurement not only are expensive but also have disadvantages in measurement uncertainty, as the photometry lab system is used for many other measurements and the conditions of the system changes from time to time (e.g., change of standard lamps, etc.) which affects the reproducibility of measurement. This new NIST facility is designed for fully automated testing of LED aging with the lowest uncertainties. It uses a 1-m diameter integrating sphere, which is designed to work as a thermal chamber as well as a high-accuracy photometric integrating sphere,

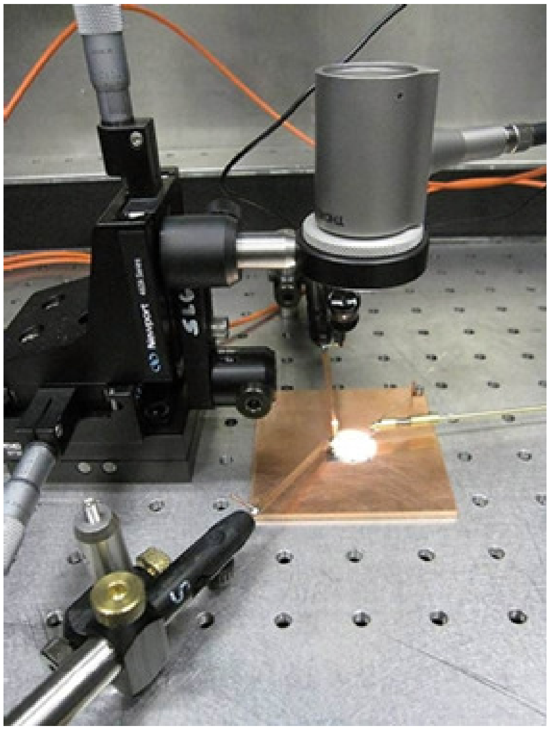
so that the aging of the LEDs and periodic photometric measurements of the LEDs are done in the same integrating sphere, without removing the LEDs, and measurements are done automatically against dedicated standard sources. There are three temperature-controlled LED boards, each with 160 high power LEDs installed, so a total of 480 LEDs can be tested in one facility. Each individual LED is computer-controlled, and operated one by one in the measurement mode. LEDs are measured with a spectroradiometer on short current pulse conditions so that measurements are done rapidly. The irradiance in the sphere, illuminated by 480 LEDs, is very high. The possible effect of the high irradiance level on the aging of the sphere will be closely monitored. The instrumentation of this sphere system is now being completed.
(Contact: Yuqin Zong, yuqin.zong@nist.gov)

Research on Mesopic Photometry in Progress at NIST

With the rapid introduction of LED street lighting, mesopic photometry is gaining increasing attention in the lighting community. CIE 191, Recommended System for Mesopic Photometry Based on Visual Performance, was published in 2010. The report indicates that white LEDs with 4000 to 5000 K CCT can be visually much more efficient than high-pressure sodium lamps and that the use of LED lights will lead to significant energy savings. However, the CIE mesopic system is still yet to be practically used because the mesopic luminous efficiency depends on the visual adaptation level (luminance of visual adaptation field), but it is still not clear what the visual adaptation field is. We still do not know the size and shape of the adaptation field, thus we cannot calculate or measure the adaptation luminance of a lighting scene. To address this urgent issue, CIE started a new TC, JTC-1, the first joint committee across CIE Divisions, to investigate such remaining problems and provide guidance on how to use the CIE 191 mesopic system. One of NIST guest researchers at Sensor Science Division, Tatsu Uchida from Japan, started researching visual adaptation field, working with Yoshi Ohno. We built a vision experimental set up with a large flat panel display to simulate nighttime driving conditions, and are conducting experiments on detection of objects in the peripheral vision under various sizes and luminance levels of assumed adaptation field. Our experiments revealed so far that the visual adaptation is fairly local, so the adaptation field is fairly small around the target. However, due to eye movements, e.g., while driving, the visual field is adapted to the average luminance of a much larger area around the target. We presented these results at a CIE Tutorial and Workshop on Mesopic Photometry in January 2012 in Vienna and a CIE 2012 conference in China in September. Ohno also developed a formula to calculate mesopic luminance without a need for iterative solution, and presented it at the CIE Workshop. NIST is now making considerable contributions to the CIE JTC-1. Further experiments will continue to answer more questions, e.g., how glare sources, such as direct light from roadway luminaires, can affect the adaptation state.
(Contact: Tatsu Uchida, tatsukiyo.uchida@nist.gov)

Simulating the Sun for Photovoltaic Research

PML researchers in NIST Boulder have devised a novel source of portable sunlight that may fill an urgent need in renewable energy research – namely, light sources that generate a near-perfect solar spectrum to be used in testing the performance and efficiency of photovoltaic (PV) materials.



Collimated output of the solar simulator illuminates a small solar cell. Electrical probes are used to measure cell efficiency.

The team's laser-based solar simulator produces a spectral distribution almost identical to sunlight at wavelengths from 450 to 1750 nm, and does so in a readily-focused beam that can be easily adapted to examine the latest generation of nanoscale, multi-cell, and multi-layer PV configurations. Recently the system was tested head-to-head against the best conventional sources with very promising results.

"The conventional light source for testing PV materials is the xenon arc lamp," says Tasshi Dennis of the Quantum Electronics and Photonics Division at NIST's Boulder, CO campus. "It has plenty of energy, a decent spectral match to sunlight after some shaping, and good uniformity. But its light is spatially incoherent – it is emitted in every direction – and thus quite difficult to focus or propagate. Moreover, it's not ideal for testing recently developed multi-junction materials in which individual sections are tuned to respond only to a particular spectral band."

Dennis' co-worker, John Schlager, came up with the idea of exploiting a technology that had just become commercially available: a "super-continuum" white-light laser system. Dennis and Schlager produced a design that makes controllable spectral modifications to the super-continuum light and uses the output to illuminate different PV materials.

"From the start," says Dennis, "there was one big question to answer: Does our light really look like the sun?" The answer to that question would depend critically on two factors.

The first factor is the pulsed nature of the light from a newly available laser system that produces a super-continuum beam in a two-stage process. First, light is generated in an optical, fiber-based, mode-locked, multi-watt laser that emits pulses of several hundred femtoseconds duration at a rate that is controllable between 1 MHz and 80 MHz. That output is then amplified and sent into a photonic-crystal fiber. In the crystal medium, non-linear effects cause the spectrum to broaden out continuously over a wavelength range of about 2000 nanometers. That broad range is the "super" in super-continuum.

"A key advantage of this method," says Dennis, "is that the light from this fiber is single-mode" – that is, all the component frequencies have the same spatial distribution and form one single ray. That fiber output is then directed into a prism which splits the light into its spectral components and directs them at a mirror. Because the different wavelengths are spread out in space, inserting masks

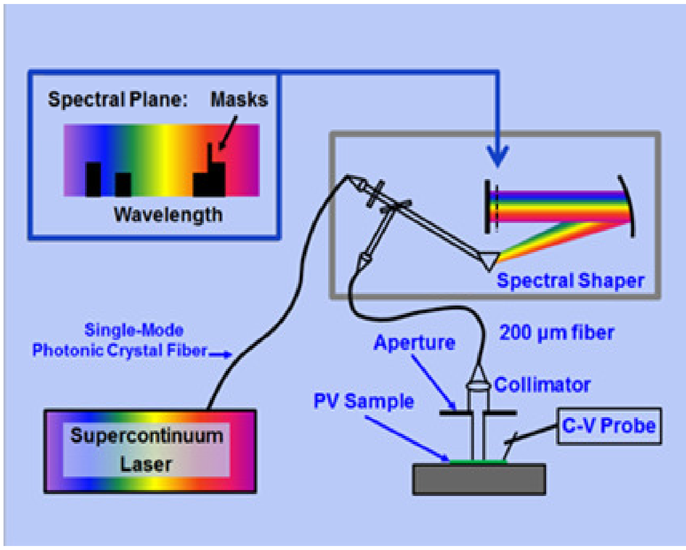
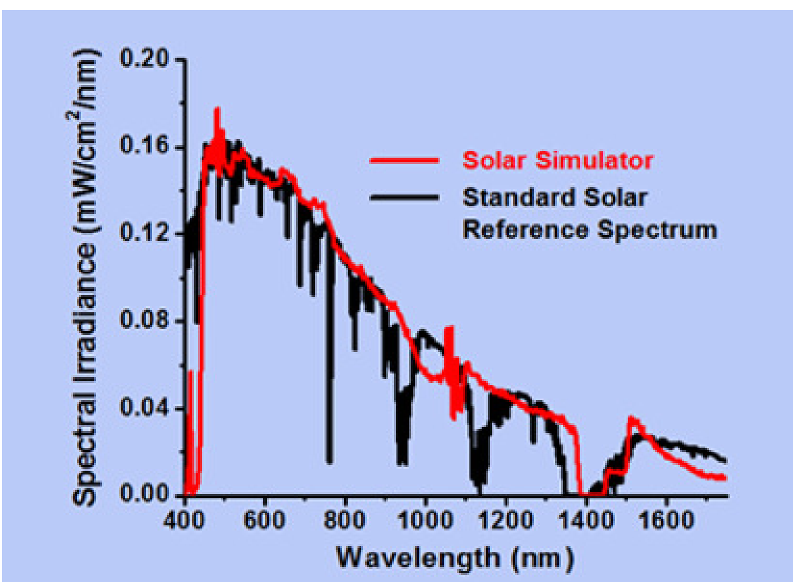


Diagram of lab apparatus. The laser output is sent to a prism which splits the light into its constitutent wavelengths. Masks are inserted into the prism beam to shape the spectrum by modulating certain wavelengths. The resulting spectrum is recombined and routed to a collimator and focused onto PV samples.

at selected points in the light before it hits the mirror will shape the spectrum to resemble sunlight by subtracting out specific wavelengths. The reflected light is then recombined into a single beam and focused onto PV samples.

"The shaped spectrum was a very good match to sunlight over our wavelength range," Dennis says, "but we worried that the pulsed beam might not have a quasi-continuous effect. But we found that it produces photovoltaic responses that are very close to continuous xenon light. We also wanted to see if the samples were sensitive to the pulse repetition rate, so we tested them at 20 MHz, 40 MHz and 80 MHz. As it turns out, the variation in response was only about 1 percent in PV cell efficiency. So it appears that the pulsed nature of the light doesn't matter for PV testing purposes."

The second factor, still an ongoing concern, is the absence of ultraviolet (UV) light in the super-continuum system. "The fiber heavily attenuates wavelengths below 450 nanometers," Dennis says, "so you're not getting photons in the 300 nm to 450 nm range you see from the sun. We're thinking of using some sort of arc-based source to fill those short wavelengths in. With that addition and a little more spectral shaping, we can get a perfect solar match," Dennis says.



Graph comparing the output of the solar simulator with the standard solar reference spectrum AM 1.5.

But even without a UV component, the team wanted to determine how well their simulator performs compared to results with xenon-source measurements taken on exactly the same materials by colleagues at the Department of Energy's National Renewable Energy Laboratory (NREL) in nearby Golden, CO, which is the federal agency responsible for certifying the efficiencies of different PV materials.

So earlier this year, Dennis and Schlager took measurements on the performance and efficiency of four different PV materials (p-type crystalline silicon, GaAs heterojunction, a thin film of copper indium gallium (di)selenide, abbreviated as CIGS, and amorphous silicon) illuminated by the super-continuum light.

"We did it two different ways," Dennis says. "First we adjusted our light to 100 mW per square centimeter, which is the average for solar radiation reaching the Earth's surface. The match to NREL's data was pretty good, but still off by around 10 percent, illustrating the challenge of an absolute calibration measurement. The discrepancies are likely caused by beam non-uniformity and spectral mismatch.

"In the second method, we just did whatever it took to tune the intensity until we got exactly the same current density for each sample that NREL did. Then we measured the efficiency, and the difference went down to 5 percent. Some materials showed even better agreement with the NREL results."

If the super-continuum system eventually joins xenon as an accepted standard solar simulator, Dennis says, it could alleviate a number of difficulties that arise in studying the newest high-tech PV materials. For one thing, its collimated beam can be tightly focused to selectively probe and excite very small features such as nanowires and carbon nanotubes.

Another advantage of the novel solar simulator may be in the testing of multi-junction solar cells. According to NREL researcher Daniel Friedman, who develops III-V multi-junction concentrator cells, "The highest-efficiency solar cells use multiple junctions, with each junction tuned to a different slice of the solar spectrum. To test these multijunction cells, the spectrum of light from the solar simulator must be rapidly and accurately adjusted, which PML's supercontinuum simulator provides."

Testing will continue on additional PV materials, along with ongoing research into using a focused beam to produce spatial maps of materials.
(Contact: Tasshi Dennis; tasshi.dennis@nist.gov)

2013 Spectroradiometry Short Course

The NIST Spectroradiometry Short Course is offered every 2 years and covers radiometry fundamentals, radiometric properties of sources and detectors, spectroradiometric techniques, reflectance properties of materials, handling and determination of measurement uncertainties, NIST calibration services, and the implementation of the quality system at NIST. Participants will gain experience in spectroradiometric measurement and calibration techniques using lamps, integrating spheres, spectrometers, and filter radiometers.

Due to high demand, the Spectroradiometry Short Course will be held again in 2013. Registration will begin at the end of 2012. If you are interested in taking this short course in 2013, send an email to tsai@nist.gov to be placed on the mailing list for further information.
Contact: Ben Tsai (tsai@nist.gov)

2013 Spectrophotometry Short Course – April 2013

The NIST Spectrophotometry Short Course is offered every 2 years and covers the fundamentals of science and technology related to the accurate measurement of optical properties of materials. Participants will gain a good understanding of the theory and practice of spectrophotometry using dispersive and Fourier-transform techniques as well as optical scatterometry. Particular emphasis is placed on the evaluation of uncertainties in transmittance, reflectance, and bidirectional reflectance distribution function (BRDF) measurements.
Contact: Simon Kaplan (simon.kaplan@nist.gov)

2013 Photometry Short Course – September 2013

The need for education and training for photometry engineers and technicians has been stressed by the Council for Optical Radiation Measurements (CORM), Lamp Testing Engineer's Conference (LTEC), and other metrology groups within industry. In response to this need, Photometry Short Course was developed by Optical Technology Division of NIST and given since 1998.

The NIST Photometry Short Course is offered every two years and covers fundamentals in photometry, radiometry, and colorimetry and practical aspects of measurements of luminous flux, luminous intensity, illuminance, luminance, color temperature, and chromaticity of light sources. Participants will gain experience in the calibration of lamps, photometers, and colorimeters. The next course is planned for September 2013.
Contact: Cameron Miller (c.miller@nist.gov)

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

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

REPORT FROM THE PHOTOMETRY, RADIOMETRY AND THERMOMETRY GROUP

Comparison of Goniometric and Integrating Sphere Methods for Measuring Diffuse Reflectance

At the National Research Council of Canada (NRC), the scale of diffuse spectral reflectance in the UV and visible range is realized using an integrating sphere method known as the Modified Sharp-Little method and has been well-characterized and validated. More recently, a robot-based gonioreflectometer has been designed to capture the bidirectional reflectance of reflecting objects. This system incorporates a diode-array spectroradiometer which can be prone to non-linearity errors. The magnitude of this non-linearity error was recently evaluated using several diffusely reflecting materials by comparing the angular-integrated reflection indicatrix measured with the gonioreflectometer with results obtained using a transfer spectrophotometer that is traceable to the sphere-based NRC Absolute Reflectometer. The differences are found to vary spectrally with a fixed pattern and a simple method is used to correct that fixed pattern deviation, leaving only a small offset between the two types of measurements. The corrected angularly-integrated data is found to be consistently higher by a small amount which falls within uncertainty for pressed PTFE but exceeds it slightly for spectralon and slightly even more for opal glass. This is attributed to sample-induced effects and will be investigated further.

This research was presented by R. Baribeau and J. Zwinkels under the title "Comparison of NRC goniometric and integrating sphere methods for realizing an absolute diffuse reflectance scale" at the SPIE International Symposium on Optical Engineering and Applications, San Diego, August 2012. *For further information, please contact Dr. Réjean Baribeau, 613-993-9351.*

New Quantum Radiometry Lab for Calibration of Single Photon Detectors

The National Research Council is developing a second Quantum Radiometry Lab. One goal is to join other National Metrology Institutes around the world in exploring the possibility of establishing photon counting techniques to underpin a new definition of the candela.

Another goal is to support emerging single-photon technologies. These include low-light imaging (e.g. molecular imaging with EMCCDs, semiconductor quality control, astronomy), absolutely secure communication (e.g. quantum cryptography), and quantum computing. All of these require single photon sources and detectors and would benefit from characterization techniques related to photon counting.

In our first project, Rebecca Saaltink, a summer student from Queen's University in Canada, under the direction of Charles Bamber and Jeff Lundeen, helped build a system for the calibration of single-photon detectors using photon-counting techniques. In the process of 'spontaneous parametric downconversion' photons are produced very rarely but always emerge in pairs. The detection of one photon heralds the presence of its twin. In this way, we can produce a beam of light with a known number of photons, which can then be used to calibrate the quantum efficiency of a detector in an absolute manner.

By simulating the angular distribution and wavelength spectrum of the pair we can optimize our collection of the photons thereby ensuring that all the photons impinge on the detector under test. Saaltink coded software to fully model downconversion and also built a downconversion setup and performed some initial tests of detector efficiency. We expect final results to be completed by summer 2013. *For further information, contact: Jeff Lundeen, 613-993-8913 or Charlie Bamber, 613-990-8990*

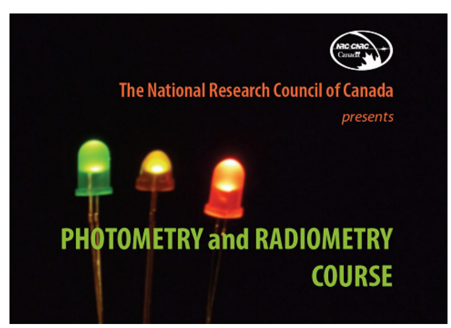
Photometry, Radiometry and Thermometry Group Staff Honoured

At the Electrochemical Society's (ECS) Pacific Rim Meeting on Electrochemical and Solid-State Science (PRiME) 2012 Meeting held in October 2012 in Honolulu, Hawaii, a Symposium D7, entitled "Pits and Pores 5, was given in honor of Dr. David Lockwood, a Principal Research Officer in the NRC Photometry, Radiometry and Thermometry Group. David has done much-cited work on growth mechanisms and the physical and chemical properties of all types of porous structures, work relevant to the formation of advanced materials and applications of these materials in different areas of science. He gave the keynote talk at this symposium which was aimed at developing better methods for the growth of nanoscale materials and for the measurement of their physical and chemical properties. The number of applications in industry for nanoscale materials has been expanding rapidly. These applications are enabled by new methods for the preparation and measurement of materials on a nanometer scale. Dr. Nelson Rowell, Group Leader for Photometry, Radiometry and Thermometry, also gave an invited presentation at this meeting, where he presented his recent work on optical characterization of self-organized nano materials.

2013 Photometry and Radiometry Measurement Course, May 2013

NRC will be offering a 2 ½ day course in Photometry and Radiometry in Ottawa, Canada, May 1-3, 2013. This course is intended for those individuals concerned with accurate and precise measurements of photometric and radiometric properties in research and development or in industrial applications. The course will include a tour of the NRC photometry and radiometry labs and an accompanying exhibition of photometric and radiometric equipment. The language of instruction will be English. Topics will include:

- Basics of photometry and radiometry (concepts, instrumentation, procedures, standards, and uncertainties)
- Basics of UV, visible and IR spectrophotometry (focus on regular spectral transmittance and specular reflectance)
- Absolute radiometry and its applications
- LED measurement issues
- ISO/IEC 17025 requirements
- Selected advanced topics:
    - Fluorescence measurements
    - Quantum based standards
    - Radiation thermometry
    - Applications of Raman spectroscopy
    - BRDF measurements



For more information, contact Charlie Bamber, Phone: 613-990-8990 or visit: www.nrc-cnrc.gc.ca/radiometry

CENAM News from the *División de Óptica y Radiometría* (DOR), Mexico.

Photo-Goniometric Determination of White LED Total Luminous Flux

As part of the implementation of high accuracy radiometric and photometric capabilities for Solid-state lighting, CENAM has recently installed a new facility for goniometric radiometry and photometry; which metrological characterization has begun by determining the luminous intensity spatial distribution of a set of high-intensity white LEDs, currently under development to become the reference standards for such a novel lighting technology. These luminous intensity spatial distributions allow the subsequent determination of the tested LEDs luminous fluxes and luminous efficacies, while still improving the previously reported uncertainty levels.

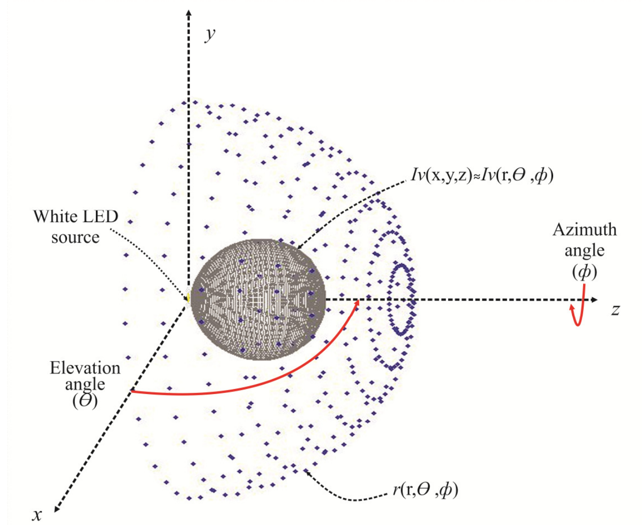


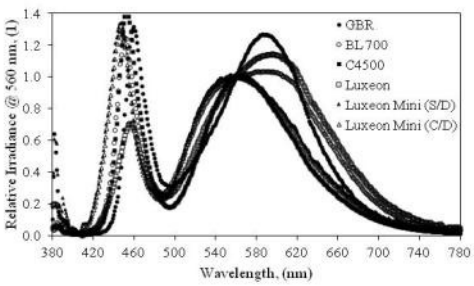
Fig.1. Typical luminous intensity spatial distribution patterns, for the studied high-intensity white LEDs

By using a photo-goniometer working under the C-γ geometry, it was possible to measure the luminous intensity spatial distribution of high-intensity white LEDs, Fig. 1, and then determine their total luminous fluxes, once these have been properly corrected, while estimating an expanded uncertainty of U=3.18, (k=2); lower than the previously obtained. These first results were presented at the "Mexican Optics and Photonics Meeting 2012", held in San Luis Potosi, Mexico, from September 19-21, 2012.

Spectral Mismatch Corrections for Solid-State Lighting Sources

Due to the large difference between the typical white LEDs emission spectra and the CIE Standard Illuminant A, usually realized with incandescent lamps operating at 2856 K; a significant spectral mismatch correction needs to be considered when calibrating those Solid-state lighting sources. Therefore at the *Laboratorio de Iluminación de Estado Sólido*, some tests are in progress in order to refine the accuracy of the total luminous flux measurements.

In this case the emission spectra for six different white LEDs have been obtained, Fig. 2.; as well as the spectral responsivities for a similar number of photometric detectors, Fig. 3. Thus, the effect the photometric responsivity of the photometric detector has over the accuracy in the determination of the spectral mismatch correction factor is being evaluated in greater detail, Fig. 4. The preliminary results of these studies were also presented at the "Mexican Optics and Photonics Meeting 2012".



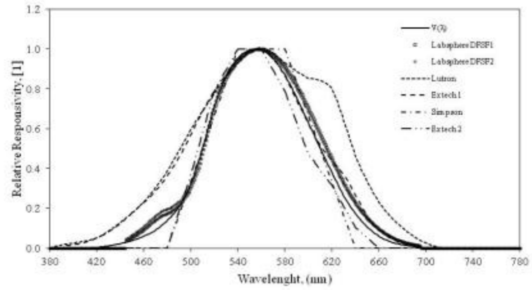


Fig. 2. White LEDs emission spectra, measured at 50 cm. Fig. 3. Measured photometric detector responsivities.

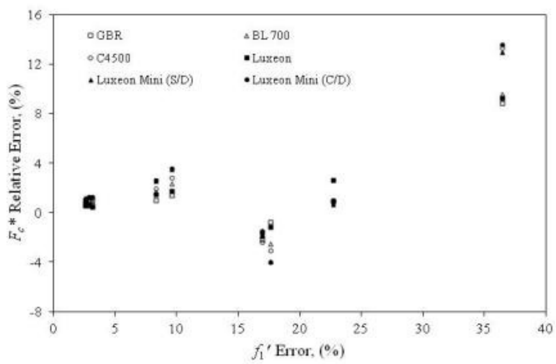


Fig. 4. Spectral mismatch correction factor as a function of the photometric detector spectral responsivity.

Improvements to the Radiant Flux Mexican Standard

The *Laboratorio de Potencia Óptica* has updated the automation of the cryogenic radiometer used to realize the optical power unit. This automation included the location and alignment of the optic components needed to select the optical radiation wavelength, which will be provided from different laser sources in the near future, thus increasing the currently reached accuracy.

This automation not only improves the cryogenic radiometer's positioning repeatability, but also provided with a safer handling of the cryogenic gasses, Fig. 5.

Fig. 5. The cryogenic radiometer accuracy and safety is being improved at CENAM.

Increasing the Wavelength Range for UV Measurements

For the past five years, the Mexican standard for ultraviolet irradiance and dose measurements has been declared only for 365 nm. However, the industry applications require calibrations services also al 254 nm and 313 nm, among other. Thus, the *Laboratorio de Dosimetría Óptica* has included those two new wavelengths as part of the working range for the second declaration of this Mexican standard, which is expected to be published during the next year.

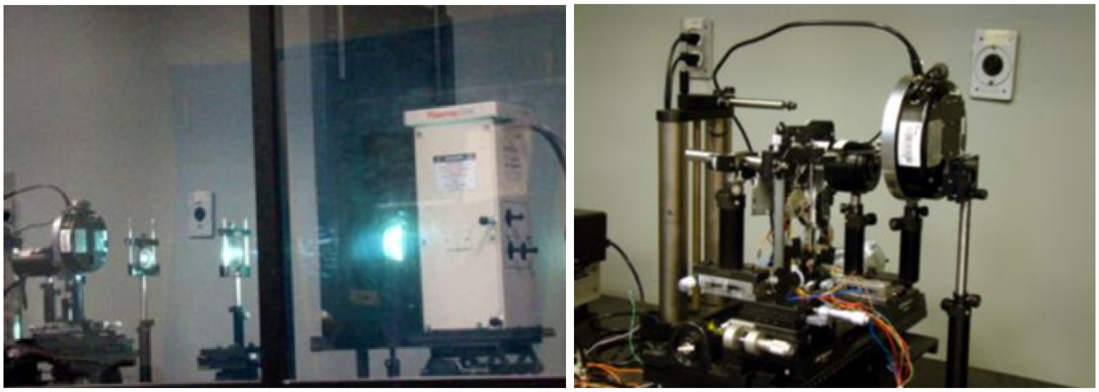


Fig. 6. UV measurement system and combined spatial uniformity set-up.

The metrological characterization supporting this wavelength range increment, is based in the determination of the uncertainty contribution due to the combined spatial uniformity fore to the radiant field (at 254 nm or 313 nm), and the spectral responsivity of the pyroelectric detector used as reference for optical power, Fig. 6.

UPCOMING IES MEETINGS CALENDAR

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

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

LIGHTFAIR International
April 21-25, 2013
Pennsylvania Convention Center
Philadelphia, Pennsylvania

2013 IES Street and Area Lighting Conference
September 8-11, 2013
Marriott Phoenix Desert Ridge Hotel
Phoenix, Arizona

2013 IES Annual Conference
October 27-29, 2013
Hyatt Regency Huntington Beach Hotel
Huntington Beach, California

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

NEWS FROM THE CIE

CIE 2012 Conference in September Held in Success

The CIE 2012 Lighting Quality & Energy Efficiency was held successfully in Hangzhou, China, on September 19 - 21, with over 300 participants from ~ 40 countries. There were also CIE Division 2 meetings on Sep. 22, 24-26, and CIE Lectures (Photometry, Colorimetry, Metrology and Standards for Solid State Lighting) on Sep. 16 – 18.

The CIE 2012 conference was the 2nd one of this series (first one was held in 2010 in Vienna). The conference had over 130 papers presented, including ~70 oral presentations, ~50 poster papers, and 9 invited papers. In addition, there were six workshops - on mesopic photometry, energy efficient (green) lighting, building energy regulations, color quality, street lighting, and Daylighting design issues for cities. There was also a Panel Discussion on "International Cooperation on SSL Standardization and Regulation - What is most needed now for good quality LED lighting" inviting representatives from other international organizations including IEC TC34, GLA, and IEA SSL Annex. Yoshi Ohno (CIE Vice President-Technical) served as the chair of International Scientific Committee for this Conference.


CIE 2012 plenary session

The Division 2 meeting (Sep. 22), chaired by Peter Blattner (Div.2 Director), focused on reviewing work of critical TCs, liaison matters, and finishing the work of old technical committees. No new TCs were established this time, as the next Div. 2 meeting is coming close in next April. Following the Div. 2 meeting, 15 TC meetings (new record) were held for full three days in Hangzhou.


Division 2 meeting

In the CIE Lectures, total 15 lectures were given by three lecturers - Dr. Ronnier Luo (Division 1 Director), Dr. Janos Schanda (former CIE VP Technical), and Dr. Yoshi Ohno. The lectures covered fundamental topics of interest in SSL - color science, color vision, color rendering, mesopic vision, circadian effects, fundamentals of photometry, colorimetry, measurement of LEDs and SSL and standards.
(*Report by Yoshi Ohno*)

TC2-71 CIE Standard on Test Methods for LED Lamps, Luminaires and Modules

This committee, chaired by Yoshi Ohno, started in spring 2011, and is now near final stage. This TC is collaborating with CEN (European Standards Organization) TC169 WG7 (chaired by Guy Vandermeersch, Belgium), developing a draft for EN standard and CIE standard on test method for solid state lighting products, so that the two standards will be harmonized on technical contents (based on CIE-CEN agreement). This test method is important in that it will be used by European SSL regulations (just as LM-79 is used by ENERGY STAR and other government programs in the U.S.), thus as the reference for SSL testing accreditation programs. The CIE test method is also expected to be referenced in the IEC performance standards of SSL products and by SSL regulations in various countries. In the current draft, there are two methods for specifying technical requirements; (1) specifying tolerances for standard conditions (e.g., ambient temperature 25±1°C) and critical instrument performance characteristics (e.g., f_1' of photometer head < 1.5 % or 2 %) – similar approach taken in IES LM-79; (2) requiring corrections for deviations from standard conditions (based on sensitivity coefficients) and report uncertainty budgets, with no tolerances for the standard conditions and no requirements for instrument performance characteristics specified. The TC also has agreed that uncertainties are required for both methods, and for method (1), the labs meeting all tolerance requirements can report the default uncertainty values provided in this standard in their test report, so that they do not have to evaluate uncertainties of their measurements. The details, however, are still under discussion, and the default uncertainty tables are under development. There is strict time line by the CEN TC, and the draft is expected to be completed by March 2012.
(*Report by Yoshi Ohno*)

eILV Online

CIE provides a new service: a searchable online database of the International Lighting Vocabulary. Just click on **http://eilv.cie.co.at/** to get immediate access to all terms and definitions (> 1400) of the current version of the ILV (CIE S 017/E:2011). They can all be found in the database, incl. the according number in the ILV. To get a list of terms containing a certain word or fraction of a word the database can be searched through by using different search options. Currently only available in English; it will be expanded for other languages also.

Upcoming Events

CIE Midterm Session and CIE CENTENARY CONFERENCE – TOWARDS A NEW CENTURY OF LIGHT, Paris, April 12 and 19, 2013

Hosted by CIE-France
April 12-14 CIE Board meetings and General Assembly
April 15-16 Centennial Conference
April 17-19 Division and TC meetings

Abstract Deadline: November 10, 2012
For more information, visit http://www.cie.co.at/index.php/Events/Future+CIE+Events.

Recent CIE Publications

The CIE has recently announced the following publications:

Proceedings of CIE 2012 Lighting Quality & Energy Efficiency, Hangzhou, China (CIE x037:2012)

A Computerized Approach to Transmission and Absorption (CIE 203:2012 including Erratum 1)

Tubular Daylight Guidance Systems (CIE 173:2012 including Erratum 1)

Colorimetry - Part 6: CIEDE2000 Colour-Difference Formula (CIE DS 014-6/E:2012)

For more information and a full list of CIE publications, visit:
http://www.cie.co.at/index.php/Publications

Lighting Research Center

RECENT PUBLICATIONS FROM RENSSELAER'S LIGHTING RESEARCH CENTER

ASSIST recommends...Flicker Parameters for Reducing Stroboscopic Effects from Solid-State Lighting Systems

This volume of ASSIST recommends outlines a preliminary calculation method for trading off frequency and percent flicker, based on recent data, for estimating the detection and acceptability of indirect, stroboscopic flicker from SSL systems.

To download a copy, visit:
http://www.lrc.rpi.edu/programs/solidstate/assist/recommends/flicker.asp

Transportation Lighting Alliance Study Explores Pedestrian Safety at Roundabouts

Roundabouts are becoming more and more common along our roads. These circular intersections can help ease traffic flow and reduce the severity of accidents, but they can also present some challenges to drivers and pedestrians, because they are still relatively new. Pedestrian crosswalks aren't always in their familiar locations, and drivers may not always know where to look for pedestrians waiting to cross the roundabout. Lighting on vehicles, mounted on poles around the roundabout, and along the landscape, can be important tools for pedestrian safety at roundabouts.

This is the topic of the newest Transportation Lighting Alliance (TLA) report from the Lighting Research Center (LRC) at Rensselaer Polytechnic Institute.

The report is accessible online at:
http://www.lrc.rpi.edu/programs/transportation/TLA/pdf/TLA-2012-01.pdf

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.

CORM Council for Optical Radiation Measurements

Officers and Board of Directors

President

Dr. Ron Daubach (2010-2013)
OSRAM SYLVANIA
Metrology & Analytics Services
71 Cherry Hill Drive
Beverly, MA 01915-1068
Ph: 978-750-1593
Fx: 978-646-2920
E-mail: ronald.daubach@sylvania.com

Vice-President

Mr. Jim Leland (2009-2013)
Copia –Lux LLC
51 Ball Park Rd
Goshen, NH 03752
Ph: 603-504-2855
E-mail: jleland@copia-lux.com

Treasurer

Mr. Macedonio Anaya (2010-2013)
The Boeing Company
PO Box 3707, MC 19-RU
Seattle, WA 98124-2207
Ph: 206-544-1677
Fx: 206-662-1723
E-mail: massy.anaya@boeing.com

Secretary

Mr. Greg McKee (2010-2013)
Labsphere, Inc.
P.O. Box 70/Shaker St.
North Sutton, NH 03260-0070
Ph: 603-927-4266
Fx: 603-927-4694
E-mail: gmckee@labsphere.com

Directors

Alan Tirpak (2011-2014)
Optronic Laboratories
4632 36th. Street
Orlando, FL 32811
Ph: 407-422-3171
Fx: 407-648-5412
E-mail: atirpak@goochandhousego.com

Mr. Andy D Jackson (2010-2013)
Philips Lighting Company
3861 South 9th Street
Salina, KS 67401
Ph: 785-822-1540
Fx:785-822-1510
E-mail: andy.jackson@philips.com

Dr. Kathleen Muray (2010-2013)
INPHORA Inc.
4425C Treat Blvd. #244
Concord, CA 94521
Ph: 925-689-2039
Fx: 925-689-2788
E-mail: murayk@aol.com

Tim Moggridge (2010-2013)
Westboro Photonics
1505 Carling Avenue, Suite 301
Ottawa, ON Canada K1Z 7L9
Ph: 613-729-0614
Fx: 613-729-9067
E-mail: tim.moggridge@wphotonics.com

Mr. Robert Angelo (2009-2012)
Gigahertz-Optik Inc
5 Perry Way
Newburyport, MA 01950
Ph: 978-462-1818
E-mail: b.angelo@gigahertz-optik.com

Mr. Dave Gross (2011-2014)
OSRAM SYLVANIA
Metrology & Analytics Services
71 Cherry Hill Drive
Beverly, MA 01915-1068
Ph: 978-750-1615
E-mail: dave.gross@sylvania.com

Dr. John D. Bullough (2011-2014)
Lighting Research Center
21 Union St.
Rensselaer Polytechnic Institute
Troy, NY 12180
Ph: 518-687-7100
Fx: 518-687-7120
E-mail: bulloj@rpi.edu

Mr. Doug Kreysar (2009-2012)
Radiant Imaging, Inc.
22908 NE Alder Crest Dr., Suite 100
Redmond, WA 98053 USA
Ph: 425-844-0152
E-mail: kreysar@radiantimaging.com

Associated Individuals

Liaison with NIST Gaithersburg
Cameron Miller
100 Bureau Drive Stop 8442
Gaithersburg, MD 20899-8442
Phone: 301-975-4713
FAX: 301-840-8551
Email: c.miller@nist.gov

Liaison with NIST Boulder
Dr. Chris Cromer
NIST Optoelectronics Division
815.01/ 325 Broadway
Boulder, CO 80305
Ph: 303-497-5620
Fx: 303-497-3387
E-mail: cromer@boulder.nist.gov

Alternate:
Dr. John Lehman
Ph: 303-497-3654
E-mail: lehman@boulder.nist.gov

Liaison with NRC
Dr. Joanne Zwinkels
National Research Council
Inst. for Nat'l. Measurement Standards
M-36 Montreal Road
Ottawa, Ontario K1A 0R6
Canada
Ph: 613-993-9363
Fx: 613-952-1394
E-mail: joanne.zwinkels@nrc.ca

Liaison with CENAM
Eric Rosas
División de Óptica y Radiometría
Centro Nacional de Metrología
Km 4.5 Carretera a Los Cués
76246, El Marqués, Querétaro
México
Ph: 442-211-0554
FAX: 442-211-0553
E-mail: erosas@cenam.mx

Editor, Optical Radiation News (ORN)
Dr. John D. Bullough
Lighting Research Center
21 Union St
Rensselaer Polytechnic Institute
Troy, NY 12180
Ph: 518-687-7100
Fx: 518-687-7120
E-mail: bulloj@rpi.edu

CORM MEMBERSHIP APPLICATION/DUES PAYMENT FORM

Name: .... ☐ Domestic* ☐ 1 year $50

Title .... ☐ 3 years $125

Affiliation: .... ☐ International ☐ 1 year $75

Address: .... ☐ 3 years $175

.... ☐ NIST NONE

City: .... ☐ Emeritus NONE

Zip Code: ....Country: .... ☐ Student NONE

Telephone: ....FAX: .... e-mail:………………………

Affiliation's Web Site Address:________________________________

* United States, Canada and Mexico

Main areas of interest: ☐ Radiometry ☐ Optical Properties of Materials ☐ Spectrophotometry ☐ Other ________________________________

Make checks payable to CORM in US dollars drawn on US banks only. Dues are nonrefundable.

Membership applications and dues payment checks should be sent to:

Greg McKee, CORM Secretary, Labsphere, Inc. P.O. Box 70, Shaker St.
North Sutton NH 03260-0070

CORM **Council for Optical Radiation Measurements**