CORM / CIE US & Canadian National Committees Joint Conference
November 18 – 20, 2025

Program Guide

CIE Overview Presentation

November 18th, 11:10am EST

Advancing Science and Communicating about Light for People and Planet

Jennifer A. Veitch, PhD, FIES, FRSC, CIE President, National Research Council (NRC), Canada

Abstract

Thanks to the Vienna Business Agency, the CIE has received 18 months' funding in 2025 and 2026 to advance public awareness of the effects of light on human health and the consequences of obtrusive light under the banner "Understanding Science – Understanding Light". We chose these topics because of their current relevance to researchers, practitioners, and industry, and because public awareness will be key to advancing the successful application of factual understanding in policy and regulations. In addition to online presentations (available in English and German), the CIE has partnered with other international organizations in a public awareness campaign under the Light for Public Health banner, through which 26 simple consensus statements have been developed and materials prepared for free use to advance understanding about how light can benefit our health. A new CIE Position Statement on Obtrusive Light and Light Pollution has been developed (and is in final editing at the time of this submission), outlining what is needed both for researchers and those with authority, to protect people and the environment when using light at night. This presentation will outline these initiatives and other current ways in which the CIE globally is meeting its mission as the international umbrella organization for all aspects of light and lighting.

Bio

Dr. Jennifer A. Veitch serves as the President of the CIE for the 2023-2027 term. She is a psychological scientist with expertise in environmental psychology, and has been a Research Officer at the National Research Council of Canada since 1992. A Fellow of national and international associations in lighting and psychology, she received the Waldram Gold Pin for Applied Illuminating Engineering from the CIE in 2011 and the IES Medal Award in 2018. In November 2024 she was inducted as a Fellow of the Royal Society of Canada.

Division 1: Vision & Color Activity

November 18th, 11:35am EST

CIE Division 1 2025 Activities

Michael Brown, PhD, York University, Canada

Bio

Dr. Michael S. Brown is a Professor and Canada Research Chair in Computer Vision at York University in Toronto. His research focuses on in-camera color processing and photo-finishing. He is currently on leave from York, serving as Vice President and Lab Director of the Samsung AI Center in Toronto. Dr. Brown frequently delivers tutorials and short courses on in-camera color processing at leading academic conferences and industry meetings. He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE).

The Calibration Dilemma for Modern LED Photometry and Colorimetry

Irena Fryc*, Maciej Listowski+
* Faculty of Electrical Engineering, Bialystok University of Technology, Wiejska 45d, 15 351 Bialystok, Poland, e-mail: i.fryc@pb.edu.pl
+ Faculty of Electrical Engineering, Bialystok University of Technology, Wiejska 45d, 15 351 Bialystok, Poland, e-mail: maciej.listowski@pb.edu.pl

Abstract

The transition from incandescent to LED lighting has introduced a fundamental calibration challenge for optical measurement instruments. For decades, Illuminant A served as a universal standard for calibrating both photometers and colorimeters. However, the CIE's introduction of the L41 spectrum—intended to better represent the spectral characteristics of phosphor-converted LEDs (pc-LEDs)—has disrupted this unified approach. L41 applies only to photometric applications and cannot provide the precise chromaticity coordinates and tristimulus values (X, Y, Z) required for colorimetry.

This study examines the practical implications of this split-standard approach by analyzing spectral mismatch correction factors (SMCFs) for photometers and colorimeters with varying f_1' values when measuring pc-LEDs with nominal correlated color temperatures defined by the ANSI C78.377 standard. Our results show that while L41 calibration significantly improves photometric accuracy for LED measurements compared to Illuminant A, it introduces substantial errors in colorimetric quantities—necessitating that colorimeters remain still to be calibrated by Illuminant A.

This bifurcation poses real-world operational challenges, as laboratories and manufacturers must now maintain separate calibration protocols for photometric and colorimetric instruments. Our findings underscore the urgent need for a new, optimized calibration spectrum capable of serving both measurement domains, thereby restoring the practical simplicity and reliability once afforded by the universal Illuminant A standard.

Bio

Maciej Listowski - MSc. Eng., a research and teaching staff member at Bialystok University of Technology, affiliated with the Department of Photonics, Electronics and Lighting Technology at the Faculty of Electrical Engineering. His research interests include electronics, photonics, metrology of optical radiation and modern lighting technologies. He takes part in university research projects. He is the author of scientific publications in national and international journals and is actively involved in the university's teaching and research activities.

Evaluating Flicker Performance of UL Type B LED Products for Campus Energy Projects

Jonathan Clark Walker,[1] Zora Liu,[1] Alyssa Schieler,[1] Madalyn Reardon,[1] Alp Durmus[1]
[1]Pennsylvania State University

Abstract

The Penn State Office of Physical Plant (OPP) has initiated a study to assess flicker performance in LED lighting, focusing on UL Type B TLEDs and flat panel products. This effort aims to replicate findings from prior research and inform future specifications for campus-wide energy-saving initiatives. The tested products, donated by distributors and not currently installed on campus, were selected based on correlated color temperature (CCT), lumen output, and wattage—parameters aligned with PSU's potential procurement criteria. Using a tabletop luminaire setup, we conducted flicker measurements in accordance with ANSI-IES TM-39-25, which evaluates temporal light modulation (TLM) through metrics such as modulation frequency. Results revealed a wide range of flicker performance across products, with some falling into the "Minimum" category and others achieving "Better" visibility ratings. This variability underscores the importance of rigorous flicker testing prior to product specification, especially in environments where visual comfort and performance are critical. Our findings provide actionable insights for facilities managers and lighting specifiers, emphasizing the need for standardized flicker evaluation in LED procurement. The presentation will detail our methodology, share comparative results, and discuss implications for future lighting upgrades at Penn State.

Bio

Yue (Zora) Liu is a Ph.D. candidate in the Department of Architectural Engineering at Penn State, with a minor in Computational Science. Her research focuses on the impacts of anthropogenic light at night (ALAN) on human perception and environment by combining psychophysical experiments with spectral and environmental data analysis.

A revision of the Pulse Width Modulated Light Signals test methods to determine its Stroboscopic Effect and Phantom Array visibility

Ernesto Mendoza, PhD, Signify

Abstract

There is an increased interest in determining the visibility of the Stroboscopic Effect and the Phantom Array visibility from Pulse-Width-Modulated (PWM) light sources with a reasonable uncertainty level. PWM light systems are used to dim LED light sources into deep modes such as 0.1% and to mix colors with high precision and reproducibility across multiple light sources installed in the same room.
The author examines state-of-the-art technology from a new perspective, exploring its ability to convert a PWM light signal into a digital file. Most light measurement equipment used today includes four basic modules: (1) A photo sensor, (2) a trans inductance amplifier, (3) an anti-aliasing filter, and (4) a digitalization system. Other researchers have considered ancillary equipment, such as power supply stability and the optical reproduction of the human eye's response to visible light. This paper's researcher pays special consideration to the photo sensor's time response, the transimpedance amplifier's frequency response, the anti-aliasing filter's frequency response, the digitalization resolution, and software features such as windowing, zero padding, and peak detection.
The researcher focuses on how PWM measurements differ from those of sinusoidal waveforms, utilizing computer simulations and test results. He discusses how the PWM fast rate of change from off to on, signal frequency, and duty cycle impact the ability to determine the stroboscopic effect and phantom array visibility.

Bio

LED Electronics Technology Manager, specializing in LED equipment performance and safety, FCC regulations, EMC/EMF, and AI.

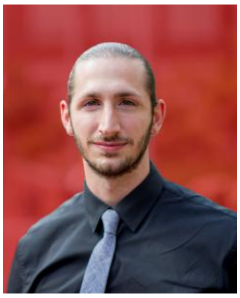
A brief history of measures of color rendition and a call to action

Tony Esposito, PhD, Assistant Professor, University of Nebraska–Lincoln

Abstract

This talk will provide a brief history of the standardization of the CIE General Color Rendering Index (Ra), attempts by the CIE to supplant Ra, and the development and standardization of IES TM-30 and TM-30 Annex E. We will discuss a vision for the future of measures of color rendition; guidance for specifiers, equipment manufacturers, and researchers will be provided.

Bio



Dr. Tony Esposito is an Assistant Professor in the Durham School of Architectural Engineering and Construction at the University of Nebraska-Lincoln, Founder of Lighting Research Solutions LLC, Co-Chair of the Color Committee of the Illuminating Engineering Society, and former Director and Light Concept Lead at the International WELL Building Institute. He has authored or coauthored more than 30 publications on light and lighting and has delivered more than 60 presentations nationally and internationally. Recognitions include the 2019 Richard Kelly Grant, the 2019 CIBSE Walsh Weston Award, and 2025 Recognition of Extraordinary Dedication and Leadership by the IES for his leadership of the IES Color Committee.

Exploring the Role of Prior Knowledge in Visual Evaluation and Performance under Dim Lighting Conditions

Zora Liu,[1] Alp Durmus[1]
[1]Pennsylvania State University

Abstract

Anthropogenic light at night (ALAN) has become an increasingly growing concern due to its potential ecological and physiological impacts. While technical solutions for minimizing light pollution have been widely proposed, less is known about how public awareness or prior knowledge of light pollution influences human perception and behavior under low-light conditions. This study aims to investigate whether prior knowledge of light pollution affects subjective and objective responses to outdoor lighting environments with varying chromaticities and illuminance levels. The first hypothesis is that individuals informed about the negative impacts of light pollution will demonstrate greater subjective tolerance—expressed as higher preference ratings—for dim and amber lighting conditions, without a corresponding change in objective visual task performance. A secondary goal is to determine whether an intermediate correlated color temperature (CCT) of 2200 K provides an optimal balance of visibility and comfort compared to amber (1800 K), a warmer (2700 K), and neutral white (4000 K) lighting. Participants will perform visual evaluations and functional vision tasks under four CCTs and four illuminance levels (1, 5, 10, and 20 lx). Subjective responses—including visual comfort, perceived brightness, and overall acceptability—will be rated using a seven-point Likert-type scale, while objective performance will be assessed through object detection and color discrimination tasks. Together, these measures will reveal how cognitive framing and physical lighting characteristics jointly shape perception and performance. The findings are expected to inform evidence-based guidelines for environmentally responsible and visually comfortable outdoor lighting design.

Bio

Yue (Zora) Liu is a Ph.D. candidate in the Department of Architectural Engineering at Penn State, with a minor in Computational Science. Her research focuses on the impacts of anthropogenic light at night (ALAN) on human perception and environment by combining psychophysical experiments with spectral and environmental data analysis.

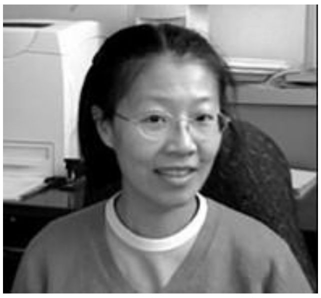
Division 2: Physical Measurement of Light Activity

November 18th, 2:25pm EST

CIE Division 2 2025 Activities

Li-Lin Tay, PhD, National Research Council (NRC), Canada
Yuqin Zong, National Institute of Standards and Technology (NIST), USA

Bio



Li-Lin Tay is a Principal Research Officer and the Team Leader of Photometry and Spectrophotometry at the Metrology Research Centre, National Research Council Canada (NRC). She holds a B.Sc. in Physics and a Ph.D. in Physical Chemistry both from the University of Toronto. Since joining the NRC, she leads research efforts in light scattering from quantum-confined nanostructures, Raman metrology and surface enhanced spectroscopies. Her team also develops state-of-the-art optical radiation measurement capabilities and advanced optical spectroscopies in support of Canada's commitment to the international Committee on Weights and Measures Mutual Recognition Arrangement (CIPM-MRA).

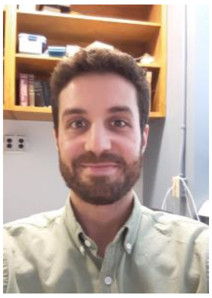
Effect of non-Lambertian surfaces in an integrating sphere absolute reflectometer

Luke Sandilands, PhD, Metrology Research Centre, National Research Council, Ottawa, ON, Canada

Abstract

At the National Research Council of Canada, a Sharp-Little-type integrating sphere absolute reflectometer is used to realize the scale for diffuse reflectance. Integrating sphere absolute reflectometers are specialized instruments that allow for absolute measurements of diffuse reflectance without the need for a calibrated standard. Application of these devices relies on a simplified description of the radiative transfer occurring within the sphere and, specifically, on the assumption that the sphere interior surface is perfectly Lambertian. However, it is well-known that the BRDFs of materials commonly employed in UV-VIS-NIR integrating spheres (e.g., $BaSO_4$ or sintered PTFE) are in fact appreciably non-Lambertian. In this work, the effect of this non-Lambertian BRDF on a Sharp-Little-type absolute reflectometer is investigated via Monte Carlo ray tracing. The numerical results suggest that a realistic non-Lambertian BRDF can introduce a meaningful measurement error, especially if the reflectance of the surface coating is low. Based on the ray tracing, an extension of the usual Sharp-Little measurement equation is introduced that accounts for non-Lambertian BRDF. These results indicate that some knowledge of the interior surface BRDF is necessary to obtain high-accuracy measurements with this type of reflectometer.

Bio



Luke Sandilands is a Research Officer in the Photometry and Spectrophotometry team. He is responsible for maintaining and developing NRC's spectrophotometric calibration services. Luke received his PhD in condensed matter physics from the University of Toronto in 2014. From 2014 to 2017, he did postdoctoral research in infrared and optical spectroscopy at the IBS Center for Correlated Electron Systems in Seoul, South Korea. He joined the Photometry and Spectrophotometry group at NRC Metrology in 2017.

Ground-based measurements of spectrally-resolved sky radiance at U.S. National Parks

Morgan Pattison[1], PhD, Lisa Pattison[1], PhD, Jeremy White[2]
[1] Solid State Lighting Services (SSLS)
[2] U.S. National Park Service

Abstract

Ground-based measurements of skyglow, also referred to as "light pollution", quantify the sky lightscape experienced by humans and terrestrial fauna. Field measurements of absolute, spectrally-resolved sky radiance have been conducted at various National Parks in the United States using a specialized portable spectrometer calibrated for nighttime light levels. These measurements establish baseline sky radiance levels, facilitating the identification and understanding of contributing light source technologies and their geographic origins. Measurements have been taken across multiple National Parks and sites of interest.

The composition of light sources responsible for skyglow can be estimated by analyzing measured spectral signatures, which consist of combinations of known light source spectra. Source localization and spectral identification enables the determination of predominant contributors to light pollution at specific sites, informing mitigation strategies within National Parks. Baseline radiance measurements taken by location, direction, and elevation angle provide reference points for future monitoring, especially in contexts of urban development or implementation of light pollution reduction initiatives.

Furthermore, this data supports outreach efforts targeting communities and municipalities to promote minimization of light pollution. It also allows for evaluation of atmospheric influences on sky radiance across different regions and weather conditions. Additionally, the quantification of light stimuli derived from these measurements enables a better understanding of its effects on animal behavior and ecological dynamics associated with light pollution.

Bio

Dr. Pattison is a recognized expert on the technology and applications of LED lighting, including horticultural, human health, and animal response applications. He is a Fellow of the IES, chair of the IES ONE Committee, and a member of the IES Horticultural Lighting Committee. Dr. Pattison consults with the US DOE, the National Parks Service, the Eel Passage Research Center, and private clients developing advanced horticultural lighting technology.

Evaluating the Validity of LPM Lamp Radiant Flux Measurement Methods

Michael L. Grather, LightLab Internation Allentown

Abstract

The measurement of Low Pressure Mercury (LPM) lamps presents significant challenges to the radiometric testing laboratory when compared to the practice of measuring light sources for general illumination. The wavelength range of interest (primarily in the UV-C region) and the relatively large size of many LPM lamps can make the use of integrating sphere systems challenging. Dense scans of radiant intensity using a gonioradiometer can be integrated into total radiant flux, but this process is time-consuming and presents its own challenges. The Germicidal UV industry has been using a method of measurement called the Keitz method, but this method is only applicable to axially symmetric linear lamps.

These methods were discussed by the IES LM-94 working group during the development of the soon-to-be-published IES standard for the measurement of LPM lamps, and some additional methods of measurement were proposed. In order to evaluate these proposed test methods, LPM lamps of various geometries were measured in the laboratory using a variety of different test methods. This paper will discuss the various measurement methods along with the laboratory testing results, and will make suggestions for the applicability and limitations of the measurement procedures based on the lamp geometry.

Bio

Mike has been President and CTO of LightLab International Allentown, LLC since the lab began doing business in 2015. During his nearly 30 years in the lighting industry, he has presented multiple papers, seminars, and presentations on the topic of light measurement and standards development. He was one of the recipients of the 2024 IES Distinguished Service Awards.

Mike continues to be heavily involved in standards development within the lighting measurement community. He is a past chair of the IES Testing Procedures Committee (TPC), and now serves as the Chair of the IES Lighting Science Advisory Panel and Chair of the IES Standards Committee. He is also an active member of several working groups under the IES TPC, the IES Ethics Committee, the IES Skyglow Calculations Committee, and the Nomenclature Committee of the IES.

Analysis of Sensitivities and Diffraction Corrections in Radiometry

Eric L. Shirley, PhD, Sensor Science Division, NIST, Gaithersburg, MD 20899

Abstract

Cryogenic, reference blackbody sources are routinely calibrated in NIST's Low-Background Infrared (LBIR) facility. Because of the long wavelengths involved, diffraction corrections are a major component of these calibrations. Until recently, most work emphasized diffraction effects of individual optical elements. The next most important effect appears to involve the interplay between loss of flux because of one element and the ensuing reduction of flux gained because of a different element downstream. Other effects involving light striking edges of apertures in serial fashion also play a role. Several exact, analytical results will be presented that obviate many costly numerical calculations. Related effects of treating sensitivities of the throughput of a system to mild perturbations of its geometry (e.g., tilts or offsets of apertures) will also be discussed.

Bio

Eric Shirley has interests in electronic structure, optical properties and electron spectroscopy of materials as well as physical optics. Research in materials has been related to studying band structure effects, several nonlinear effects, and calculation of optical constants from the far-IR to hard x-ray regions, with applications in ferroelectricity, semiconductor manufacturing, battery technology and defense. Research in optics has been related to studying photonic crystals, synchrotron radiation (especially at the NIST synchrotron, SURF) and diffraction corrections in radiometry relevant to astronomy, ocean optics and defense.

Characterization and calibration of transfer-standard spectroradiometers using a tunable laser

Yuqin Zong, C. Cameron Miller, PhD
National Institute of Standards and Technology, Gaithersburg, MD 20899

Abstract

Spectral irradiance scales are realized in National Metrology Institutes (NMIs) and then disseminated to calibration laboratories through transfer-standard lamps. The most common transfer-standards are 1000 W quartz tungsten halogen FEL lamps that are custom-made for good repeatability and reproducibility. Such metrology grade FEL lamps were discontinued by manufacturers in 2019. To address this issue, we are developing spectroradiometers as new, detector-based transfer-standards.

Several spectroradiometers have been characterized and calibrated using a tunable laser. The calibration is based on transfer-standard trap detectors that have expanded uncertainties of less than 0.10 % ($k = 2$) for irradiance responsivity in the visible region. The expanded uncertainty of the spectral irradiance responsivity of the spectroradiometer is expected to be smaller than those of conventional spectral irradiance transfer-standard FEL lamps, which are typically greater than 0.50 % ($k = 2$) in the visible region. The calibrated spectroradiometer will be a new detector-based spectral irradiance standard in addition to the conventional source-based spectral irradiance standard FEL lamp for dissemination of the spectral irradiance scale.

Bios

Yuqin Zong is an optical engineer and the photometry project leader at the National Institute of Standards and Technology, USA. His research and responsibility cover development of calibration standards, measurement of LEDs, calibration of optical sensors and imagers using tunable lasers, and correction of stray light for array spectroradiometers and imaging instruments.

Cameron Miller joined the National Institute of Standards and Technology in 1996 and was promoted in 2022 to the position of Deputy Division Chief for the Sensor Science Division. Currently, he focuses on research including photometry & radiometry, germicidal ultraviolet irradiance, photopolymer additive manufacturing, and measurement uncertainty. Cameron is active in many standards' developing organizations and professional societies and was made an Illuminating Engineering Society (IES) Fellow in 2023. He is also a National Voluntary Laboratory Accrediation Program assessor for the Energy Efficient Lighting Program and the Calibration Program. Cameron Miller obtained his PhD in Physical Chemistry from Cornell University (1994).

Division 6: Photobiology & Photochemistry Activity

November 19th, 11:00am EST

CIE Division 6 2025 Activities

Jennifer A. Veitch, PhD, FIES, FRSC, CIE President, National Research Council (NRC), Canada

Bio

Dr. Jennifer A. Veitch serves as the President of the CIE for the 2023-2027 term. She is a psychological scientist with expertise in environmental psychology, and has been a Research Officer at the National Research Council of Canada since 1992. A Fellow of national and international associations in lighting and psychology, she received the Waldram Gold Pin for Applied Illuminating Engineering from the CIE in 2011 and the IES Medal Award in 2018. In November 2024 she was inducted as a Fellow of the Royal Society of Canada.

Monte Carlo Methods for Evaluating Photobiological Lighting Parameters

Eric Bretschneider, PhD, CTO at EB Designs & Technology

Abstract

The introduction of solid-state lighting has greatly increased the variability of metameric spectra suitable for lighting applications. Experimental studies comparing different competing models for biological impact of lighting are necessarily limited to a small subset of spectral power distributions. Limited sampling such as this limits the ability to make general comparisons between different models. Use of Monte Carlo simulations based on combinations of spectral power distributions offers a way to compare predictions of lighting models over a wide variety of spectral power distributions suitable for general illumination applications. Exemplary examples comparing circadian lighting models and scotopic/photopic ratio will be discussed.

Bio

Eric Bretschneider has over 30 years of experience designing, developing and testing LEDs and LED fixtures. He has worked at all levels of technology development including: semiconductor structure design/growth, chip design and fabrication, phosphor conversion, package design and luminaire design. He has been a member of the IES Test Procedures Committee since 2006 and is also a member of the IES Science Advisory Panel. He has over 45 US Patents related to LEDs and lighting and has given over 30 presentations to industry on topics that span the gamut of LED technology and applications.

Advancing Circadian Lighting Measurement: Establishing a Vancouver-Based Test Facility Leveraging Quantum Dot Precision

Sarah Morgan[1], Jeff Yurek[2], Martin Devenney[2]
[1]NANO-LIT TECHNOLOGIES BC LTD., VANCOUVER, CANADA
[2]SHOEI ELECTRONIC MATERIALS, INC. DBA NANOSYS, MILPITAS, CA, USA

Abstract

The July 2025 agreement between the International Bureau of Weights and Measures (BIPM) and the International Commission on Illumination (CIE) establishes a critical framework for circadian lighting by aligning melanopic equivalent daylight illuminance (m-EDI) and biological light metrics with SI-traceable standards. Despite this progress, Western Canada and the U.S. West Coast lack ISO 17025/NVLAP-accredited facilities capable of testing circadian performance alongside LM-79, DLC, and Energy Star protocols. This gap inhibits product commercialization and slows alignment with new CIE–BIPM standards.

In alignment with Laboratories Canada's national strategy and its $2.8 billion investment to modernize federal science infrastructure, this initiative addresses a critical opportunity to advance circadian lighting measurement capacity in Western Canada.

This paper proposes a Vancouver-based accredited circadian test facility designed to validate the biological eff ectiveness of light sources, accelerate certifi cation processes, and provide photometric and spectral characterization aligned with CIE–BIPM metrics.

A unique aspect of the facility is its integration of quantum dot (QD) technology, off ering superior spectral precision, tunability, high CRI, and energy effi ciency. QD lighting enables optimized circadian stimulus not achievable with conventional phosphor LEDs.

By combining quantum dot spectral capabilities with rigorous, standards-compliant testing, the facility aims to support healthcare, workplace, and residential lighting applications, facilitating global adoption of circadian lighting.

Bios

Sarah Morgan is the Founder and CEO of Nano-Lit Technologies and Earthlight, innovating circadian lighting for health, performance, and public-health impact. With a Master's in Industrial Design from Pratt Institute, she develops quantum-dot hardware and AI-driven circadian intelligence aligned with BMJ Public Health, CIE S 026, and WELL v2. Her work has included the founding of a Circadian Rhythm Research Consortium with Northwestern, Stanford, UCLA and Weill-Cornell. She has consulted for the Canadian Space Agency, NASA, and Blue Origin. Earthlight translates global scientific consensus into daily lighting schedules and ROI insights, making complex chronobiology usable for designers, clinicians, and operators.

Jeff Yurek is Head of Marketing at Nanosys-Shoei, he has been a driving force behind the company's success in bringing quantum dot technology to consumer products. Yurek's expertise in quantum dot technology extends beyond his work at Nanosys. As an active member of several industry organizations, including the Society for Information Display, IEC and ICDM, Yurek is dedicated to advancing the field of display technology. Prior to his work in marketing, Yurek worked as a creative professional, bringing his passion for storytelling and technology to a variety of projects.

COGNITIVE RESPONSES TO MELANOPIC EQUIVALENT DAYLIGHT ILLUMINANCE

Olivia Knoechel[1], Dorukalp Durmus[1]
[1]Penn State University, University Park, PA, USA

Abstract

In recent years, the non-visual effects of light have received growing attention, particularly the role of intrinsically photosensitive retinal ganglion cells (ipRGCs) in regulating cognitive and physiological responses. While many studies have examined acute effects of light on alertness and cognitive performance [1], relatively few have systematically investigated how variations in melanopic equivalent daylight illuminance (mel-EDI) [2] influence cognition under controlled laboratory conditions. To address this, a pilot study was conducted with four participants who completed a series of cognitive assessments—including the Rey auditory verbal learning test (RAVLT) [3], trail making test (TMT-A/B) [4], and controlled oral word association test (COWAT) [5]—across lighting conditions designed to vary mel-EDI while maintaining constant illuminance, as shown in Table 1.

Table 1. Summary of Lighting Conditions

	Condition 1	**Condition 2**	**Condition 3**
Nominal Color	White	White	Blue
Illuminance (lux)	250	248	240
CCT (K)	4198	3879	N/A
￼ (lux)	138	189	196

Preliminary findings show subtle differences in cognitive performance across conditions, but the small sample size and potential confounds limit firm conclusions. In particular, repeated testing revealed patterns consistent with both cognitive fatigue and the practice effect, complicating interpretation of the data. These results highlight the need for larger studies that extend beyond short-term measures, incorporate more participants, and include protocols specifically designed to mitigate or account for practice and fatigue effects. Although the results of this study do not yield definitive answers, they provide valuable insight into the methodological challenges of linking mel-EDI to cognitive performance.

Bio

Olivia Knoechel is a fourth-year student in the integrated Bachelor and Masters Architectural Engineering program at Penn State University. She has conducted undergraduate research for three years on topics including light-induced damage to acrylic paint and museum projector lighting. Her current work investigates the cognitive effects of light.

The photobiological impact of illumination on alertness and sleep: from the laboratory to the field

Renske Lok[1], Roelof A. Hut[2], Jamie M. Zeitzer[1,3]

[1] Department of Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, USA

[2] Chronobiology Unit, Groningen Institute for Evolutionary Life Sciences, University of Groningen, Groningen, The Netherlands

[3] Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

Abstract

Light is a potent biological stimulus influencing not only vision but also a wide range of non-image forming physiological processes. To understand this functional relevance of these effects, our research integrates photobiology, circadian neuroscience, and human factors science to elucidate how light characteristics (intensity, timing, spectral composition) impact alertness, cognitive performance, and sleep regulation.

Controlled laboratory experiments, useful for examining the capacity of a system to respond, demonstrate that light spectra and intensity can be used to modulate alertness and sustained attention, even under conditions of circadian misalignment observed so frequently in modern society. These effects are accompanied by measurable changes in physiological markers, including melatonin, cortisol, and core body temperature, underscoring the interplay between photoreceptor activation and physiologic outcomes.

Complementary field studies, useful for examining the magnitude of change under real-world conditions, link natural variation in daytime daylight exposure patterns to improved sleep timing, circadian stability, and overall sleep quality. These improvements are further validated through machine learning examination of large-scale and population-based datasets that further reveal associations between daytime light exposure, sleep consolidation, and healthy aging.

Together, these studies advance our understanding of the photochemical and photobiological pathways through which light influences human physiology and behavior. Ongoing work aims to translate these mechanisms into precise, personalized light-based interventions that enhance cognitive health, sleep quality, and health equity across diverse populations.

Bio

I earned my Ph.D. from the University of Groningen, where I investigated how light influences human alertness, thermoregulation, and sleep. Following this, I joined the Stanford University Center for Sleep Sciences and Medicine as a postdoctoral fellow, expanding my research to bridge basic and translational approaches to human sleep and circadian biology. My work focuses on understanding how sleep patterns relate to health and disease, and how light exposure can be harnessed to improve sleep and cognitive function.

I am the recipient of an NIH K99/R00 Pathway to Independence Award from the National Institute on Aging, supporting the launch of my independent research program—the cLOcK Lab—at the University of Colorado Boulder in January 2026. My lab will focus on developing precision light-based interventions to promote healthy sleep, cognition, and aging. I currently serve as Vice President of the Society for Light, Rhythms, and Circadian Health.

A SYSTEMATIC REVIEW OF STUDIES UNDERPINNING NON-VISUAL LIGHTING RECOMMENDATIONS: METHODOLOGICAL GAPS AND RESEARCH IMPLICATIONS

Y. Sogodok, N. Ghorbanian Matloob, C. Pierson
College of Engineering, Oregon State University, Corvallis, Oregon, USA

Abstract

Light profoundly influences human health, not only through vision, but also by regulating psychophysiological processes such as circadian phase shift, melatonin secretion, sleep, and alertness. These effects are primarily mediated by intrinsically photosensitive retinal ganglion cells containing melanopsin. Since their discovery, research on non-visual responses to light has expanded, but comparing findings remains difficult due to methodological gaps, incomplete reporting, and a lack of diversity in study design and populations.

We conducted a systematic review to identify recommendations related to lighting that promote non-visual responses of building occupants and examined the studies underpinning them. Our goal was to evaluate methodological gaps in those studies and discuss implications for future research and standards development. Using the PRISMA and Webster & Watson approach, six documents (standards, recommendations, guidelines, and positional statements) met the inclusion criteria. From these, we extracted all cited studies (n=157) supporting the recommendations and analyzed their methods.

Evidence underpinning current recommendations is predominantly lab-based, drawn largely from developed countries, and centered on campus-age participants. Sample sizes are often small (median n=16), but designs are predominantly within-subject. Exposure timing is frequently at night, misaligned with how most people live during daytime. Reporting is also uneven: information such as spectral content and spatial distribution of light or participant demographics is inconsistently documented, limiting reproducibility and generalizability. Collectively, these limitations call into question the relevance of current lighting recommendations and hinder progress in lighting design and research. Research practices should improve to support the reliability, applicability, and inclusivity of future standards.

Bio

My name is Yahya Sogodok, and I am currently a second-year PhD student in Civil Engineering with a concentration in Architectural Lighting Design. I hold both a bachelor’s and a master’s degree in Electrical and Electronic Engineering from the Islamic University of Technology (Bangladesh) and Kocaeli University (Türkiye), respectively. I am presently working under the supervision of Dr. Clotilde Pierson on research examining the effects of light on human non-visual responses.

YEAR-LONG HOME LIGHT EXPOSURE IN OLDER ADULTS LIVING ALONE: ASSOCIATIONS WITH SLEEP AND BRAIN HEALTH

Vali, K.[1], Au-Yeung, W-T. M.[2], Kaye, J.[2], Pierson, C.[1]
[1]Oregon State University, Corvallis (OR), USA, [2]Oregon Health & Science University, Portland (OR), USA

Abstract

Light exposure helps regulate circadian timing and supports healthy sleep-wake patterns, among other non-visual effects. These are especially relevant for older adults, who often experience circadian disruption and age-related sleep disturbances. Most prior research has assessed older adults' light exposure over short durations, and studies with longer timelines have primarily relied on participants' self-reported time outdoors. Moreover, few studies have used appropriate metrics to assess light exposure relevant to circadian regulation, and even fewer have examined light exposure in residential settings. In this observational study, we assessed the indoor light exposure of 16 older adults (mean age = 84 years) living alone over one year using home-based spectral light sensors combined with passive infrared occupancy data. Simultaneously, we collected longitudinal objective sleep data and a point-in-time brain health evaluation. We computed melanopic Equivalent Daylight Illuminance (mEDI) and Circadian Stimulus (CS) metrics to characterize light exposure during daytime, evening, and nighttime periods. Our results indicate that daytime indoor exposure was generally low (below current recommendations for this population), whereas evening exposure was relatively elevated, yielding a weak day-evening contrast. Because the sensors have limited sensitivity at very low light levels, nighttime estimates are uncertain but suggest no indoor light pollution at night. Overall, this light exposure profile underemphasizes the bright-days/dark-nights distinction considered important for circadian entrainment. We will discuss the home light exposure in this cohort in greater detail, together with environmental factors influencing it, and present preliminary results on associations between home light exposure and sleep and brain health outcomes.

Bio

Kianoush Vali is a Ph.D. student in Civil Engineering (Architectural Engineering focus) at Oregon State University, advised by Dr. Clotilde Pierson. His research explores how indoor lighting and daylighting conditions influence sleep, cognitive function, and overall brain health in older adults, with the aim of supporting healthy aging through building design. He seeks to develop evidence-based strategies that make residential and care environments more supportive, comfortable, and health-promoting for older populations.

Development of a web-based knowledge base for use, installation and maintenance of GUV sources

Rolf S. Bergman[1], PhD, Kathleen McPhaul[2], PhD
[1]Consultant, [2]University of Maryland School of Public Health

Abstract

The use of Germicidal UV-C sources received increased attention during the Covid 19 pandemic. However, it was clear that the knowledge base for GUV room design and effective and safe installation of such sources was not as widespread as it needed to be to assure successful remediation of airborne viruses. In 2022, funded by a grant from the Balvi Foundation, Dr.'s Bergman, Sliney and Jenson developed and initiated a training program based on written and hands on certification of technicians and engineers for GUV systems. The written material is available through a U of Maryland website and certification, at three levels, can be obtained through NALMCO. The GUV technology considered is source neutral, applying to all UV-C source types. A number of training sessions were held over the course of three years resulting in a cohort of certified installers. However, it became clear through that process that we needed a better means advancing the program. To that end, Dr. Kate McPhaul has been working to put together a website called the GUV Hub, as a resource for everyone involved in germicidal remediation.

Communications research has an array of tools for developing messages, that clarify, explain, empower, and encourage action according to a target audience's health literacy levels. Since the pandemic, evidence suggests that trust has eroded in government sources of public health information. There appears to be an information vacuum that creates an opportunity for a new approach. We used qualitative research methods including key informant interviews, focus groups, case studies, and message testing to inform the development of a credible prototype "GUV-Information Hub". We developed and tested communication materials for specific target audiences, including those who are considering GUV installations. We aim to establish credibility and trust while using plain language to explain complicated concepts. The "GUV Info-Hub" is currently in a "soft-launch" phase. Preliminary analytics will be reported.

Bios

Rolf S. Bergman, Ph.D., is currently an independent consultant (sole proprietor) in lighting technology, including UV, and measurements. After graduating with a Ph.D. in Electrical Engineering in 1972 from the University of Minnesota, Dr. Bergman worked for over twenty-eight years at GE Lighting, all at Nela Park, Cleveland, OH, both as an individual contributor and manager in lamp technology. While at GE Lighting he was involved new product and process development, measurement capability and industry standards. Dr. Bergman was named Chief Scientist, Lamp Technology in 1992, a position he held until retirement in 2001.

Currently, among other consulting work, he serves as an assessor of lighting laboratories for accreditation to NVLAP, and accrediting body organized at the National Institute of Standards and Technology (NIST).

Dr. Bergman served as President of the CIE/USA National Committee from 11/2003 to 11/2008. He also was the chair of CIE TC 6-47, the group that producing a global standard for photobiological risk evaluation of lamps, IEC 62471 (also CIE E9). He serves as a member of the IESNA Technical Procedures and Photobiology Committee, and he is a member of CORM, an industry group that advises NIST on measurement needs in US industry.

Kathleen M McPhaul, PhD, MPH, RN is an Associate Research Professor at the University of Maryland School of Public Health. She is the former Chief Nurse at the Smithsonian Occupational Health service and Chief Consultant for Occupational Health at the Veterans Health Administration (VHA). She is a fellow in the Collegium Ramazzini of Occupational Medicine. Currently, she focuses on pandemic preparedness for airborne respiratory diseases, especially the engineering and building controls that improve air hygiene (i.e. ventilation, filtration and germicidal ultraviolet light air disinfection). She leads research on the best approaches to communicate with communities to ensure that information and messaging is clear and actionable with respect to indoor air, germicidal UV, and other pandemic preparedness issues.

Division 8: Image Technology Activity

November 19th, 3:25pm EST

CIE Division 8 2025 Activities

Robin Atkins, PhD, Dolby Laboratories, Max Derhak, PhD, Onyx Graphics Inc.

Bio

Robin Atkins is a Principal Researcher at Dolby Laboratories, where leads a team of researchers responsible for innovating new visual experiences and inventing video processing algorithms. He is a key contributor to the development of the High Dynamic Imaging ecosystem, for which he has been awarded a technical Emmy amongst other accolades. His research encompasses studying and modeling the fundamentals of human vision through to developing complex software platforms. His work has been adopted in multiple international standards and has been integrated into millions of professional and consumer devices worldwide. He holds a PhD in Interdisciplinary Studies (Physics and Psychology).

Bio

Max Derhak has worked for Onyx Graphics Inc. since 1990 where he currently functions in the role of Principal Scientist and Team Development Lead. Max has a bachelor's in computer science from the University of Utah, a Masters in Imaging Science at The Rochester Institute of Technology, and a Doctorate in Color Science at RIT. He serves as the Co-Chair of the International Color Consortium (ICC) where he continues to be a driving force in advanced color management iccMAX standards and the DemoIccMAX implementation. Max also represents the CIE-USNC within CIE Division 8.

Temporal Anti-Aliasing Techniques for HDR Imaging in 1D and 2D Systems

Tim Moggridge, Westboro Photonics

Abstract

Accurate imaging in the presence of temporally modulated light sources can be challenging, particularly when the exposure time of the imaging system is not synchronized with the source's modulation frequency. This mismatch can lead to poor measurement reproducibility and increased uncertainty. Traditional approaches to mitigate these issues include synchronizing exposure with modulation, using extended exposure durations, or averaging multiple frames.

This presentation introduces a novel method for reducing measurement errors in high dynamic range (HDR) imaging without requiring prior knowledge of the source modulation frequency. The technique maintains the speed of conventional HDR imaging while enhancing robustness against temporal aliasing effects. It is especially advantageous in scenarios involving high dynamic range sources and where rapid measurement acquisition is critical.

Bio

Tim Moggridge has dedicated his career to test and measurement and has served as CEO of Westboro Photonics since 2000. Under his leadership, the company has developed advanced 2D photometer and colorimeter systems for evaluating displays and lighting. Tim holds five patents in imaging photometry, colorimetry, and spectroscopy, underscoring his commitment to innovation in light measurement. He also served as a director of CORM for a decade, and participates in other light metrology organizations, contributing to industry standards and best practices.

Retina-Inspired Demultiplexing of RGB into Five Perceptual Channels (RGBYCW)

Vasile Diaconu, PhD, Université de Montréal

Abstract

Conventional three-primary pipelines compress rich spectral structure into device RGB, which can mask distinct cyan and yellow contributions and reduce robustness under metameric variation. We introduce a retina-inspired demultiplexing model that maps device RGB into five quasi-monochromatic channels—Red, Green, Blue, Yellow, and Cyan (RGBYC). The method leverages cone-contrast interactions and chromatic opponency aligned with the CIE 2006 LMS fundamentals, while preserving compatibility with standard colorimetric reporting.

The algorithm proceeds in two stages: (1) characterize the camera/display and convert device RGB to an LMS-contrast representation with luminance normalization; (2) compute cross-opponent interactions that unmask latent contributions and separate overlapping spectral influences into five "effective primaries." Simulations on synthetic and measured spectra show three benefits: (i) improved separability of cyan and yellow components that are confounded in trichromatic pipelines; (ii) greater stability of chromatic estimates across metameric sets and exposure levels; and (iii) a practical mapping for five-primary display driving, suggesting gains in color-gamut coverage and hue linearity at high luminance.

We outline calibration requirements (camera spectral sensitivities, display emission spectra, and stable forward/inverse transforms) and derive psychophysical predictions, including hue-angle shifts for mixed short–long wavelength stimuli and conditions where weak short-wavelength L-cone contributions are unmasked by post-receptoral processing. The framework remains compatible with CIE practice (summaries in LMS/CIE spaces, tristimulus reproducibility) while enabling evaluation protocols for multiprimary rendering in HDR/WCG contexts. We invite CNC-CIE to consider validation datasets, color-difference metrics adapted to demultiplexed channels, and round-robin testing with shared reference implementations.

Bio

Vasile Diaconu is a physicist and associate professor at the Université de Montréal, specializing in retinal-inspired imaging systems. With more than 30 years of experience in physiological optics, color perception and biomedical signal processing, he holds several patents and is the author of numerous publications in color vision and multispectral analysis. He is also the inventor of techniques for demultiplexing color channels in retinal structures, bridging neuroscience and engineering in the field of color imaging.

Division 3: Interior Lighting Activity

November 20th, 11:00am EST

CIE Division 3 2025 Activities

Jennifer A. Veitch, PhD, FIES, FRSC, CIE President, National Research Council (NRC), Canada

Bio

Dr. Jennifer A. Veitch serves as the President of the CIE for the 2023-2027 term. She is a psychological scientist with expertise in environmental psychology, and has been a Research Officer at the National Research Council of Canada since 1992. A Fellow of national and international associations in lighting and psychology, she received the Waldram Gold Pin for Applied Illuminating Engineering from the CIE in 2011 and the IES Medal Award in 2018. In November 2024 she was inducted as a Fellow of the Royal Society of Canada.

Redefining Roi: Incorporating Human Performance Into Lighting Valuation Models

Chris Sembroski[1], Sarah Morgan[2]
[1]INSPIRATION4 ASTRONAUT, SEATTLE, USA, [2]NANO-LIT TECHNOLOGIES BC LTD., VANCOUVER, CANADA

Abstract

Building operators and engineers are tasked with achieving operational efficiency at the lowest possible cost. In the context of lighting, this typically means comparing technologies by installation cost, energy consumption, utility incentives, and the time required to recoup capital investment. These analyses form the backbone of most lighting decisions, yet they consistently overlook the most valuable asset in any building: the people inside it.

Lighting profoundly influences human health, cognition, and performance. While this is qualitatively acknowledged, quantitative assessment of productivity gains or losses remains absent from most cost–benefit analyses. This omission results in a narrow financial model, where kilowatts and therms are measured but the human factors; alertness, sleep quality, error reduction, and long-term health outcomes are ignored. Such a limited framework leads to missed opportunities: buildings may achieve energy efficiency while failing to maximize the performance and well-being of their occupants.

This presentation introduces a methodology for integrating human performance considerations into lighting ROI calculations. By reframing the “savings envelope” to include not only the facility’s operational costs but also the productivity and health of its occupants, we open the door to a more holistic valuation of lighting design choices. Case studies and emerging research will be highlighted, showing how circadian-aligned and biologically aware lighting can deliver measurable returns well beyond energy savings. Lighting is more than illumination; it is a lever for both economic efficiency and human potential.

Bios

Chris "Hanks" Sembroski is an Inspiration4 astronaut who experienced Earth's natural light cycles from orbit, inspiring his mission to bring space-grade environmental optimization to terrestrial buildings. With extensive experience in energy retrofit and utility savings creating smart buildings, Chris uses his unique perspective from space to solve Earth's toughest challenges.

Sarah Morgan is the Founder and CEO of Nano-Lit Technologies and Earthlight, innovating circadian lighting for health, performance, and public-health impact. With a Master’s in Industrial Design from Pratt Institute, she develops quantum-dot hardware and AI-driven circadian intelligence aligned with BMJ Public Health, CIE S 026, and WELL v2. Her work has included the founding of a Circadian Rhythm Research Consortium with Northwestern, Stanford, UCLA and Weill-Cornell. She has consulted for the Canadian Space Agency, NASA, and Blue Origin. Earthlight translates global scientific consensus into daily lighting schedules and ROI insights, making complex chronobiology usable for designers, clinicians, and operators.

UGR – A Misunderstood Glare Metric with Limited Usefulness

Naomi Miller, FIES, FIALD, retired

Abstract

Unified Glare Rating is the best indoor glare metric available, and it has serious shortcomings: poor documentation and instructions, confusing routes for implementation, wide misunderstanding by design professionals and regulators, and published product values by manufacturers that mislead specifiers and compliance programs. Plus, it doesn't apply to most luminaires and spaces for which it is used. This will be a brief introduction to why this metric should be applied sparingly, and what needs to be done to improve it.

Bio

Naomi Miller survived a very long career, first as an architectural lighting designer in San Francisco and Upstate New York, and then as a Senior Lighting Scientist at Pacific Northwest National Laboratory. She has Emerita status now, and seems to be failing retirement because she is driven to eradicate flicker and glare from LED lighting systems before her obituary is written. In 2023 she received the CIE Waldram Gold Pin for Outstanding Contributions in Applied Illuminating Engineering, and in 2024 received the IES Medal Award, their top technical award. She is both a Fellow of the Illuminating Engineering Society and the International Association of Lighting Designers.

Division 4: Outdoor Lighting Activity

November 20th, 12:15pm EST

CIE Division 4 2025 Activities

Lynn Asselin, Holophane Canada

Bio

Lynn is a lighting specialist with over 28 years of experience in Theatrical, industrial, commercial and architectural lighting and currently hold a Sales position with Holophane/AEL (Acuity Brands Lighting) as Sales Manager for British Columbia for 14 years. Lynn combines physics with sustainability as she holds a Lighting Certification with NCQLP and bachelor's degree in physics from University of Toronto, and an Electronic Certificate from BCIT, and has experience with Visual and AG132 Software for lighting design. She also teaches lighting courses with the Education Section for IES Vancouver. Also hold a membership with IES Roadway Lighting Committee and work on Sub committees to assist on creating standards. Lynn approaches lighting by providing a solution first to the application with economic and with recommended lighting levels suitable in all areas for indoor or outdoor needs. When its "lights out" for work, Lynn enjoys hiking, cycling and ice hockey.

Development of a Moon Metric to Characterize Roadway Lighting Impact on Flora and Fauna

Ronald Gibbons, PhD, Virginia Tech Transportation Institute
Travis Longcore, PhD, UCLA

Abstract

To address this growing awareness of the ecological impacts of roadway lighting and the need for guidelines for lighting and transportation engineers, a metric must be developed to allow for the assessment of the lighting and compare the impact across multiple designs. To accomplish this, a proposed metric for the impact of nighttime lighting on an area is a comparison with naturally occurring light sources and conditions, of which the moon is the most dominant.

The impact of a lighting system on flora and fauna is based on two aspects of the lighting system: the spectrum of the light source and the intensity of the light source (Longcore et al.(2018b)). The input variables include the spectral power distribution of the light sources in use, the actinic response spectrum for a species of interest, the latitude and longitude of the installation location, and, optionally, the date and time of consideration. These aspects can be considered as a dosage; thus, a lighting system with a higher intensity but a less reactive spectrum may be better than a dim lighting system with a more invasive spectrum.

Sample calculations of the moon metric show: The lighting levels from installed lighting systems are typically much higher than the illuminance from the moon, which means that the moon metric is much higher than 1 for most installations. The moon metric generally follows the CCT in terms of magnitude and a higher CCT and therefore a bluer light source has a higher moon metric result. The metric is an effective comparison tool, but additional research is needed to clarify an acceptable magnitude of impact.

Bio

Ron Gibbons leads the Infrastructure-Based Safety Systems group at VTTI and also serves as an associate professor in the School of Architecture and Design at Virginia Tech.

He is also the Institute's lead lighting research scientist and is responsible for lighting- and visibility-associated research projects and projects which consider roadway safety as they relate to infrastructure.

He is currently the PI on multiple projects including studies on the impact of lighting design on roadway safety, the impact of headlamp design on safety, wet night visibility and the performance of alternative light sources in roadway lighting. Gibbons is also the Principal Investigator on the Institute's IDIQ contract for the FHWA Office of Safety.

Gibbons is the author of several published papers on roadway lighting, photometry and target visibility. He is a Past President of the Illuminating Engineering Society of North America. Gibbons obtained his Ph.D. from the University of Waterloo, Canada.