CIE/USA

COMMISSION INTERNATIONALE DE L'ECLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

2013 Biannual Joint Meeting of CIE/USA and CNC/CIE

November 7 & 8, 2013 – UC Davis Conference Center, 550 Alumni Lane, Davis, CA

Thursday, November 7, 2013

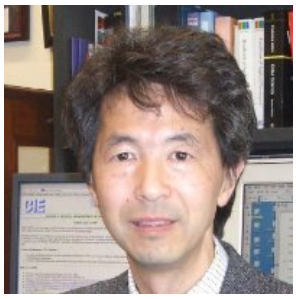
Time	Event
08:30 - 09:00	Registration/Continental Breakfast
09:00 – 10:30	Welcome/ Paper Session 1
10:30 – 10:45	Coffee Break
10:45 – 12:15	Paper Session 2
12:30 – 13:30	Lunch
13:30 – 15:15	Paper Session 3 Panel Discussion – Industry Issues
15:15 – 15:30	Coffee Break
15:30 – 17:00	Tour of the Davis Campus

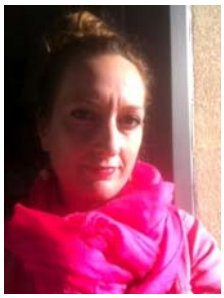
Dinner on your own

Friday, November 8, 2013

Time	Event
08:30 – 10:30	Continental Breakfast Division Reports – Joint (All welcome)
10:30 – 12:00 10:30	CNC/CIE Business Meeting (Observers welcome) CIE/USA Business Meeting (includes ANSI TAG meeting) Coffee available
12:00 – 13:00	Lunch
13:00 – 17:00 15:00	CIE/USA Business Meeting (continuation) CIE/USA Executive Meeting CAC-ISO-TC274 Business Meeting Coffee available

ABSTRACTS: Technical Day, November 7, 2013

9:00	**Welcome** *Cameron Miller, NIST and Jennifer Veitch, NRC*
PAPERS	**SESSION 1**
9:10 	**Investigating the Trade-Off between Luminous Efficacy of Radiation and Color Rendering Index** *Lorne A. Whitehead, University of British Columbia* This presentation concerns an emerging collaborative effort among several laboratories, the purpose of which is to develop a better understanding of an important design tradeoff - for white light at any selected correlated color temperature (CCT), there are many possible spectral power distributions, each of which has a certain value for luminous efficacy of radiation (LER) and another for color rendering index (CRI). Unfortunately these desirable characteristics correlate negatively, so there is a need to compromise between the two. A consortium of laboratories is now devising a series of experiments, to be performed simultaneously and independently, the goal of which is to identify the optimum compromise between LER and CRI. Likely the optimum will depend on illuminance, CCT, and the anticipated visual task(s). This investigation is needed to inform the selection of minimum requirements for illuminance and CRI in various settings. *Lorne Whitehead is an applied physics professor at the University of British Columbia where he is also UBC's Special Advisor on Innovation, Entrepreneurship and Research. Before joining UBC in 1994 he was CEO of TIR System Ltd. Lorne's research has led to over 100 patents and six new companies. He has served on numerous boards, and he is currently the Treasurer and a member of the Board of Administration, of the International Commission on Illumination (CIE).*
9:30 	**Vision Experiments on White Light Chromaticity – Duv Range Perceived Most Natural** *Yoshi Ohno,' National Institute of Standards and Technology, and* *Mira Fein, Oberlin College* Standards for chromaticity of fluorescent lamps specify acceptable chromaticity ranges centered around the Planckian Locus since three decades ago. Recent ANSI standard on chromaticity of LED sources also follows it. Anecdotes say, however, that chromaticities below the Planckian Locus (pinkish shift) are often preferred, but there have been no vision experiments testing acceptability or preference of chromaticity shifts across the Planckian Locus (yellowish or pinkish shift, measured by Duv) in real lighting environment. A series of vision experiments have been conducted at NIST using 18 subjects, using NIST Spectrally Tunable Lighting Facility, presenting lights with six different Duv levels (-0.03, -0.02, -0.01, 0, +0.01, +0.02) at four different CCTs (2700 K, 3500 K, 4500 K, 6500 K). The results show that lights with Duv around -0.015 (below the Planckian Locus) on the average is perceived most natural at all CCTs. This Duv level is outside the ranges specified by the existing standards. This indicates that lighting products with more preferred color quality than existing products may be possible. *Yoshi Ohno is a NIST Fellow and Group Leader for the Optical Sensor Group at the National Institute of Standards and Technology. He is very active in international standardization for light and lighting. Among his current positions, he is CIE Vice President-Technical (2011-2015) and President-Elect (2013-2015), and also serves as Chair of working groups in the Consultative Committee of Photometry and Radiometry (CCPR), IES, and ANSI. He was awarded the De Boer Gold Pin Award from CIE in 2007 for his outstanding contributions to organizational efficiency in CIE.*

9:50 	**Improving the Traceability of Fluorescence Calibrations: Extending the Measurement Geometries for Applications in Colorimetry** *Joanne Zwinkels and William Neil, National Research Council of Canada* The traceability of absolute fluorescence calibrations for colorimetric applications using the two monochromator method has been a concern for several years because these calibrations are performed in accordance with the CIE recommended geometry of 45°:0 (or 0:45°) whereas for many important applications of fluorescence colorimetry, e.g. for paper and textiles, the recommended measurement geometry is hemispherical using an integrating sphere. It is well known that measured spectral radiance factors are dependent upon geometry, with the magnitude of these differences being dependent upon the type of sample. As a consequence, empirical methods have been developed to apply a geometric correction to this calibration data but this has compromised the traceability of these fluorescence calibrations. To improve this situation, the National Research Council of Canada is developing a new two-monochromator reference goniospectrofluoimeter that features a large sample compartment that can accommodate a variety of sampling accessories. These include a gonio-stage to investigate variation of sample fluorescence with angles of illumination and viewing; an integrating sphere for near-normal hemispherical fluorescence calibrations; and an annular ring for 45°a:0 fluorescence calibrations. This paper will discuss the development of this new reference fluorescence instrument and the preliminary results obtained on extending the traceability of fluorescence colorimetric calibrations to different CIE measurement geometries. *Joanne Zwinkels is a Principal Research Officer at the National Research Council of Canada where she leads research into the development of reference facilities, standards, and procedures for high-accuracy spectrophotometry and fluorescence measurements. Joanne is actively involved in international standardization activities and currently serves as Chair of the Strategic Planning Working Group of the CCPR, International Convenor of ISO TC6/WG3 (Paper, board and pulps: optical properties), and Associate Director of CIE Division 2 (Physical Measurement of Light and Radiation).*
10:10 	**An Alchemist, A Frustrated Poet, Some Charlatans and Contemporary Color Theory** *Gioia Fonda, Sacramento City College* Color theory courses often take a rather dry, clinical and objective approach to the subject, sticking to the scientific aspects of color. Tragically so, since the history of color theory is peopled with vibrant characters from many backgrounds including philosophers, biologists, mathematicians, physicists, chemists, psychologists, and artists. The nature of color and the long running dialogue between such varied disciplines has resulted in color being a field of study that remains in many ways rather wild and speculative. I teach my students traditional and technical color theory but as an artist I know there is also great value in studying the less measurable, more intuitive and at times cultural aspects of color. This line of research has led me down some murky and forgotten corners of both color theory and art history. As obscure as some these players and their ideas may have been, their influence is surprisingly still at work in much mainstream and contemporary thinking about color. *Gioia Fonda is an interdisciplinary two-dimensional artist (painting, drawing, sewing and photography) who occasionally makes forays into sculpture and new media. Her subject matter ranges widely from working in a colorful non-objective manner to directly addressing the fallout of the Great Recession. She received her BFA at California College of the Arts and her MFA at School of Visual Arts in New York. She is a tenured professor of art at Sacramento City College.*
10:30	**COFFEE BREAK**

PAPERS	SESSION 2
10:45 	**Designed Lighting Interventions Reduce Negative Behaviors and Increase Positive Behaviors** *Melinda La Garce, Southern Illinois University* The hypothesis for this research study was: specifically designed lighting interventions can reduce negative behaviors and increase positive behaviors of residents and staff in a long term healthcare facility. This study was funded by the Illinois Department of Public Health. Lighting interventions designed for the research included electric white daylight lamps and wall and ceiling surface coatings in a color that did not alter the color appearance of the electric lights. A month of baseline assessment was made by discretely video recording 100 hours of behaviors before the lighting interventions were installed to determine both negative and positive behavior markers. Eight negative behavior markers and seven positive behavior markers were identified. Of the 654+ hours of taped behaviors after the lighting interventions were installed, 100 hours were randomly selected for the comparative study. Assessment methods included systematic behavior observations made by trained observers, direct observation by the principal investigator, and interviews with residents, staff, and family members as appropriate. Comparative study found eight of the eight negative behavior markers were reduced by an average of 83% and seven of the seven positive behavior markers were increased by an average of 90%. Findings indicate the hypothesis is supported. *Melinda La Garce is an Associate Professor in the School of Architecture at Southern Illinois University in Carbondale, Illinois. She conducts research into the effects of environmental lighting on human behavior and physiology, which she publishes and presents nationally and internationally. She also has examined sustainable design. She has built work in many major U. S. cities in the corporate, health care, retail, and hospitality design specialties; and consults with design firms, owners, developers on methods to implement sustainable design, daylighting, and neuropsychological effects of ambient and therapeutic lighting systems into the built environment.*
11:05	**Effects of Specific Wavelengths of Ambient Light on Human Blood Chemistry in Alzheimer's and ADHD Subjects** *Melinda LaGarce, Southern Illinois University* The author and an associate researcher (a physician) have studied effects of lighting interventions on behaviors of the Alzheimer's type and ADHD using systematic behavior observation methods. Findings indicated that particular colors of ambient light and white light affected behaviors characteristic of Alzheimer's and ADHD. Researchers 1) delineated specific wavelengths of light for testing, and 2) determined that radiological plasma assays would be used for determining changes in blood chemistry due to exposure of specific wavelengths of light. Participants were screened and Alzheimer's and ADHD diagnoses were made. Participants were exposed to five different wavelengths of electric light. Blood samples were drawn and radiological immuno plasma assays were performed to determine any changes in blood chemistry. Blood chemistry changes were found for the Alzheimer's and ADHD participants but not in all normal healthy subjects.

11:25 	**Optical Safety Standards for Lamps are Being Revised** *David H. Sliney, Consulting Medical Physicist* Human exposure limits for ultraviolet visible and infrared radiation from the American Conference of Governmental Industrial Hygienists (ACGIH) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) were the basis of emission limits for lamp product risk groups (http://www.icnirp.org). Photobiological safety standards for lamps have been published by the CIE (S009:2002) based upon ANSI/IESNA RP27.1-3 and also adopted by the International Electrotechnical Commission as IEC 62471:2006. The primary concerns relate to ultraviolet radiation and blue light. Although IARC classifies sunlight as a Group I carcinogen, it is nearly impossible to protect to currently recommended ACGIH/ICNIRP exposure guidelines for the skin during summer months, and emissions from fluorescent lamps are trace amounts compared to sunlight. However, it is from an understanding of outdoor exposure, that lamp safety standards could emerge. Although the biological effects of ultraviolet radiation have been studied for decades, there continues to be a debate with regard to obtaining an optimum balance of preventing excessive exposure that increases risks of delayed effects upon the skin and eye, while at the same time having the benefits of low-level UV in producing Vitamin D and possibly obtaining other positive effects for the immune system. Revisions are now being proposed for the current photobiological safety standards to provide more realistic time-weighted exposure conditions for risk-group assessment. This applies to compact-fluorescent lamps and LED sources. For example, no one is exposed with a lamp in their face at 20 cm for 8 hours/day, as some have interpreted the current standards and guidelines. *David H. Sliney holds a Ph.D. in biophysics and medical physics from the University of London and until his retirement in 2007 managed the Laser/Optical Radiation Program for the US Army Center for Health Promotion and Preventive Medicine. He served as the Director of CIE Division 6 (Photobiology and Photochemistry) from 1991-2002 and as a CIE Vice-President from 2002-2006. Dr. Sliney has long been active in the establishment of safety standards for protection of the eye and skin from lasers, sunlight and high-intensity optical sources. Among his many present commitments, he serves on the IESNA/ANSI Committee that maintains ANSI RP-27, Photobiological Safety of Lamps and Lighting Systems.*
11:45 	**Flicker from Commercially-Available LEDs: Measurements and Metrics** *Keith Graeber, California Lighting Technology Center* *Keith Graeber leads CLTC's staff of lighting technology researchers and engineers. He supervises the development of next-generation, energy-efficient lighting systems and controls at CLTC. He also oversees engineering demonstration projects and laboratory evaluations, collaborating with industry partners to bring promising new products to the marketplace more quickly and effectively. Keith is a regular contributor to LD+A, and he has claimed patents for his contributions to daylight harvesting and the calibration of lighting control systems. He graduated from the University of California, Davis, in 2005 with a B.S. in Mechanical Engineering.*

12:05 	**Light Source Flicker: What We Need to Know, and Why You Should Care** *Jennifer A. Veitch, National Research Council of Canada* Electromagnetic radiation between 380 and 780 nm is detected by cells in the retina (sensation), which sends signals to brain structures. Perception is the process by which the brain interprets sensory information. Modulation in the luminous signal (flicker) is perceived at rates up to as high as 100 Hz, although the average critical flicker frequency is around 60 Hz. Flicker above 100 Hz has effects on brain activity, eye movements, and visual performance even though the individual would not report having consciously perceived the flicker. Ongoing research addresses under what conditions (frequency, amplitude, spectral variation, the adaptation luminance, and the contrast and retinal size of the flickering source) such effects occur and, importantly, those conditions under which there is no evidence that the flicker is detected. Such knowledge would enable solid-state lighting products to be engineered now to reduce health risks, thus avoiding potential pitfalls to their adoption. *Jennifer A. Veitch, PhD, Fellow IESNA, is a senior research officer at the National Research Council of Canada. She's best known for her research on lighting quality, individual controls, and environmental and job satisfaction in open-plan offices. She is active in several professional associations including CIE, where she is Director of Division 3 (Interior Environment and Lighting Design), and vice president of the Canadian National Committee. She is also a member of IEEE PAR 1789, a committee dedicated to writing a recommended practice for LED flicker to minimize health risks.*
12:30	**LUNCH**
PAPERS	**SESSION 3**
13:30 	**Impact of Adaptive Lighting on Driver Safety** *Ronald B. Gibbons, Virgina Tech Transportation Institute* With the development of new lighting technology and a push to reduce the overall energy and environmental impact of lighting, adaptive lighting has become a new trend in the roadway industry. Adaptive lighting is a design methodology in which the lighting system adapts to the roadway environment. More specifically, the roadway lighting illumination levels are adjusted based on the needs of the roadway's users. The level of lighting can be reduced or dimmed when traffic on highways, sidewalks, or both is reduced. Reducing the light level will not affect an object's contrast or uniformity; however, its contrast threshold will increase, resulting in a longer detection time. By design, luminaires installed in new lighting designs often exceed the minimum requirements for lighting so that, over time, accumulated dirt dims them to their required level. Dimming the luminaires until they no longer exceed the minimum requirements would save on energy costs. This project studied the crash rate on roadways as compared to the lighting level. The crash rate from seven US States over a 5 year period and lighting measurements made in-situ on large roadways were correlated. The results indicate that there is a significant impact of the lighting on crash safety and this effect varies by roadway type. Recommended lighting levels have been established based on the crash rate impact. Recommendations are also made on when lighting can be adapted. *Ron Gibbons is the director of the Center for Infrastructure Safety at the Virginia Tech Transportation Institute (VTTI). Dr. Gibbons is responsible for lighting and visibility research projects. He is currently the PI on projects designed to develop a method for applying adaptive lighting to roadway lighting and to establish the benefit of light source spectrum. He has also worked on several projects studying crosswalk lighting, vehicle head lighting, airport lighting, and visual performance. He is a past president of the Illuminating Engineering Society of North America.*

13:50

Indoor Ice Rinks and LED Technology

André Laperrière, Hydro-Québec and Chrisnel Blot, Spectralux

Traditional luminaires operating with metal halide and fluorescent light sources are widely used in indoor sport applications. While the lamp lumen depreciation is a major obstacle of metal halide and pulse tart lamps, the T5HO technology shows a sharp decrease of the light output at low temperature. LED technology provides an increase in performance at low temperature. In this project, a temperature test was conducted at 11°C in an environmental thermal chamber to simulate the ambient temperature of the interior hockey ice ring. The *In Situ Temperature Measurement Test* (ISTMT) report confirms a 4.7% increase in luminous flux, compared to the value obtained at 25°C.

Lighting layout calculations were carried out using AGI32 software and different IES files to evaluate the efficiency in lux per Watt at 25°C with correction factor for ambient temperature of 11°C. Technical results obtained show a real strong benefit of using LED technology.

Figure 1: Ice rink application in Canada with LED technology.

André Laperrière obtained a Masters degree in Engineering from the University of Ottawa in 1983. and a Bachelors degree from Laval University in 1981. Before joining the Research Institute at Hydro-Québec in 1988, he worked in the Chalk River Nuclear Laboratory (CRNL) of Atomic Energy Canada Limited (AECL) in the department Advanced Project and Reactor Physics as well as the Advanced Engineering Branch. He was also involved in the engineering department of Canadian Aviation Electronic (CAE). André has been involved on several Canadian Standard Association technical working groups, represents of Canada in Division 4 of the CIE, and is a senior technical advisor for Hydro-Québec in energy efficiency.

14:10

Ultra-Smart Luminaires, Windows and Skylights

Konstantinos Papamichael, California Lighting Technology Center

This presentation will be focused on a new paradigm for lighting and daylighting controls, which aims at increasing the granularity of intelligence at the level of individual luminaires, windows and skylights. Traditional control approaches that utilize a single processor to control multiple components have significant limitations in terms of reliability and cost. The proposed approach is expected to provide increased reliability in sensing environmental conditions and significant cost reduction in installation and commissioning. “Ultra-smart luminaires, windows and skylights have dynamic components along with integrated sensors, processors and communication capabilities, which allow for automated operation to maximize comfort and energy efficiency. The communication capabilities allow each luminaire, window and skylight to consider not only the signals from their own sensors but also the signals from the sensors of the rest luminaires, windows and skylights in the space. Moreover, they support automated calibration to match the space they serve, greatly reducing commissioning effort and associated cost.

	Konstantinos Papamichael is a professor in the Department of Design at the University of California, Davis and co-director of the California Lighting Technology Center (CLTC). He has 30 years of experience in the development of energy efficiency strategies and technologies for buildings, focusing on fenestration systems and daylighting, as well as the integration of electric lighting and fenestration controls. Dr. Papamichael participates in a wide range of academic and professional activities related to computer-aided design, daylighting, electric lighting, and their impacts on energy use and the environment, among which he currently serves as the Chair of the Illuminating Engineering Society (IES) Daylighting Committee. He is the author or co-author of over 80 publications related to research and development in these areas and holds four patents for lighting controls.
14:30	**PANEL DISCUSSION: Industry Issues** An invited panel of industry executives will discuss their perspectives on the most pressing issues facing the lighting industry today, addressing particularly the introduction of advanced lighting controls and solid-state lighting.
15:15	**Coffee Break**
15:30	***Tour of UC Davis Campus***
17:00 -	*Dinner on your own…*

Come back on Friday for the CIE updates and business!