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, Light and Health Research Center, Icahn School of Medicine at Mount Sinai, Suite 560, Albany, NY 12205. Tel: 518-242-4620, e-mail: John.Bullough@mountsinai.org.

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2025 JOINT CNC/CIE, CIE-USNC & CORM CONFERENCE

Save the dates: November 18 - 20, 2025

FIRST CALL FOR ABSTRACTS

The joint Canadian and United States CIE National Committees and the Council for Optical Radiation Measurement (CORM) conference will be held virtually on November 18 to 20, 2025.

We invite abstract submissions for oral presentations covering any topic related to optical radiation, light, lighting, and vision, including but not limited to:

- Vision and Color
- Physical Measurement of Light
- UV and IR Radiation
- Optical Properties of Materials
- Interior Environment and Lighting Design
- Transportation and Exterior Lighting Applications
- Photobiology and Photochemistry
- Image Technology
- Current Research at National Metrology Institutes

Presentations will be approximately 20 minutes, depending on the number of abstracts received. Abstracts should be 250 words or less. Abstracts should be submitted to secretary@cormusa.org by October 15, 2025. More details about the conference will be posted when available on the following websites: CNC/CIE (cms.cnc-cie.ca), USNC-CIE (www.cie-usnc.org) and CORM (www.cormusa.org).

NEWS FROM THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Tiny New Lasers Fill a Long-Standing Gap in the Rainbow of Visible-Light Colors, Opening New Applications

Scientists have made small red and blue lasers for years, but other colors have been a challenge. Researchers have filled an important technology gap by creating orange, yellow and green lasers tiny enough to fit on a chip. Low-noise, compact lasers in this wavelength range are important for quantum sensing, communications and information processing.

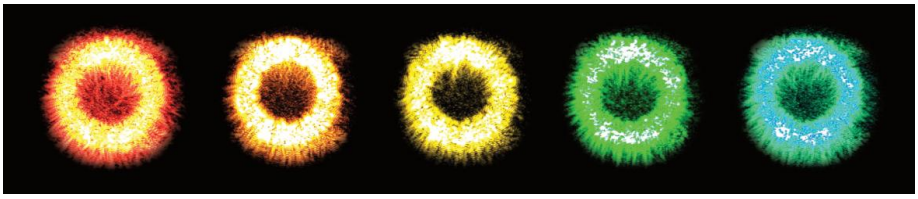

Photo credit: Sean Kelley, NIST

https://www.nist.gov/news-events/news/2024/08/tiny-new-lasers-fill-long-standing-gap-rainbow-visible-light-colors-opening

NIST Moonlight Data Will Help Satellites Get a More Accurate Look at Earth

Earth-observing satellites can use new measurements of the Moon's brightness as a benchmark to ensure that they are recording light from our planet's surface accurately. Reliable measurements of the light from our planet can help industries from agriculture to meteorology to mining. The new data represents a tenfold improvement over the data that satellite sensor engineers used previously.

NASA's ER-2 taking off with the air-LUSI moonlight collection equipment on board. Photo credit: NASA photo/Ken Ulbrich

https://www.nist.gov/news-events/news/2025/05/nist-moonlight-data-will-help-satellites-get-more-accurate-look-earth

Smart New Laser Technology Can Monitor Greenhouse Gases Faster, More Sensitively

New laser technology, known as free-form dual-comb spectroscopy, quickly measures gases of interest by homing in on the most information-rich parts of a sample. In this study, the system creates real-time images of methane plumes not visible to the naked eye. This technique can be used for many different gases and materials. When adjusted to focus on one specific gas, it becomes much more sensitive than older methods.

https://www.nist.gov/news-events/news/2024/10/smart-new-laser-technology-can-monitor-greenhouse-gases-faster-more

Now Live: Living Cells Can Be Seen With Infrared Light

Scientists captured clear images of biomolecules in single live cells in water for the first time using infrared (IR) transmission imaging. The IR technique enables researchers to measure the mass of biomolecules such as proteins in a cell. Using simple components, the method has the potential to speed up advances in biomanufacturing, cell therapy development and drug development.

https://www.nist.gov/news-events/news/2024/09/now-live-living-cells-can-be-seen-infrared-light

Ultraviolet to Short-Wave Infrared Spectral Reflectance

ROSI: the Robotic Optical Scattering Instrument
Photo credit: NIST, Thomas Germer

A new NIST Special Publication, SP250-101, available free of charge via NIST's website, gives a comprehensive overview of calibrations of spectral reflectance in the ultraviolet (UV) to short-wave infrared (SWIR) spectral regions using the Robotic Optical Scattering Instrument (ROSI) and its associated Reference Integrating Sphere (RIS). Measurement methods for spectral reflectance, the elements of the uncertainty budget, and validation of the reflectance scale through comparison with NIST's previous reference instrument, the Spectral Tri-function Automated Reference Reflectometer (STARR), are described. Examples of calibration

measurements, including specular reflectance of mirrors, bidirectional reflectance of diffuse reflectors, and directional-hemispherical reflectance, are given. Examples of typical calibration reports are also provided.

https://www.nist.gov/publications/ultraviolet-short-wave-infrared-spectral-reflectance

Validated UV-C Bidirectional Reflectance Distribution Function Measurements with a Spectrophotometer Directional Reflectance Module

The efficacy and safety of UV disinfection systems depend on the radiant flux throughout the space being disinfected, which in turn depends on the directional reflectance of materials located within the space. Little publicly available data exists on the directional reflectance of common materials in the germicidal UV spectral range, 220 nm to 280 nm. We present methods to validate directional reflectance (bidirectional reflectance distribution function) measurements performed with a spectrophotometer and provide measurement results for materials commonly found in public spaces. The data presented may lead to improved models of UV disinfection efficacy and safety, and the methods described will enable other researchers to readily collect traceable UV directional reflectance data.

https://www.nist.gov/publications/validated-uv-c-bidirectional-reflectance-distribution-function-measurements

Spectral Characteristics and Indoor Air Quality Effects of Germicidal 254 nm and 222 nm Ultraviolet Light

Current Germicidal Ultraviolet (GUV) devices are designed to inactivate pathogens in air at either 222 nm or 254 nm wavelengths. Previous research has demonstrated both wavelengths can produce oxidants in air (222 nm: ozone, 254 nm: hydroxyl radicals) and potentially directly photolyze some chemicals. This NIST internal report, NIST IR 8550, describes results of study sought to determine the impacts of GUV devices on indoor air chemistry in both laboratory chamber and field settings. The report is available free of charge.

https://www.nist.gov/publications/spectral-characteristics-and-indoor-air-quality-effects-germicidal-254-nm-and-222-nm

System Vicarious Calibration for Climate and Global Long-Term Operational Ocean Color Applications

System Vicarious Calibration (SVC) enhances the accuracy of satellite ocean color radiometric data products by removing the bias due to the intrinsic inaccuracies affecting both the responsivity of the space sensor and the correction for the atmospheric contribution to the measured signal. Various SVC procedures have been implemented and applied for regional studies, specific mission goals, and the most challenging climate and global long-term operational applications that require accurate and consistent data products across multiple missions. This work summarizes the outcome of a workshop organized by the Ocean Color SVC Task Force of the International Ocean Color Coordinating Group (IOCCG) to review requirements for SVC supporting ocean color missions for climate and global long-term operational applications. The work further emphasizes the essential need for long-term sustained SVC infrastructures and associated services, summarizes the primary requirements for

establishing a comprehensive ocean color SVC framework, and provides directions for new investigations to tackle arising matters on SVC advancements and methods.

https://www.nist.gov/publications/system-vicarious-calibration-climate-and-global-long-term-operational-ocean-color

Metrological Near-Room-Temperature Photon-Number-Resolving Detector: A Design Study

We describe and model a non-cryogenic optical detector designed to count incident photons with metrological accuracy. Our design consists of a semiconductor device operating at −10 °C and is predicted to resolve pulses of up to 10 photons with an error rate of 2% in the input number of photons. We present an estimate of the overall device performance using a combination of estimates and simulations of optical loss, discrete electron loss and noise, and electronic noise.

https://www.nist.gov/publications/metrological-near-room-temperature-photon-number-resolving-detector-design-study

Multi-Facility Comparison of InGaAs Trap Detector Responsivity for Optical Fiber Power

The absolute responsivity of an optical detector in a trap configuration has been investigated in the interest of high-accuracy fiber-coupled measurements for commercial optical fiber power meters and fiber-coupled single-photon detector calibrations. The highest accuracy measurements of optical power are typically undertaken free space and then disseminated for fiber-coupled measurements with some additional uncertainty. At the lowest uncertainty, the difference between free-space and fiber-coupled optical power measurements can be significant. We present here a complete evaluation of multiple trap detectors consisting of two InGaAs photodiodes and a concave mirror. This evaluation includes fiber-based responsivity at discrete laser wavelengths measured both with cryogenic and room temperature standards (diverging input beam), free-space absolute spectral responsivity over a broad wavelength range (converging beam), free-space responsivity at discrete laser wavelengths (collimated), linearity, and spatial uniformity.

https://www.nist.gov/publications/multi-facility-comparison-ingaas-trap-detector-responsivity-optical-fiber-power

Fully Transparent GaN/InGaN LED as a Position Sensitive Detector

Commercial imaging technologies have an increasing need for an accurate, in-situ beam locator to ensure laser alignment during operation. In this work, gallium nitride LED with indium gallium nitride quantum wells is leveraged is leveraged to create a fully transparent two-dimensional position sensitive detector (PSD). Two different architectures are developed and characterized. Fabricated devices are shown to successfully and repeatably locate 405 nm laser light in two dimensions in the PSD area with a best observed limit of detection of 8.4 microns while maintaining approximately 3 \% linearity.

https://www.nist.gov/publications/fully-transparent-ganingan-led-position-sensitive-detector

NATIONAL RESEARCH COUNCIL OF CANADA

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

RECENT ACTIVITIES FROM NRC CANADA

Light Detectors Illuminate the Future of Quantum Sensing

Almost a century after silicon semiconductors and chips became the backbone of computing technology, a new player, quantum photonics, promises to revolutionize how the world works once again. Quantum photonics catapults information processing and sensing beyond the limits of existing technologies by using quantum states of light (photons) to operate.

A key technology that makes this possible is the photon-number-resolving (PNR) detector. These new types of detectors allow for more precise optical measurements than ever before, offering quantum technologies new ways of achieving a "quantum advantage" for performance beyond anything the world has ever seen.

The National Research Council of Canada (NRC), the only public-sector lab in the country with access to this technology, is taking PNR-based quantum technologies to new levels. Through international collaborations with academia and industry, as well as funding from Innovative Solutions Canada and the NRC's Internet of Things: Quantum Sensors Challenge program, researchers can pursue novel approaches to quantum sensing that will accelerate development.

https://nrc.canada.ca/en/stories/light-detectors-illuminate-future-quantum-sensing

Under the Microscope: Quantum Sensing for Biochemical Applications

Researchers peering deep into biological samples—or optometrists looking into your retinas—need blinding light to see beyond the surface. In traditional microscopy, the exhaustive process and the invasive high-intensity light can damage cells and reduce the quality of images produced. That calls for complex precautions, which could also limit the study of biological processes.

With innovative quantum technology driving development of a new microscope, the sky is the limit. Now in the prototyping stage, the microscope not only consistently delivers high-resolution images without harming cells but also does it more quickly under ultra-low light. This innovative technology is all about manipulating photons—the smallest possible packets of electromagnetic energy.

Developed by a team of researchers from the NRC, University of Calgary (UCalgary), the University of Ottawa (uOttawa) and beyond, the microscope uses entangled photons to provide ultra-low intensity illumination. By harnessing the power of correlations between single photons, the technology speeds the process and reduces the risk of photo damage while delivering high-resolution images.

https://nrc.canada.ca/en/stories/under-microscope-quantum-sensing-biochemical-applications

World's First Ultraweak Photon Emission Technology Holds Promise for Medical Forecasts

If you've ever been to an aquarium, you've probably seen sea creatures glowing in the dark. This phenomenon comes from chemical reactions, known as bioluminescence, that some marine organisms use to defend themselves or attract prey.

But there's a different kind of glow, called ultraweak biophoton emission, that all living beings—plants, animals, humans—emit. These tiny flashes of light are naturally generated by the body but are much fainter, so they are invisible to the naked eye. Scientists are still working to fully understand their role. So far, they have linked these emissions to various biological processes, including cell metabolism and cellular communication.

"Because light is closely linked to life, changes in its intensity or spectral distribution may reflect disruptions in the body's metabolism or cell-to-cell communication, which could potentially serve as early indicators of disease," says Dr. Maria Moreno, Interim Director of R&D at the translational bioscience group at the NRC's Human Health Therapeutics Research Centre. To address this technology challenge, Drs. Moreno and Umar Iqbal, also from our Human Health Therapeutics Research Centre, partnered with Canadian imaging technology company Photon etc. to develop a next-generation biophoton imaging system.

https://nrc.canada.ca/en/stories/worlds-first-ultraweak-photon-emission-technology-holds-promise-medical-forecasts

Assessing the Effects of Polychromatic Light Exposure on Heart Rate in Healthy Adults

Part of a series aimed at gathering all studies assessing the effects of polychromatic light on mood, physiology and cognition, this systematic review investigated the effects of polychromatic (white) light exposure on heart rate. High melanopic equivalent daylight illuminance (EDI) was hypothesized to be more strongly associated with fast heart rate than other α-opic EDIs. This effect was predicted to be more evident during the morning. The larger literature search identified 3,548 articles, of which 10 reported heart rate and were included in the current report. The spectral power distribution, illuminance, heart rate means and core methods for each article were documented. Using the luox app, α-opic EDIs were calculated for each of the five photoreceptors to characterize the light exposures in each study. Regression models were applied to determine how α-opic EDI, duration, and timing related to heart rate. Results showed that none of the five α-opic EDIs were significantly associated with heart rate (all estimates $<4.21e^{-3}$, $p > 0.119$). Light exposure in the morning (all estimates $> |-6.40e^{-2}|$, $p < 0.001$) and longer light exposure duration (all estimates $> |-7.94e^{-4}|$, $p < 0.001$) were found to be associated with slower heart rate. None of the light conditions available for the current review had an α-opic profile in which melanopic EDI exceeded the other α-opic EDIs, so the proposed relationship between high relative melanopic EDI and heart rate could not be tested.

https://doi.org/10.1080/15502724.2024.2438682

Solid-State Lighting: Health Effects and Knowledge Gaps

The health effects of solid-state lighting products used in general lighting applications were reviewed by a team of international experts working under the 4E implementing agreement of the International Energy Agency (SSLC platform). Issues that concern both large fractions of the population and small sensitive groups were addressed considering acute effects on the eye and the skin, discomfort glare, circadian disruptions, neuro-behavioral effects, temporal light modulation, and long-term effects, including age-related macular degeneration, myopia, and cancer risk. This paper presents the conclusions and recommendations of the expert group. Knowledge gaps are detailed in each effect category.

https://doi.org/10.1109/LS2463127.2024.10881837

Effects of Near-Infrared Radiation in Ambient Lighting on Cognitive Performance, Emotion, and Heart Rate Variability

Although sunlight contains approximately equal amounts of near-infrared radiation (NIR) and visible light, NIR is absent from most present-day electric lighting systems and is filtered by energy-efficient windows. However, NIR is biologically active and is commonly applied in targeted photobiomodulation treatments for a range of cognitive, emotional, and physical conditions. Given the removal of NIR from indoor illumination, it is critical to understand how ambient NIR may influence psychological and physical health, and whether reduced exposure to NIR in indoor environments could because for concern. In a preregistered within-subjects double-blind experiment, acute effects of NIR and far-red wavelengths in ambient illumination on cognition, emotional state and cardiovascular health were examined in a sample of 151 university students (117 females, 34 males). During a 2-h laboratory session, participants were monitored at rest and while engaged in cognitively demanding tasks across two counterbalanced lighting conditions. Both included 3500 K white light generated by a light-emitting diode (LED) system, while one additionally included LEDs with peak wavelengths in the NIR (875 nm, 960 nm) and far-red (735 nm) spectrum. The addition of NIR and far-red to the ambient lighting showed beneficial effects on resting high-frequency heart rate variability (HF-HRV), HF-HRV responses to cognitive demand, and feelings of pleasure, but reduced performance on a visual search task. These findings reveal that the absence of NIR from architectural lighting influences humans at a psychological and physiological level, with implications for health and well-being that need to be balanced with energy-saving considerations.

https://doi.org/10.1016/j.jenvp.2024.102484

UPCOMING IES MEETINGS CALENDAR

The Illuminating Engineering Society (IES) is sponsoring the following meetings and conferences in the coming months (specific details are subject to change; please check the links for the latest information):

IES Aviation Lighting Conference
October 19-23, 2025
Pittsburgh, PA
https://www.iesalc.org/

IES26: The Lighting Conference
August 13-15, 2026
Denver, CO
https://ies.org/events/ies26/

Street and Area Lighting Conference
November 8-11, 2026
Phoenix, AZ
https://ies.org/events/salc2026/

NEWS FROM THE CIE

International Commission on Illumination
Commission Internationale de l'Eclairage
Internationale Beleuchtungskommission

Upcoming Events

CIE Project: "Understanding Science - Understanding Light"
Through June 30, 2026
Multiple events and lectures
https://cie.co.at/news/cie-project-understanding-science-understanding-light

31st Quadrennial Session of the CIE
Nanjing, China
July 9-17, 2027
https://cie.co.at/news/31st-quadrennial-session-cie-nanjing-china

Recent CIE Publications

CIE has issued the following publications recently:

- The Functional Visual Field, CIE 255:2025
- CIE Position Statement on Colour Quality Metrics, 2nd Edition, CIE PS 002:2025
- CIE Position Statement on Integrative Lighting - Recommending Proper Light at the Proper Time, 3rd Edition, CIE PS 001:2024
- Overview of Methods for Evaluating Colour Rendition of White-Light Sources beyond Colour Fidelity, CIE 253:2024

Visit http://www.cie.co.at for additional information.

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

Instructions for Contributing Authors

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

Policy on Commercial Activities at CORM Conferences

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

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