Consultative Committee for Photometry and Radiometry (CCPR)

President M.L. Rastello, Executive Secretary J. Viallon

Meets every 2 years **Last meeting** in September 2019 **Members/Observers** 22/3	**Working groups**: Key Comparisons (WG-KC), CMCs (WG-CMC), and Strategic Planning (WG-SP)		
Comparison activity	**Completed**	**In progress**	**Planned**
CCPR KCs (& CC Supplementary)	21 (2)	7 (1)	2 (0)
RMO KCs (& SCs)	25 (16)	9 (12)	2 (1)
BIPM comparisons (all on-going)	0	0	0
CC Pilot studies	1	1	2
CMC	1448 CMCs in 92 service categories		

Pointers to the future, stakeholder needs and technological developments

- **Increase engagement with stakeholders** to better understand their metrological needs and better align CCPR future efforts to meet their challenges. CCPR has a broad collection of stakeholders including: NMIs, RMOs, DIs, liaison international organizations (CIE and WMO), CIPM/CGPM, other CCs, international organizations linked through CIPM/CGPM agreements (WHO, IMEKO, IEEE), Standards Organizations (ISO, IEC), instrument makers, calibration and testing laboratories from a wide range of industries and emerging areas such as bio-medicine, quantum-based information and quantum photonics, Tera-hertz, climate, and photovoltaics. The CCPR needs to link their stakeholders through joint activities to identify and promote the development of measurement standards which can meet their current and future practical demands.
- **Future key scientific challenges in the definition of the candela are the link between a cone-fundamental based photometric system and radiometry and its nature.**
- The revolutionary changes in lighting to LED sources are impacting the CCPR since the current methodologies used to characterize traditional light sources are not sufficient for these LED-based lighting products known to exhibit temporal light modulation and different spectral distribution from traditional light sources. **The advanced technologies of solid-state lighting require new standard measurement protocols and standard artifacts.** The applications of these new sources are rapidly growing to general purpose lighting, displacing traditional incandescent and fluorescent lights bringing significant energy savings, as the percentage of world-wide use of electricity by lighting continues to drop.
- **SI-traceable measurements are critical for monitoring climate change** including studies of Earth resources, the environment, and human well-being. There are several areas for which the CCPR can have a significant role in supporting the UN sustainable development goals and key environmental challenges. These include measurements to support the introduction of technologies for the sustainable generation and use of energy. However, the most demanding relate to the very small signals of climate change which need to be measured globally from space- where more than two thirds of the key indicators, Essential Climate Variables (ECVs) require measurements in the optical domain and several decades to be large enough to detect. A formal CCPR Recommendation was submitted to the CGPM "On the Importance of SI traceable measurements to monitor climate change" and the World Meteorological Organization (WMO) was made a Permanent Observer of CCPR. WMO and space agencies are active in seeking ways to ensure SI-Traceability can be established and maintained at the location of measurement e.g. in space, deserts, oceans, and forests.
- There is an increasing need in many sectors to measure optical radiation at very low intensity levels, sometimes down to single photons. Some examples of applications where **radiometric measurements using single-photon detectors and sources standards** are of increasing importance include Industries using quantum key distribution for secure communication, bio-photonics, and nano /mems photonic devices. In response, the CCPR established WG-SP TG7 on Discussion Forum on Few-Photon Metrologies and TG11 on Single-Photon Radiometry.
- **SI traceable measurements for photobiological quantities are needed** to create an international basis for accurate and reliable measurements to underpin the commercial development and exploitation of photobio-technology. Comparable and validated biotechnological measurement methods are vital to driving production efficiency, product safety and to improving therapeutic and diagnostic tools.
- The development and application of new traceable optical property measurements and predictive modelling are needed to characterize the properties and performance of novel materials throughout their lifecycle. These activities will provide the appropriate tools to aid innovative developments and ensure full and safe exploitation of new materials.

Workload Trend & Workload Management

- 10 KCs test the principle techniques and methods for the primary realization of measurement scales in photometry, radiometry and spectrophotometry and are regularly organized at the CC level with a repeat cycle of 10 years. The CCPR is currently on the second cycle for all the KCs. There are also supplementary comparisons at the RMO level to test specialized measurement scales or standards in the field of CCPR. To better manage and reduce the workload of KCs, the CCPR published G4 on "Guidelines for Preparing CCPR Key Comparisons".
- Several pilot studies are planned to better understand emerging technologies and the needs for new CCPR standards metrology and comparison artifacts for future KCs.
- CMC related Guideline G9 was published adopting the risk-based approach for CMC review to facilitate sustainability of NMIs workload and to support establishment of CMCs for emerging NMIs without adversely impacting the integrity and quality of the CCPR data in the KCDB.

BIPM – references to laboratory activity at the BIPM

BIPM has no laboratory activity in photometry and radiometry.