

Consultative Committee for Photometry and Radiometry (CCPR)
24th Meeting (19 - 20 September 2019)

Questionnaire on activities in radiometry and photometry

Reply from: Giorgio Brida and Alice Meda

Delegate: Giorgio Brida

1. Summarize the progress in your laboratory in realizing top-level standards of:

- (a) broad-band radiometric quantities :
- (b) spectral radiometric quantities :

Metrology for single photon source and detectors

INRIM has coordinated the European joint research project MIQC2 « Optical metrology for quantum enhanced secure telecommunication » (2015-2018) ; INRIM is active in the development single-photon sources based on colour centers in nanodiamonds and cryogenic photon number sensitive detectors (based on Transition-Edge Sensor) for visible to microwave applications.

Spectral responsivity

INRIM spectral responsivity facility for the calibration of broadband detectors has been upgraded with a laser driven plasma source with large improvement in the signal-to-noise ratio in the short wavelength region.

INRIM participate to the European joint research project chipS-CALe, “Self-calibrating photodiodes for the radiometric linkage to fundamental constants”; the main focus of the project is the development of a more robust linkage to the revised SI candela for optical power measurements. An improved and simplified traceability chain is vitally important for spectrally resolved measurements in photonic science and industry. INRIM will contribute with ellipsometric characterization of the passivation layer ($\text{SiO}_2, \text{SiN}_x, \text{Al}_2\text{O}_3$), linearity measurements of photodiodes and electronic development.

INRIM participated to the following comparison :

- CCPR pilot study on the detection efficiency of single-photon detectors (850 nm);
- EURAMET.PR K6 comparison – regular spectral transmittance;
- European joint research project MIQC2 : intercomparison of detection efficiency of fiber coupled single photon detector (1550 nm) and Glauber second-order auto-correlation function of an heralded low-noise CW and a nitrogen vacancy single-photon source.

- (c) photometric quantities :

- INRIM participate to the luminous intensity comparison of LED standard lamps using PQED, without $V(\lambda)$ filter, within the European joint research project PhotoLED.

2. What other work has taken place in your laboratory in scientific or technological areas relevant to the CCPR?

INRIM has coordinated the European joint research project MIQC2 “Optical metrology for quantum-enhanced secure telecommunication” (2015- 2017) in the technological areas relevant to the CCPR;

INRIM participates in the following ongoing European joint research projects in the technological areas relevant to the CCPR:

- SIQUST: Single-photon sources as new quantum standards (2018–2021);
- BeCOMe: Light-matter interplay for optical metrology beyond the classical spatial resolution limits (2018–2020);
- Chip SCALE: Self-calibrating photodiodes for the radiometric linkage to fundamental constants (2019-2021);
- SURFACE: Pavement surface characterisation for smart and efficient road lighting (2018-2020).

3. What work in PR has been/will be terminated in your laboratory, if any, in the past /future few years? Please provide the name of the institution if it has been/will be substituted by a DI or accredited laboratory.

INRIM has terminated Luminous exposure calibration services for flashing light sources and exposure photometers; no other institution will provide this service.

4. What are present, new or emerging needs of users of your services that are not being supported sufficiently by current CCPR activities or initiatives? In the light of this information please suggest desirable changes in the future working program of the CCPR.

none

5. What priorities do you suggest for new research and development programmes at NMIs in the area of Photometry and Radiometry?

The techniques developed in quantum radiometry field can be applied in the photometry frame for the investigation of the linearity of the eye response at different regimes, from mesopic down to single photon, aiming to the development of new quantum photometry techniques. Moreover, the exploitation of a deterministic source of single photons can provide a different physical basis to the estimation of K_{cd} , representing a powerful tool for a more precise measurement of all the photometric quantities.

6. Are there any research projects where you might be looking for collaborators from other NMIs or are there studies that might be suitable for collaboration or coordination between NMIs?

A research project for the pioneering study of the quantum photometry is desirable. It is important to provide the necessary skills for the design a psychophysical experiment for the measurement of K_{cd} with photon sources and its relationship with physical constants. The first step is to establish a consortium in order to explore the possibility of realizing an experiment to test eye response at few or single photon level and to test the linearity of the retina response.

7. Have you got any other information to place before the CCPR in advance of its next meeting?

No

8. Bibliography of radiometry and photometry papers of your laboratory since the last CCPR (September 2016)?

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