

Consultative Committee for Photometry and Radiometry (CCPR)
25th Meeting (on-line 10-11 May 2022)

**CCPR member report on activities in radiometry and photometry since the last
CCPR meeting (2019)**

Reply from: VNIIOFI

Delegate: Boris Khlevnoy

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1. Summarize the recent progress in your laboratory with respect to measurement standards, research projects, and metrology services to fulfill the demands of customers in:
 - (a) **broad-band radiometric quantities:**

Modernization of the National primary standard facility for laser power. The measuring laser power has been increased up to 10 kW.

A new type of power meter has been realized for easy and reliable multi-kilowatt CW laser power measurements. It measures the power without absorbing the laser beam by measuring the mechanical force due to the exchange of momentum between the mirror and the reflected laser light. VNIIOFI participates in the CCPR WG-SP TG 11 Pilot study on the detection efficiency of single-photon detectors.

Activity have been carrying out for improving capabilities of applying the absolute cryogenic radiometer to measure the optical power of sources and the spectral sensitivity of detectors.
 - (b) **spectral radiometric quantities:**

Modernization of the National primary standard facility for spectral responsivity based on absolute cryogenic radiometer. The long-wavelength limit of spectral range has been widened up to 300 μm .

Measurement facility for detector quantum efficiency (sensitivity at single photon level) was developed. Traceability chain of average power measurements (combined with controlled attenuation units) as well as the reference-less correlated-photon method based on SPD effect were realized.

Piloting the key comparison CCPR-K.2.a on spectral irradiance 200-2500 nm
 - (c) **photometric quantities:**

VNIIOFI has been developing a new National standard facility for realisation of luminous intensity based on large-area fixed-point blackbody (MoC-C) with the temperature of about 2856 K. The expected standard uncertainty is 0.12%.
 - (c) **other area(s) relevant to CCPR:**

Expanded the capabilities of the National primary standard (GET 138-2021) of the refractive index unit. The spectral range has been widened for (450 – 1550) nm, and the number of wavelengths has increased up to 11 in this range.

A new technique for precise wavelength calibration of high-resolution spectrographs and frequency-stabilized laser sources using frequency combs has been realized. Based on it the high-accuracy method for a calibration of spectrally-selective transmitting filters by FTIR in UV-VIS-NIR was developed.

In the field of Fiber Optics VNIIOFI piloted two comparisons: COOMET.PR-S8 «Supplementary Comparison on Wavelength for Fiber Optics» and COOMET.PR-S9 «Supplementary Comparison on polarization mode dispersion in optical fiber». We have submitted the corresponding CMCs on wavelength and polarization mode dispersion in fiber optic brunch.

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

[reply](#)

3. Summarize the Capacity Building and Knowledge Transfer activities undertaken by your institute in photometry and radiometry (courses, training, ...):

[reply](#)

4. Summarize the research projects currently performed within a collaboration with one or more NMIs or Dis (name of the project, participants):

[Join project NIM-VNIIOFI: Realisation of Spectral Irradiance scale based on WC-C \(3020.6 K\) high-temperature fixed point.](#)

5. Are there any other 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?

[reply](#)

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

[reply](#)

7. Bibliography of radiometry and photometry papers of your laboratory since the last CCPR (September 2019):

- [1] S.S. Shirokov, B.B. Khlevnoy, E.A. Ivashin, T.B. Gorshkova, O.B. Tarasova, D.V. Scums, A.D. Kupko, M.V. Huriev, COOMET.PR-S1 Comparison of Whiteness and Brightness. Final Report, *Metrologia* 2022 **59** Tech. Suppl. 02001
- [2] Caihong Dai, Yanfei Wang, Ling Li, Zhifeng Wu, Yihang Xie, Boris Khlevnoy, Irina Grigoryeva, Shufang He and Yandong Lin, Spectral Irradiance Scale Realization and

- Uncertainty Analysis based on a 14 mm Diameter WC-C Fixed-point Blackbody from 250 nm to 2500 nm, *Metrologia*, 59 (2022) 024001.
- [3] Tatiana V. Groppa, Vyacheslav S. Ivanov, Anatoly A. Liberman, Aleksey S. Mikryukov, Sergey A. Moskalyuk, National primary standard for the unit of average laser radiation power GET 28–2016, *Measurement Techniques* №1 2021, p. 3-9.
- [4] Dong-Joo Shin, Boris B. Khlevnoy, Caihong Dai, Seongchong Park, Dong-Hoon Lee, Maxim V. Solodilov, Svetlana S. Kolesnikova, Zhifeng Wu, Yanfei Wang, Assessment of Equivalence of the Spectral Radiance Scales Following the Results of the Comparison between the National Metrology Institutes of Korea, China, and Russia, *Measurement Techniques*, Vol. 63, No. 12, March, 2021.
- [5] Yihang Xie, Caihong Dai, Yanfei Wang, Zhifeng Wu, Ling Li, Boris Khlevnoy, Irina Grigoryeva, Shufang He, Yandong Lin, Approximation of a Melting Plateau of Large-area HTFP cells used for Spectral Irradiance Realization, *Applied Optics*, Vol. 60, No. 7, 1 March 2021.
- [6] Vladimir Kravtsov and Aleksei Mitiurev, COOMET Supplementary comparison on polarization mode dispersion in optical fiber, *Metrologia*, 2021, **58** Tech. Suppl. 02003.
- [7] Vladimir Kravtsov and Aleksei Mitiurev, COOMET supplementary comparison on wavelength for fiber optics, *Metrologia*, 2021, **58** Tech. Suppl. 02002.
- [8] Yanfei Wang, Caihong Dai, Boris Khlevnoy, Irina Grigoryeva, Ling Li, Zhifeng Wu, Yihang Xie, Shufang He, A method for spectral irradiance measurement based on large area WC-C fixed point blackbody, *Optics Express*, 2020, 28(19).
- [9] B. Khlevnoy, O. Tarasova, D. Scums, T. Gorshkova, E. Ivashin, M. Krempasky, A. Kupko, N. Vyrodova and E Woolliams, COOMET.PR-K3.a comparison of luminous intensity, *Metrologia*, 2020, **57** Tech. Suppl. 02002.
- [10] Vishnyakov G. N., Fricke A., Parkhomenko N. M. and Przybylska J. Report on supplementary comparison COOMET.PR-S2: angle of rotation of plane of polarization, *Metrologia*, 2019, Volume 56, Number 1A. 02002.