

Bureau International des Poids et Mesures

# Consultative Committee for Photometry and Radiometry (CCPR)

Report of the 19th meeting  
(21–22 June 2007)  
to the International Committee for Weights and Measures



Comité international des poids et mesures

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Note:

Following a decision made by the International Committee for Weights and Measures at its 92nd meeting in October 2003, reports of meetings of Consultative Committees will henceforth be published only on the BIPM website in the form presented here.

Full bilingual printed versions in French and English will no longer appear.

A.J. Wallard,  
Director BIPM

**LIST OF MEMBERS OF THE  
CONSULTATIVE COMMITTEE FOR  
PHOTOMETRY AND RADIOMETRY  
AS OF 21 JUNE 2007**

**President**

Dr F. Hengstberger, member of the International Committee for Weights and Measures, NMISA, Pretoria.

**Executive Secretary**

Dr M. Stock, International Bureau of Weights and Measures [BIPM], Sèvres.

**Members**

Centre for Metrology and Accreditation [MIKES], Espoo.

Laboratoire National de Métrologie et d'Essais [LNE], Paris.

Federal Office of Metrology [METAS], Bern-Wabern.

Hungarian Trade Licensing Office [MKEH], Budapest.

Institute for Opto-Physical Measurements, Rostekhnregulirovaniye of Russia [VNIIOFI], Moscow.

Instituto de Física Aplicada, Consejo Superior de Investigaciones Científicas [IFA-CSIC], Madrid.

Istituto Nazionale di Ricerca Metrologica [INRIM], Turin.

Korea Research Institute of Standards and Science [KRISS], Daejeon.

Measurement Standards Laboratory of New Zealand [MSL], Lower Hutt.

National Institute of Metrology [NIM], Beijing.

National Institute of Standards and Technology [NIST], Gaithersburg.

National Measurement Institute of Australia [NMIA], Lindfield.

National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology [NMIJ/AIST], Tsukuba.

National Metrology Institute of South Africa [NMISA], Pretoria.

National Metrology Institute/Ulusal Metroloji Enstitüsü [UME], Gebze-Kocaeli.

National Physical Laboratory [NPL], Teddington.

National Research Council of Canada, Institute for National Measurement Standards [NRC-INMS], Ottawa.

NMi Van Swinden Laboratorium, Nederlands Meetinstituut [NMi VSL], Delft.

Physikalisch-Technische Bundesanstalt [PTB], Braunschweig.

Slovak Institute of Metrology/Slovenský Metrologický Ústav [SMU], Bratislava.  
Standards, Productivity and Innovation Board [SPRING Singapore], Singapore.  
The Director of the International Bureau of Weights and Measures [BIPM], Sèvres.

**Observers**

Centro Nacional de Metrología [CENAM], Querétaro.

## 1 OPENING OF THE MEETING; APPOINTMENT OF THE RAPPORTEUR; APPROVAL OF THE AGENDA

The Consultative Committee for Photometry and Radiometry (CCPR)\* held its 19th meeting at the International Bureau of Weights and Measures (BIPM), Sèvres, on Thursday 21 June and Friday 22 June 2007. Three sessions were held.

The following were present: G. Andor (MKEH), M. Ballico (NMIA), P. Blattner (METAS), J. Clare (MSL), A. Corróns (IFA-CSIC), J. Dubard (LNE), N.P. Fox (NPL), G. Fraser (NIST), E. van der Ham (NMi VSL), F. Hengstberger (President of the CCPR, NMISA), E. Ikonen (MIKES), Y. Lin (NIM), D-H. Lee (KRISS), P. Manson (NMIA), N. Nel-Sakharova (NMISA), Y. Ohno (NIST), M.L. Rastello (INRIM), A. Razet (LNE-INM), K. Rochford (NIST), T. Saito (NMIJ/AIST), V. Sapritsky (VNIIOFI), K. Stock (PTB), K. Türkoglu (UME), G. Ulm (PTB), A.J. Wallard (Director of the BIPM), J. Williams (NPL), G. Xu (SPRING), J. Zwinkels (NRC-INMS).

Observer: C. Matamoros (CENAM).

Guests: J. Bastie (CIE), H. Belaidi (INMETRO), I. Rüedi (WMO).

Also attending the meeting: M. Stock (Executive Secretary of CCPR, BIPM), R. Goebel (BIPM), and C. Thomas (Coordinator of the KCDB, BIPM).

Apologies were received from P. Nemeček (SMU), W. Schmutz (PMOD/WRC, expert of METAS).

The President, Dr Hengstberger, opened the meeting, welcoming representatives, observers and guests. He offered a particular welcome to the representatives of SPRING and UME following the acceptance of these institutions as members and noted that the status of the three guests would be addressed later in the meeting. The President invited the BIPM Director to address the meeting. Professor Wallard welcomed all to the BIPM for this the 19th meeting of CCPR.

The President gave each attendee the opportunity to introduce him or herself during which the changes in name of OMH to MKEH, and CSIR-NML to NMISA and the retirement of Prof. Wallard as Director of BIPM at the end of 2010 were noted.

John Clare was appointed as *rapporteur* for the meeting. The 2nd draft agenda distributed before the meeting was accepted by the members with no additional items requested.

## 2 APPROVAL OF THE MINUTES OF THE LAST MEETING

Dr Zwinkels, seconded by Dr Fox, proposed that the minutes of the previous meeting be adopted without change. Passed.

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\* For the list of acronyms, [click here](#)

### 3 MATTERS ARISING FROM THE MINUTES

The President reported the following actions arising from the minutes of the 18th meeting:

- Item 13: CIPM has approved the election of SPRING and UME to membership of CCPR following the presentation by the President to CIPM of the recommendations of CCPR.
- Item 14: The appendix on photobiological units in the SI Brochure has been translated into French.
- Item 14: New text for Appendix 2 of the SI Brochure, on the practical realisation of the candela, has been drafted and will be reported by the Working Group on Strategic Planning (WG-SP).
- Item 15.4: The proposed joint BIPM/WMO workshop on metrology and climate change was reported on by Prof. Wallard. He has had a very positive response from WMO; some objectives have been drafted; a meeting will be held shortly to draft a scientific programme; the scope is now much broader than encompassed by CCPR; and the meeting is likely to be too big for BIPM and more appropriately hosted by WMO in Geneva.
- Item 15.5: Classification of documents on the CCPR website by category for online sorting has not yet been done.

The Executive Secretary reported the following further actions arising from these minutes:

- Item 8: The request by COOMET for the inclusion of total radiance in the CCPR service category list has been agreed and completed (service 5.7).
- Item 8: The request by APMP for the inclusion of UV irradiance in the CCPR service category list has been agreed and completed (service 2.9).
- Item 9: The Working Group on Key Comparisons (WG-KC) has developed membership criteria and NRC and MIKES have subsequently been accepted as members.
- Item 9.6.1: The comparison CCPR-S1 has been re-launched.
- Item 9.9: The Guidelines for CCPR key comparisons were published on the CCPR website in March 2006.
- Item 12.1: WMO have accepted the invitation to send a representative to this meeting.
- Item 12.2: The agreement with the CIE, presented by the President at the last meeting, has been signed as a cooperation agreement by the Director of BIPM and the President of CIE.

### 4 DOCUMENTS PRESENTED TO THE MEETING

The President submitted the list of eight working documents to the meeting and drew attention to the modification of CCPR/07-06 (on restricted access) on the previous day. The complete list of these working documents is given in Appendix P 1.

## 5 REVIEW OF PROGRESS IN THE LABORATORIES

Eighteen replies had been received to the CCPR 2007 questionnaire sent out prior to the meeting and these written reviews were submitted to the meeting in working document [CCPR/07-02](#). The President invited representatives of each NMI to make oral presentations of their laboratory's reply but requested them to limit these to 5 to 7 minutes per laboratory because of time constraints. Most gave a PowerPoint™ presentation and any discussion that followed the presentations is reported below.

**MIKES:** Professor Ikonen presented the progress made by MIKES.

No comments were received on this presentation.

**LNE and LNE-INM:** Dr Dubard presented the progress made by LNE-INM/CNAM and by LNE.

No comments were received on this presentation.

**METAS:** Dr Blattner presented the progress made by METAS.

No comments were received on this presentation.

**MKEH:** Mr Andor presented the progress made by MKEH (formerly OMH).

No comments were received on this presentation.

**IFA-CSIC:** No presentation was available.

**INRIM:** Dr Rastello presented the progress made by INRIM.

Dr Saito asked whether the last graph showing heat pulses in a transition edge sensor was experimental or calculated. Dr Rastello replied that the graph did not represent experimental data, but that the experimental data did match the calculated results.

**VNIIOFI:** Professor Sapritsky presented the progress made by VNIIOFI.

No comments were received on this presentation.

**KRISS:** Dr D.-H. Lee presented the progress made by KRISS.

Dr Ohno commented that in the method used for total luminous flux it appeared that the beam passed through the centre of the integrating sphere. Dr Lee assured him that it was below centre in an arrangement similar to that used at NIST.

**MSL:** Dr Clare presented the progress made by MSL.

In answer to a question from Professor Wallard on the nature of the colour measurements made in the horticulture industry to determine maturity of kiwifruit, Dr Clare replied that values of hue angle in the laboratory coordinate system were required with an accuracy of parts of a degree.

**NIM:** Dr Lin presented the progress made by NIM.

No comments were received on this presentation.

**NIST:** Dr Ohno presented the progress made by NIST (Gaithersburg).

Dr Rochford presented the progress made by NIST (Boulder).

No comments were received on these presentations.

**NMIA:** Dr Ballico presented the progress made by NMIA.

Dr Xu asked what allowance was made for the effect of temperature on aperture area. Dr Ballico replied that the apertures were at ambient temperature. Dr Hengstberger enquired about the model used for flashing-light photometry. Dr Ballico described the two ways in which the photometers were characterised.

**NMIJ:** Dr Saito presented the progress made by NMIJ.

No comments were received on this presentation.

**NMISA:** Mrs Nel-Sakharova presented the progress made by NMISA.

No comments were received on this presentation.

**UME:** Mr Türkoglu presented the progress made by UME.

No comments were received on this presentation.

**NPL:** Dr Fox presented the progress made by NPL.

No comments were received on this presentation.

**NRC:** Dr Zwinkels presented the progress made by NRC.

No comments were received on this presentation.

**NMi VSL:** Dr van der Ham presented the progress made by NMi VSL

No comments were received on this presentation.

**PTB:** Dr Stock presented the progress made by PTB (Braunschweig). He referred to the new platform AMPHORA (<http://www.ptb.de/en/org/4/amphora/amphora.htm>) opening the unique capabilities, facilities and skills of the PTB in the field of photometry and radiometry to all potential users within the scope of the CCPR.

Dr Ulm presented the progress made by PTB (Berlin).

No comments were received on these presentations.

**SPRING:** Dr Xu presented the progress made by SPRING.

No comments were received on this presentation.

**CENAM:** Dr Matamoros, attending as an observer, presented the progress made by CENAM.

No comments were received on this presentation.

**INMETRO:** Dr Belaidi, attending as a guest, made a presentation on the work of INMETRO.

No comments were received on this presentation.

**SMU:** An oral presentation on the progress made by SMU was not given as no representative from this institute was in attendance at this meeting.

The President thanked everyone for the preparation of the reports and PowerPoint™ presentations. He stated that decisions on which presentations will be on an open BIPM website and which will be protected by password will be taken later in the meeting.

The President concluded these reviews by remarking on how pleasing it was to see the impressive amount of development that has been taking place over the past five years. Professor Wallard agreed that the reviews showed the rapid pace of the changes that were being made. He

stated that the key question now was when to launch pilot comparisons or key comparisons in new areas. Pilot comparisons were a useful way to develop the competence to run a full comparison. The President replied that we are looking at whether the existing key comparisons cover the whole field adequately but that CCPR is reluctant to increase the workload on NMIs.

## **6 REPORT OF THE WORKING GROUP ON CALIBRATION AND MEASUREMENT CAPABILITIES (WG-CMC)**

Dr Blattner presented the report of the Working Group on Calibration and Measurement Capabilities.

The working group met on 24 October 2006 at CENAM in Querétaro, Mexico. Representatives from four RMOs (APMP, EUROMET, SADCMET and SIM) were present as well as 12 observers from NMIs, Dr Espina (JCRB) and the President and the Executive Secretary of the CCPR. The Working Group met again on 19 June 2007 at the BIPM at which meeting representatives from the same four RMOs (APMP, EUROMET, SADCMET and SIM) were present as well as 16 observers from NMIs, Dr Espina (JCRB) and the President and the Executive Secretary of the CCPR. No representative from COOMET was present at either meeting. The chairmanship of the Working Group transferred from SIM to APMP at the beginning of the 2006 meeting, from APMP to EURAMET at the beginning of the 2007 meeting, and will go from EURAMET to SADCMET at the start of the 2008 meeting.

In order to increase confidence in the intra-RMO process for reviewing CMCs it was resolved at the second meeting that RMO guidelines on the process be shared between RMOs: chairs of RMO-TCs are to send guideline documents on their process to the Executive Secretary of CCPR by 30 September 2007 and he will make them available on the CCPR-WG-CMC website.

Guidelines on the key comparison participation and supporting service-category entries required to support CMC claims have been established in the form of an Excel™ table. A task group has been set up to sort out some difficulties in the table and should report by the end of September.

A procedure has been prepared for the review of CMCs following the publication of new key comparison results:

- Each NMI participating in a key comparison must review its CMC entries related to that key comparison and prepare a written statement on the consequences and any actions that will eventually be needed.
- These statements are to be collected by the pilot laboratory and forwarded to the chairs of the RMO technical committees.
- If a NMI does not participate in the most recent key comparison of a capability at either the CCPR or the RMO level or in a subsequent bilateral comparison then all of its CMC entries that relate to that capability must be removed from the Table.
- This procedure is to be added to the CCPR-KC Guidelines.

The importance of having this procedure in place has been heightened by the advent of the second round of key comparisons.

Dr Blattner stated that Revision No. 9 of the CCPR classification of services, dated January 2007, is now available from the KCDB web-page. There are no major outstanding issues with

the regular CMC review process and very few new CMC entries have been requested. NMIs can now check the status of the inter-RMO process on the JCRB website. They are requested in preparing new or updated CMC claims to format them correctly by downloading the current version of their CMC file from the JCRB website, modifying existing capabilities or adding new ones to this file, and highlighting the modifications in red.

Dr Xu asked for, and got, confirmation that all changes to CMC entries must go through the proper review process. He also entered a plea for the Excel™ CMC template as well as the simplified Word™ CMC category list to be available on the BIPM website<sup>1</sup>. Professor Wallard asked for clarification that the Guidelines spreadsheet listed the key comparison participation and other requirements needed in claiming a CMC. Dr Xu stated that in some cases, where it did not appear that there was any key comparison whose results were relevant to the support of a CMC claim, there were three possibilities: (a) a new key comparison is required, (b) the NMI has participated in all key comparisons and nothing further was required because these were deemed to cover all CMCs, or (c) the CMC should be removed from the list of service categories because no key comparison tested it. The President stated that when the WG-KC was given the task of establishing a set of key comparisons these were expected to cover the whole field; if there are gaps either we must create a new key comparison or discourage CMC claims that need that parameter. But CCPR can not create a compulsory supplementary comparison. In response to a further question from Dr Xu the President defined the role of supplementary comparisons as enabling a NMI to enter an area without the key comparison participation that is otherwise required to cover a capability. Professor Wallard stated that supplementary comparisons were meant to address regional needs. There have, however, been some Consultative Committees who have used them to meet a professed need for more information in some situations; this is undesirable, CMC support should be based on key comparisons. The President closed the discussion with the remark that we should not be second guessing the outcome of the task group established to complete the Guidelines table.

## **7 REPORT OF THE WORKING GROUP ON KEY COMPARISONS (WG-KC)**

Dr Ohno presented the report of the Working Group on Key Comparisons.

The Working Group met on 23 October 2006 at CENAM in Querétaro (Mexico), under the chairmanship of Dr Ohno. The President and the Executive Secretary of the CCPR, representatives from six of the eight member NMIs (not including NIM and PTB) and one KC pilot laboratory were present together with seven observers from NMIs. The Working Group met again on 18 June 2007 at the BIPM at which meeting the President and the Executive Secretary of the CCPR, representatives from eight of the nine member NMIs and one KC pilot laboratory were present together with seven observers from NMIs.

Guidelines for membership of WG-KC have been developed, approved by CCPR and published on the CCPR website on 31 August 2006 together with a list of members at that date. Two new members (NRC in August 2006 and MIKES in January 2007) have been approved since the last CCPR meeting. NIM (China) was removed from membership at the 2007 meeting because they

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<sup>1</sup> The Excel CMC template is available on the JCRB website:  
[http://www.bipm.org/en/committees/jc/jcrb/cmc\\_excel\\_files.html](http://www.bipm.org/en/committees/jc/jcrb/cmc_excel_files.html)

were in breach (in 2006 and 2007) of a mandatory requirement to not be absent from two consecutive meetings. Current membership is now eight NMIs, one pilot laboratory of an ongoing comparison and ex-officio members. No changes have been made to the terms of reference.

Final reports published since the last CCPR meeting:

- [CCPR-K1.a](#), spectral irradiance, 250 nm to 2500 nm;
- [CCPR-K1.a.1](#), spectral irradiance (NMIA, SPRING);
- [CCPR-S2](#), aperture area.

The following sections 7.1 to 7.6 present Dr Ohno's summary of the status reports that were given at the June 2007 meeting of WG-KC by chairs of on-going key comparisons, and also include comments made during Dr Ohno's presentation.

### 7.1 [CCPR-K1.b](#), spectral irradiance, 200 nm to 350 nm (PTB, contact: P. Sperfeld)

Five participants are involved. The transfer standards are three deuterium lamps.

The pre-Draft A and the relative data were distributed to participants on 6 June, 2007, waiting for comments until 30 June. The final report should be published in April 2008.

### 7.2 [CCPR-K2](#), spectral responsivity

#### 7.2.1 [CCPR-K2.a](#), 900 nm to 1600 nm (NIST, contact: S. Brown)

There are 14 participants and the transfer standards are three InGaAs photodiodes. After Draft A-2 was distributed, a large number of comments were received on the NIST transfer uncertainty and on problems with the data analysis. The transfer uncertainty is being re-evaluated, data re-analyzed, and the draft is being revised to address these concerns. Draft A-3 is yet to be completed due to the high workload of the staff member. NIST apologizes for the long delay and promises to complete and distribute Draft A-3 by the end of August 2007.

#### 7.2.2 [CCPR-K2.c](#), 200 nm to 400 nm (PTB, contact: L. Werner)

There are 14 participants in this comparison and measurements are still in progress. Some of the PtSi photodiodes were damaged during the comparison, additional detectors were prepared, and measurements by the last participant are still in progress. All results should be received by October 2007, followed by the pre-Draft A process. Draft A is expected to be circulated in April 2008.

### 7.3 [CCPR-K5](#), spectral diffuse reflectance (NIST, contact: Y. Ohno)

Twelve NMIs are participating and the transfer standards are three Spectralon and three matt ceramic plaques.

- The review of uncertainty budgets was completed in December 2006. Several questions and responses were exchanged. Two participants revised their uncertainty budgets.
- The effect of fluorescence on ceramic tile samples was questioned during the uncertainty review. NRC offered to measure two samples used in this comparison using their spectrofluorimeter. Their results showed negligible effects of fluorescence.
- Relative data were sent to all the participants in June 2007. Discussion will follow by email on details of the analysis method for Draft A.
- The data of additional bilateral comparisons with some of the participants will be analyzed later and the results will be published separately.

### 7.4 [CCPR-K6](#), spectral regular transmittance (LNE-INM, contact: J. Bastie)

Fifteen NMIs are participating in this comparison. The comparison artefacts were five neutral-density glass filters of nominally 92 %, 56 %, 10 %, 1 % and 0.1 % transmittance that were measured at eight specified wavelengths from 380 nm to 1000 nm.

The analysis method was discussed in the pre-Draft A stage. Draft A was distributed in July 2006 and subsequent to that strong concerns were raised over the large drifts of transfer standards that in many cases dominate the uncertainty of results. Two new analysis methods were proposed in Draft A-2 distributed in March 2007. There was considerable discussion of concerns over the uncertainties arising from changes in the artefacts and on the identification of outliers. WG-KC agreed that:

- In spite of the problems, following the CCPR Guidelines, the results (with exclusion of some outliers in the calculation of the key comparison reference value, KCRV) in Draft A will stand for the final report, pending final decision by the participants.
- The next round of [CCPR-K6](#) should be scheduled early.
- The transfer standards and the protocol for the next round of [CCPR-K6](#) should be improved.
- Explicit guidelines for removing outliers from the calculation of KCRV should be developed.

Dr Fox stated that the working group's position is that the analysis in Draft A is not supported yet; the working group is providing advice to participants. Dr Xu raised the question of the exclusion of outliers from the KCRV; the CCPR Guidelines do not define an outlier and there are issues over whether participants consented to the exclusion of results from the KCRV calculation.

### 7.5 **Pilot comparison on spectral responsivity, 10 nm to 20 nm** (PTB, contact: F. Scholze)

The wavelength range is 11.5 nm to 20 nm in 19 steps. There are three participants (NMIJ, PTB, NIST). The transfer standards are six photodiodes (3 type AXUV100G, 3 type SXUV100).

The protocol has been approved and the photodiodes were characterized and measured at the PTB. The measurement process started in July 2006 and is in progress.

## 7.6 Reports on the progress of CCPR supplementary comparisons

### 7.6.1 [CCPR-S1](#), Spectral radiance (VNIIOFI, contact: V. Saprisky)

There are five participants (LNE, NIST, NRC, PTB, and VNIIOFI), the transfer standards are three to six tungsten strip lamps, and the wavelength range is 220 nm to 2500 nm. VNIIOFI reported that the measurements are complete and the results have been collected by the pilot laboratory. The pre-Draft A procedure was completed at the end of April 2007 and Draft A will be distributed by the end of August 2007.

Professor Saprisky apologised for the delay that has occurred with this comparison and explained that it was due in part to the participants and in part to his spending a period of time working in Japan.

### 7.6.2 CCPR-S3.a-d, Cryogenic radiometers (NPL-NMIJ/UME/SPRING/CMI)

The methodology for these four bilateral comparisons is that of [CCPR-S3](#) with trap detectors prepared by the NPL. All four results will probably be grouped in a single report.

The measurement process is in progress, near completion. The pre-Draft A reports are expected for July-August 2007.

## 7.7 Reports from the RMOs on comparison activities

This is reported in item 12.

## 7.8 Proposals for new comparisons

No new comparisons were proposed.

## 7.9 Plans for the next round of CCPR key comparisons

Dr Ohno reported a summary of discussions that took place in WG-KC on this subject over the last two years. The problems to be addressed in planning the next round key comparisons are:

- key comparisons are taking too long;
- the number of participants is increasing;
- the work load and cost to pilot laboratories are increasing.

A task group on strategy for CCPR and RMO comparisons (chair: N. Fox) was formed in 2004. Discussions took place in 2005 and 2006, and also by email. Issues discussed included:

- ways of reducing the number of participants in CCPR key comparisons;
- whether participation in either CCPR or RMO key comparisons will suffice to meet MRA requirements;

- that CCPR key comparisons serve as a comparison of link laboratories for RMO key comparisons;
- that low uncertainties in CCPR key comparisons are desirable for linking with RMO key comparisons.

At its 2006 meeting, WG-KC agreed to conduct a survey of NMIs on their plans for participation in the next round. The survey was developed by WG-KC in early 2007, distributed to CCPR members and observers on 5 March 2007, and responses were collected by 13 April 2007. The survey showed a significant increase in the number of planned participants in many comparisons with 19 to 20 expected in most. Comments from the survey included requiring independent realization by participants, limiting participation to RMO-nominated link laboratories for RMO comparisons, avoidance of the use of claimed uncertainty as a primary selection criterion, and requiring participation only in alternate key comparisons. After discussing a detailed proposal put to them by the chairman the working group agreed on the following principles for participation in CCPR key comparisons:

(1) Pre-requisites for participants:

- membership of CCPR;
- independent realization of the relevant units;
- CMC coverage of the quantity (at all wavelengths in the range) at the time of the call except where the key comparisons is new;

(2) If the number of qualifying applicants is less than twelve all are accepted as participants.

(3) If the number exceeds twelve then groups of RMOs will choose participants:

- Group 1 (COOMET and EURAMET): up to six;
- Group 2 (APMP and SADC MET): up to four;
- Group 3 (SIM): up to two;

with the selection criteria determined by individual RMO groups.

In the ensuing discussion the President said that these principles are the current agreement but they are not set in stone and can be altered in the future. Dr Zwinkels stated that with thirteen applicants it was clear that the three pre-requisites would be applied but would they be applied with twelve or fewer applicants? Dr Fox pointed out that the working group had agreed that these three parameters are an entry requirement for participation. WG-KC also agreed that, in some exceptional circumstances, WG-KC can be consulted for changes of the entry conditions for a particular comparison and that the CMC coverage is not required for a new key comparison.

## 7.10 Changes in the list of key comparisons

Survey respondents had suggested dropping either [CCPR-K3.a](#) (luminous intensity) or [CCPR-K3.b](#) (illuminance responsivity). After considerable discussion of these strongly correlated comparisons, in which some favoured one and some the other, WG-KC recommends retaining both [CCPR-K3.a](#) and [CCPR-K3.b](#) for the next round.

The President commented that this issue can be re-opened. Dr Clare pointed out, and Dr Ohno agreed, that it is accepted that to cover both quantities only one of these capabilities is required to be tested in a key comparison.

Survey respondents had also suggested extending the wavelength ranges on [CCPR-K2.a](#), [CCPR-K2.b](#), [CCPR-K5](#) and [CCPR-K6](#). WG-KC recommends that wavelength ranges be reviewed and extended if appropriate when protocols are written for each key comparison.

Dr Fox stated that if a range is extended then we have a new comparison with a new number or letter. Dr Lee and Dr Ohno disagreed. Dr Fox remained of the opinion that any alteration of the range was a matter that must be brought to CCPR whereas the President was of the opinion that this could be a modification dealt with in the protocol. The ensuing discussion left this issue unresolved.

### **7.11 Scheduling and pilot laboratories for the next round of key comparisons**

The working group had not had time to discuss this topic fully. Dr Ohno reported that, in their responses to the survey, a number of NMIs volunteered to pilot the next round key comparisons, and that the time schedule and pilot laboratories for each key comparison are being planned. A list of members volunteering to pilot key comparisons was tabled. The working group is recommending that [CCPR-K6](#) should be repeated first owing to the problems experienced in the first round and that it should start in 2009 with the task group formed and pilot laboratory appointed soon after Draft B of the present comparison becomes available. Comparisons [CCPR-K3.a](#) and [CCPR-K3.b](#) are also overdue for being redone. The working group defines start date as meaning the year in which measurements commence, after formation of a task group, appointment of a pilot laboratory, call for participants and production of a protocol.

One question that had been raised was whether a RMO key comparison that is completed at a time midway between two CCPR key comparisons can be later unlinked from the earlier CCPR key comparison and linked to the subsequent CCPR key comparison. Dr Espina was reported as having said there was no precedent for linking a RMO key comparison to a subsequent CC key comparison. Dr Fox suggested that Dr Espina would take the issue to the JCRB. Professor Wallard stated that it was not the JCRB's role to decide this question; CCPR should decide this but that he could not see how a forward linkage could be practicable. Professor Wallard was of the opinion that RMO key comparisons should be done quickly after a consultative committee key comparison otherwise their relevance was diminished. Dr Saito said that if a RMO key comparison could not be linked to a subsequent CCPR key comparison then we would have concurrent traceability to two key comparison reference values.

Dr Xu commented that the working group had not had enough time to discuss these issues, that there was a need to make MRA procedures more efficient and that delays were occurring for reasons other than the number of participants. Dr Ohno pointed out that the Guidelines now laid down a detailed timetable for key comparisons. Dr Fox responded that the Guidelines were not in place when the earlier comparisons started and that the comparisons causing problems are among the earlier ones. Dr Xu said that there were issues with the timing of RMO comparisons and that these should be done more quickly.

The President emphasized that pilot laboratories should be assigned as early as possible in order that they can arrange purchase of artefacts; selection of a pilot laboratory in the start year is too late. Professor Wallard expressed the concern of the JCRB about delays between participation and report; these are causing chaos in their work. He added that analysis of comparisons is a hot topic for all consultative committees and commended a paper on this topic by Dr C. Sutton of

MSL<sup>2</sup>. Dr Ohno said that the WG-KC meeting agenda included an item on linking RMO key comparisons to CCPR key comparisons but that there had not been time to discuss it.

### 7.12 Discussions on RMO comparisons

Dr Ohno reported a list of seven desired supplementary comparisons suggested in the survey; the working group had not, however, made any decisions on more supplementary comparisons. He pointed out that supplementary comparisons, which are run by an RMO, fall into two categories: world-wide RMO comparisons that are open to all NMIs, like the APMP comparison on LEDs, and closed RMO comparisons, open only to members of that RMO.

### 7.13 Guidelines for the preparation of reports on CCPR comparisons

The Guidelines were completed and published in March 2006. The working group supports the proposal, already discussed in WG-CMC, that, after the final report is published, pilot laboratories are to send a request to each participant asking them to check the consistency of their comparison results and their CMCs. If the CMCs are not supported, they should state which action they will take. The pilot laboratory will only collect this information and does not need to make its own judgement. The replies from the participants will be collected in a separate report. This requirement is to be included in the next version of the Guidelines. Other issues to be addressed were outliers and guidance on bilateral CCPR key comparisons.

### 7.14 Chairmanship of the working group

The recommendation of the working group that Dr Ohno continue as chairman was reported.

The President proposed that this recommendation be accepted and CCPR so resolved. Dr Ohno agreed to continue.

## 8 EVOLUTION OF THE SI

The President invited the Executive Secretary to make a presentation on the evolution of the International System of Units (SI), a topic of interest to all in CCPR. Dr Stock reminded the meeting of the 2005 CIPM Recommendation 1 (CI-2005), outlined proposals to redefine the kilogram, ampere, kelvin and mole in terms of fundamental constants, reviewed the benefits that would flow from this together with the negative but trivial consequences for molar mass and the formerly fixed values of the permeability and permittivity of free space, and sketched a timetable leading to adoption at the 24th CGPM in October 2011 that could be achieved if acceptable results were obtained in several experiments. Of particular interest to CCPR were the recent measurements of the Planck constant  $h$  showing an unexplained divergence of  $1.1 \times 10^{-6}$  between watt-balance measurements on the one hand and molar-volume measurements of silicon on the other. He reported the position on these proposals of the other Consultative Committees:

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<sup>2</sup> C.M. Sutton, *Metrologia*, 2004, **41**, 272-277.

- The CCEM has formed a working group (WG-SI) and strongly supports change that will fix the elementary charge  $e$  and the Planck constant  $h$  thereby exactly defining the Josephson and von Klitzing constants.
- The CCM saw the matter as less urgent and stipulated several prerequisites for change, including measurements to 2 parts in  $10^8$  and full agreement between the molar-volume and watt-balance measurements of  $h$ , that are not easily met before 2011.
- The CCT have established a task group on the kelvin redefinition, are looking for more independent measurements of the Boltzmann constant and assuming that its relative standard uncertainty can be reduced to 1 part in  $10^6$ , and state that the proposed redefinition will not then influence measurements within ITS-90. They recommend a redefinition of the kelvin in 2011.
- The CCQM also want a decision deferred until the discrepancy between watt-balance and molar-volume measurements of  $h$  is resolved and want the kilogram definition based on fixing the Avogadro constant not the Planck constant.
- The CCU in a meeting in early June indicated their preferences, including retention of the notion of base units, fixing  $h$  not  $N_A$  for the kilogram and  $e$  not free-space permeability for the ampere, and changing all four units at the same time.

Progress by seven groups working on experiments to determine the Planck constant was reviewed in detail.

In response to a request from the President to any who were at the CCU meeting, Dr Thomas reported that there was discussion over fixing  $e$ , not free-space permeability for the ampere, and consensus on fixing  $h$  for the kilogram. CCU will draft definitions and put together *mises en pratique* for circulation internally and to executive secretaries of the other Consultative Committees from May 2008 to May 2009 in the hope that wording can be agreed at their meeting in June 2009 and in time for CIPM 2010. It would appear that consensus was coming but not yet reached. Professor Wallard said that owing to the differences between the electrical and mass groups he had had doubts about consensus but with recent positive progress he is optimistic of a good result soon on the Avogadro experiment and optimistic about agreement for 2011. The President stated that we have our working group WG-SP looking at the implications for the candela and that this leads into the report from the chair of this working group.

## 9 REPORT FROM THE WORKING GROUP ON STRATEGIC PLANNING (WG-SP)

Dr Zwinkels presented the report of the Working Group on Strategic Planning.

The working group had its inaugural meeting on 22 October 2006 at CENAM, Querétaro (Mexico), under the chairmanship of the President. The meeting resolved to recommend the appointment of Dr Zwinkels as chair with effect from the end of that meeting. The working group met again on 20 June 2007 at the BIPM at which meeting all ten NMI members were represented, the President and the Executive Secretary of the CCPR were present, and there were nine observers in attendance.

The working group has established three task groups:

- TG 1, Terms of reference: 6 members; chair: initially M.L. Rastello, now E. van der Ham;
- TG 2, Membership criteria: 5 members; chair: P. Blattner;
- TG 3, CCPR structure: 7 members; chair: N. Fox.

The first has produced draft terms of reference and the other two are expected to produce documents by the end of December.

At their 2007 meeting the working group discussed a presentation by Dr Stock on why the candela should remain a base unit. A document that he had drafted in consultation with the working group on the “Impact of the proposed redefinitions of the kilogram, the ampere, the mole and the kelvin on radiometry and photometry” (CCPR/07-03, restricted access) was submitted to the CCU meeting on 11 June 2007. The meeting then addressed the definition of the candela in Appendix 2 of the SI Brochure; the section dealing with this definition has been extensively revised by an *ad hoc* task group (CCPR/07-06, restricted access) and further modifications to this draft were agreed for submission to CCPR. A two-page submission to Dr Kaarls, for use in the report “Emerging needs” that he is due to complete this year, was prepared following the Querétaro meeting and submitted in November 2006. The working group meeting approved the terms of reference (Draft 3, 20 June 2007) from TG 3 for submission to CCPR.

## 9.1 Recommendations from WG-SP

### 9.1.1 Terms of reference

Professor Wallard asked about the intention underlying point 3 of the terms of reference and the President replied that there was no intention to alter the membership criteria for CCPR or its working groups. Professor Wallard also wanted to see a formal mechanism for handling applications. After brief discussion the President ascertained that CCPR were unanimous in agreeing to adopt the terms of reference.

### 9.1.2 R1: Update of Appendix 2 of the SI Brochure on the definition of the candela

The President indicated that the last paragraph of the draft had been reformatted with two bullets. Professor Wallard said that it was unnecessary and unhelpful for the wording to state that the scotopic function was less important than the photopic function. The President stated that the draft had already been sent to Professor Mills, the President of CCU. Dr Thomas pointed out that “contemplating” would translate into “observing” in the French and on the suggestion of Dr Fox it was agreed to change this to “considering”. The meeting then agreed that the revised draft be sent to CCU.

### 9.1.3 R2: Closure of CCPR WG-UV

Dr Zwinkels reported that WG-SP endorsed the recommendation for the closure of WG-UV. The President noted the working group’s endorsement and set the recommendation aside for consideration later.

#### 9.1.4 R3: Appointment of Y. Ohno as CCPR liaison to CIE

The President stated that the Memorandum of Understanding was between the CIE and the CIPM and that he was therefore doubtful whether CCPR could make this decision. Professor Wallard replied that the definition of BIPM includes all of CIPM and that it would therefore be permissible for CCPR to make this appointment. It was agreed that CCPR endorse the appointment of Dr Ohno as BIPM liaison to CIE.

Professor Wallard stated that there was a need to agree with CIE on the detail of an agreed program for regular consultation. Dr Ohno said that two issues to be discussed with CIE were (a) the  $10^\circ V(\lambda)$  function and (b) mesopic functions for which recommendations were being developed for  $2^\circ$  and  $10^\circ$  observer functions. The President raised the question of whether CCPR and CIE should consider jointly producing a definitive document on photometry. Mention was made of documents on photometry that each body had produced in the past, both largely written by W.R. Blevin.

#### 9.1.5 R4: Appointment of CIE and WMO as Observers to CCPR

Professor Wallard stated that this was a matter which would be reported to CIPM but that it should not require their approval if it can be taken in each case to be implicit in or consistent with the relevant Memorandum of Understanding. On the motion of the President it was resolved, *nem. con.*, to appoint CIE and WMO as observers to CCPR and to so report to CIPM.

#### 9.1.6 R5: Application from KRISS for membership of WG-SP

Dr Zwinkels reported that WG-SP supported the application submitted by Dr D.-H. Lee for membership by KRISS of WG-SP. CCPR resolved that KRISS be elected to membership of WG-SP.

#### 9.1.7 Chairmanship of WG-SP

It was reported that the working group have recommended that Dr Zwinkels continue as chair until the next meeting of CCPR. The President put a resolution to this effect to the meeting and it was carried with acclamation.

### 9.2 Notification to CCU of the formation of a CCPR task group on the candela definition

Dr Zwinkels reported that WG-SP had established a new task group, TG-SI, with six members under the chairmanship of Dr Rastello, on the definition of the candela in the SI, that an announcement of its formation should be made to CCU and that this announcement had been drafted. After some views had been expressed the President deferred any further decisions on the wording until after informal discussion over morning tea.

*(Note: The following discussion and resolution were taken after item 11.)*

Dr Zwinkels brought to the meeting a slightly revised draft which better reflected the consensus of those concerned, namely that the present candela works for existing industries but that we are

prepared to reformulate it if that, “through linkage to the Planck constant,  $h$ , would provide greater consistency among the definition of the base units and thereby better serve the additional needs of emerging sectors such as the quantum based technologies”. The President put the revised draft to the meeting, it was resolved to accept it and that the Executive Secretary forward it to CCU.

## 10 REPORT FROM THE WORKING GROUP ON UV RADIOMETRY (WG-UV)

Dr Fox reported, in the absence of Prof. Ikonen, on the meeting of the Working Group on UV Radiometry held at BIPM on 19 June 2007. This Working Group was the first and until recently the only working group of CCPR and has played a very important role in reviewing the needs of industry in the UV and in expanding CCPR’s remit into the vacuum UV. Over the last few years, however, its work has been seen to be completed as problems have been resolved. WG-UV has one task group, on the vacuum-UV spectral range, which is presently setting up a pilot comparison on detector spectral responsivity. This work, involving PTB, NIST and NMIJ, is underway and no longer needs the support of a dedicated working group; it could report to WG-KC. Dr Fox presented the working group’s recommendation that it be closed, but that this should possibly be deferred until WG-SP has recommended a plan for the structure of CCPR.

The President reviewed the context in which this situation has developed and asked that WG-SP submit a proposal on CCPR structure by December 2007. He reiterated that we will ensure that the work of this group is not lost and that all activities will have a home. No groups like, for example, fibre optics should be left out of the structure and vacuum-UV must not be allowed to drift away.

The recommendation for closure was put to the meeting and passed. Dr Fox then asked, and it was agreed, that we record our gratitude to Prof. Ikonen and Prof. Wende and their predecessors for their excellent work, their efforts and contributions. The President endorsed this and remarked that he hoped something similar could be done in relation to work in the far-IR spectral region.

## 11 REPORT ON LIAISON WITH CCT WORKING GROUP 5, RADIATION THERMOMETRY

Dr Fox presented a report on the progress made by this working group in establishing high temperature fixed points (HTFP) for primary thermometry using metal-carbon eutectics. He noted the possible relevance to photometry of one metal carbide-carbon eutectic, that of molybdenum, which has a eutectic point close to 2856 K. The plan to which this group is working has been set out in the paper “M(C)-C eutectic research plan — the next steps” (CCT-WG5/docs-01). The research programme is focussed on five areas each covered by a task group or working party:

- WP 1: Long term stability and robustness studies;
- WP 2: Construction of “primary” cells for fixed-point temperature assignment;
- WP 3: High temperature fixed-point operational requirements for optimal performance;

- WP 4: Radiometric comparisons and recommendations for absolute radiometry improvements;
- WP 5: Plan and perform fixed-point temperature assignments for definitive HTFP cells.

In addition another working party, WP 6, is preparing text for a *mise en pratique* to allow these high-temperature fixed points to be used as a viable alternative to ITS-90. The target uncertainty is better than 200 mK ( $k = 1$ ) for the Re-C point and less for the lower temperature points.

Professor Sapritsky asked why rhenium was the highest-temperature point included to which Dr Fox replied that he did not know but that he surmised that the rhenium point was more reproducible than those higher. In further discussion Prof. Sapritsky said that good agreement had been obtained on the higher-temperature points. Dr Fox asked that he make clear his expectations of success at higher temperatures to which Prof. Sapritsky replied that 3000 K will be important. Dr Fox said that in the measurements planned for 2009 to 2010 an extra cell will probably be included if the existing cells prove satisfactory.

The President reminded the meeting that the function of liaison is to convey reactions. Feedback from CCPR is that we would appreciate the CCT WG 5 going to higher-temperature points if this is feasible and sound results can be obtained. The possibility of this work coming under CCPR not CCT arises. The President summarised the discussion by asking that we record that CCPR takes note of the plans of this working group, appreciates what they are doing and asks that Dr Fox convey this to them.

## 12 REPORTS BY RMO TC CHAIRS

### 12.1 APMP

The report of the APMP Photometry and Radiometry Technical Committee was given by Dr Saito who has been Chair since the last day of the APMP General Assembly in December 2006. The following comparisons have been completed:

- [CCPR-K3.a.1](#), luminous intensity and [CCPR-K3.b.1](#), luminous responsivity; report published 2005;
- [CCPR-K1.a.1](#), spectral irradiance, 250 nm to 1600 nm; report published 2006;
- [APMP.PR-S1](#), irradiance responsivity of UV detectors; report published December 2006.

The following comparisons are in progress:

- [APMP.PR-S2](#), fibre optic power responsivity, 1310 nm and 1550 nm; eight participants, measurements December 2005 to May 2007, Draft B expected in September 2007;
- [APMP.PR-K4](#), luminous flux; eight participants, measurements May 2006 to February 2007, Draft A expected in July 2007;
- [APMP.PR-K3.a.1](#), luminous intensity, bilateral involving NIM and SIRIM; measurements taken in May 2006 and report in preparation.

The following comparisons are in preparation:

- luminous intensity;
- spectral diffuse reflectance;

- spectral power responsivity, 300 nm to 1000 nm;
- LED properties: CIE averaged luminous intensity, luminous flux, colour coordinates.

A brief meeting of the Technical Committee was held on 20 June 2007 at which plans were discussed for the forthcoming APMP meeting in Sydney. Dr Xu proposed holding a workshop at which pilot laboratories of RMO comparisons could share information on guidelines, report preparation and calculation of reference values.

The President opened discussion by explaining that the purpose of this agenda item is to allow CCPR as a whole to interact with the RMOs but that this meeting is not the main venue for that purpose; that lies with WG-KC and WG-CMC. Dr Xu outlined the workshop proposal in more detail. Dr Fox suggested that the Technical Committee should wait for better guidance before running a workshop on this subject. Dr Ohno explained that the WG-KC presently has outliers and linking on its agenda and plans to resolve these issues soon. Some additional guidance may be needed in relation to linking, particularly if there is a multi-year time gap. No consensus has been reached yet. The President said that preparing guidelines for key comparisons must be seen as an on-going process, not an event. Dr Ballico reminded the meeting that a lot has been published on these topics. He suggested that whilst a general workshop may be useful it is in general more productive to analyse specific examples.

Professor Wallard commented that CCQM held a workshop with case studies. Dr Thomas, who had been at the CCQM workshop, said that when very few laboratories participated one could end up with spuriously low uncertainties and it was difficult to arrive at a reference value. Dr Xu said that he would revise his proposal; it appears that it should be left to WG-KC to run a workshop at an appropriate time. The President remarked that this seemed logical and compared the situation with that which prevailed a few years ago with uncertainties. We need to sort out outliers and linking first; next year may be too soon but a workshop in two years should be fine. Dr Fox said that we need more reports to Draft B stage before we can have a useful discussion on these topics; there are not enough examples yet and we need more real data but we do have real examples of outliers in comparison CCPR-K6.

In reply to Dr Matamoros's statement that one thing, namely guidelines, is missing the Executive Secretary said that the Guidelines are a working document and are available in an open area on the website. Dr Ohno expressed the view that the definition of outliers must be agreed by all participants in the pre-Draft A process. The President said that the decision on what is considered an outlier should be taken by the task group for each individual comparison and that any decision on outliers should be "blind" to the measurement results.

## 12.2 COOMET

No report was presented and Prof. Sapritsky said that he had nothing to bring to CCPR.

## 12.3 EURAMET

Dr Blattner reported on the activities of EURAMET PHORA, the Photometry and Radiometry Technical Committee, of which he has been chair since 1 June 2007. The European Metrology Research Programme (EMRP) is co-funded by the European Commission under Article 169 but this funding is limited to appropriately incorporated legal entities. To create a legal entity suitable for both the operation of an ERMP and for its other purposes EUROMET has been

incorporated as an association of public utility under German law (e.V.) and renamed EURAMET. The principal components of the new structure are the EMRP Committee which coordinates research and a Research Council. All EUROMET bodies will cease work on 30 June 2007, EURAMET takes over tasks and responsibilities on 1 July, the financial operations of EUROMET are to be wound up by 31 December, and a new website for EURAMET is to be established by 31 December 2007.

The PHORA Technical Committee held meetings, at which 21 member countries were represented, in April 2006 and April 2007 and has a meeting planned for April 2008 at NPL in the United Kingdom. He reported that 24 projects have been completed, 26 more have been agreed and a further five have been proposed. CMC entries EUROMET.PR3 (four countries) and EUROMET.PR4 (five countries, including PMOD) have been published and EUROMET.PR5 (Finland) has been approved by intra-regional review. No key comparisons have been completed but one supplementary comparison has been completed, namely [EURAMET.PR-S1.1](#), chromatic dispersion, a bilateral between MIKES and METAS.

The following comparisons are in progress:

- [EURAMET.PR-K2.b](#), spectral responsivity (pilot: IFA-CSIC);
- [EURAMET.PR-K3.a](#), luminous intensity (pilot: PTB);
- [EURAMET.PR-K4](#), luminous flux (pilot: PTB);
- [EURAMET.PR-K4.1](#), luminous flux and luminous intensity (bilateral between LNE-INM and INM-BRML);
- [EURAMET.PR-K5](#), spectral diffuse reflectance (pilot: OMH);
- [EURAMET.PR-K6](#), spectral regular transmittance (pilot: LNE-INM);
- [EURAMET.PR-S2](#), radiant power of high power lasers (pilot: PTB).

The following key comparisons are planned:

- [EUROMET.PR-K2.a.1](#), spectral responsivity (bilateral between NMi VSL and SP);
- [EUROMET.PR-K2.a.2](#), spectral responsivity (bilateral between NMi VSL and JV).

No comments were received on this presentation.

## 12.4 SADC MET

Mrs Nel-Sakharova presented a brief report. Because South Africa is the only member of SADC MET with an accredited photometry and radiometry laboratory, NMISA is an associate member of APMP and participates in APMP comparisons. Two other SADC MET members, NIS (Egypt) and the Kenya Bureau of Standards (KEBS), have photometry and radiometry laboratories and do have plans for accreditation.

The President stated that there will in the future be another African RMO, AFRIMETS, of which SADC MET will become a part. The first General Assembly of AFRIMETS will be held in South Africa in July 2007.

## 12.5 SIM

Dr Matamoros, chair of the SIM Photometry and Radiometry Technical Committee, presented a report on their activities. There is only one comparison in progress, [SIM.PR-K4](#), luminous flux for which Draft A is currently being prepared. One comparison, on fiber-optic power meters, is being planned. The participants invited are CENAM, KRISS and NIST. The comparison time schedule and protocol are being defined and will be registered as soon as they have been agreed. Further new comparisons may be defined during this year following discussion with members on their needs.

No new CMCs have been published but some will be submitted by the next year. There are no other activities to report on.

No comments were received on this presentation.

Professor Wallard concluded this agenda item with a request to members to please notify BIPM appropriately when a comparison is taking place. Dr Thomas added a reminder that for any key comparison the protocol must be approved by CCPR.

## 13 LIAISONS WITH OTHER ORGANIZATIONS (WMO, CIE, CORM, ORM)

### 13.1 WMO

Dr Rüedi presented a report on WMO activities relevant to CCPR. After outlining the history and structure of the WMO she drew attention to:

- The Commission for Instruments and Methods of Observations (CIMO), and
- The Commission for Atmospheric Sciences (CAS),

as the WMO Technical Commissions of greatest relevance to CCPR. WMO does not itself run a calibration laboratory but in general its members do and are responsible for their own calibration. WMO requires traceability of measurements to SI and this occurs through the requirement that WMO Regional Instrument Centres shall have traceability to their NMI. WMO Regional Radiation Centres are required to have traceability to the World Radiation Centre, Davos and discussions are taking place over WMO becoming a signatory to the MRA. Only highest-level WMO reference standards, such as those held at PMOD, EMPA and NOAA, are under consideration for recognition through the MRA. Possible areas of collaboration with CCPR are the solar radiation World Radiometric Reference (WRR) and atmospheric infrared radiation activities of the World Weather Watch programme of CIMO, the Global Atmosphere Watch (GAW) programme of CAS (ozone, UV radiation and optical measurements of aerosols) and the Space Programme of the Commission for Basic Systems (intercalibration of space and ground-based instruments). The WRR, which is critical for climate monitoring, is disseminated by International Pyrheliometer Comparisons (IPC) every five years.

Dr Ballico said that this presentation raised an issue of importance to WG-CMC and WG-KC in that we have no comparisons that cover pyranometers or total solar irradiance measurements. Dr Rüedi replied that she was not sure how this should be done. Dr Fox stated that what we were concerned with were measurements of spectral responsivity and spectral irradiance, that these quantities were linked through aperture area measurements traceable to METAS, and that for the

spectral responsivity of the instruments there was adequacy in the process. Dr Ballico asked whether the CMCs approved by CCPR are going to be adequate for WMO. The President stated that only one laboratory, PMOD, had a relevant CMC entry. Dr Ballico added that NMIA were also proposing to be involved. The President said that we need to ensure such CMCs are well reviewed. Dr Blattner proposed that we separate natural sun and artificial sun calibrations. Dr Ballico said that pyranometers for solar simulators are the concern. The President commented that we want to do the right thing for both sides, that is for WMO and CCPR. It was agreed that CMCs for artificial sun can be declared as in the past, while CMCs for the Sun could only be declared if the laboratory had participated in the IPC.

Professor Wallard said that BIPM were in parallel discussions with the WMO secretariat who want to become a signatory to the CIPM MRA. Three laboratories are involved: PMOD, WCC/EMPA (Dübendorf) and NOAA. The current policy for Intergovernmental organisations covered the existing signatory (the International Atomic Energy Agency) which has its own laboratories but we now need a policy that covers organisations which do not have their own laboratories. The discussions have not included WMO's Regional Instrument Centres and we would rather that they were traceable to NMIs.

### 13.2 Presentation on the 14th CIMO meeting

The Executive Secretary presented a report on the 14th meeting in Geneva in December 2006 of the WMO's Commission for Instruments and Methods of Observation (CIMO). He attended for one day as a representative of BIPM to make a presentation on:

- the BIPM and its mission;
- the importance of SI traceable measurements in monitoring climate change;
- WMO becoming a signatory to the MRA,
- WMO representation at the next CCPR meeting; and
- the proposed BIPM/WMO workshop on metrology and climate change.

In a review of their expert teams CIMO invited BIPM to send representatives to teams related to BIPM's mission. Dr Fox and Dr W. Schmutz (PMOD/WRC) have been nominated to Team A3: Meteorological Radiation and Atmospheric Composition Measurements and Dr R. Kohler (BIPM) has been nominated to Team C2: Regional Instrumentation Centres, Quality Management Systems and Commercial Instruments Initiatives.

The President put the motion that CCPR confirm the appointment of these representatives and the motion was carried.

### 13.3 CIE

Dr Bastie and Dr Zwinkels presented a report on the activities of the International Commission on Illumination (CIE) over the period from 2005 to June 2007 that are relevant to the CCPR, the relevant CIE Divisions being numbers 1, 2, 6 and 8. Three new technical committees have been formed:

- TC 1-69, colour rendition by white light sources (chair: W. Davis);

- TC 2-60, effect of instrumental band pass function and measurement interval on spectral quantities (chair: E. Woolliams);
- TC 6-60, spectral weighting of UVR from solar surrogate sources (chair: P.D. Forbes).

Dr Bastie reported a general concern that the present colour rendering index was not working satisfactorily and TC 1-69 had been established to sort this out. He listed three standards, two draft standards and eight relevant technical reports that have been published in this period.

Four CIE Expert Symposia have been held:

- symposium on “75 years of the CIE Standard Colorimetric Observer”, in May 2006 at NRC, Ottawa, Canada;
- the 2nd CIE Expert Symposium on Measurement Uncertainty, in June 2006 in Braunschweig, Germany;
- the CIE Expert Symposium on Visual Appearance in October 2006 in Paris, France; and
- the 2nd CIE Expert Symposium on Lighting and Health in September 2006 in Ottawa, Canada.

Proceedings of all of these meetings are available from the CIE.

He reported that the Cooperation Agreement between CIE and BIPM was signed by the President of CIE and the Director of the BIPM on 2 April 2007. A revision of the *International Lighting Vocabulary* published jointly by CIE and the International Electrotechnical Commission is under way and is being coordinated by Dr Bastie. The 26th Quadrennial Session of the CIE will be held in Beijing, China in July 2007.

No comments were received on this presentation.

### 13.4 CORM

Dr Ohno reported on the structure and current activities of CORM (Council for Optical Radiation Measurements). CORM has a membership of about 200, mostly from the US and the rest of North America, and has a specific role in advising NIST on research needs in optical metrology. Its annual meeting in May 2007 “Optical Radiation Consensus Standards and Industry” had an attendance of about 60. It featured a tutorial workshop on photometry and colorimetry for LED and solid state lighting and sessions on developing standards for solid state lighting, colour and appearance standards and methods, and retroreflective safety materials. Dr Ohno highlighted one presentation on an electrical substitution method for an LED as a way of directly realizing the lumen on LEDs.

Dr Saito stated that one of his colleagues had already done this more than ten years ago, using it to measure the efficiency of an LED and its internal quantum efficiency. Professor Sapritsky commented that he had seen an even earlier report of this being done twenty years ago in Russia.

### 13.5 ORM

Dr Fox reported on the recent activities of the ORM (Optical Radiation Measurements) Club run by the NPL which has a similar size of membership and anticipates 70 at its annual meeting in June 2007. More information can be found on the NPL website at [http://www.npl.co.uk/optical\\_radiation/ormclub/](http://www.npl.co.uk/optical_radiation/ormclub/).

The President commented that we should take account of data from these user groups in our strategic planning group.

## **14 MEMBERSHIP OF CCPR AND WORKING GROUPS**

The President stated that we have an application from CENAM for full membership of CCPR. Dr Matamoros made a presentation on the work of CENAM. Mexico has been a signatory to the Metre Convention since 1890, a signatory to the MRA since 1999 and CENAM has been an Observer to CCPR for the past 8 years. The NMI is governed by legislation enacted in 1992 and established an optical radiation laboratory in 1994. The optical radiation group have participated in six international comparisons including one CCPR key comparison and three SIM comparisons. They have played an active part in their RMO, including chairing the photometry and radiometry technical committee for the past several years. Dr Matamoros reviewed the photometric and radiometric capabilities that have been established and listed recent publications.

The application of CENAM was unanimously recommended to the CIPM for full CCPR membership.

Professor Wallard commented on the importance of publishing regularly as an indicator of the continuity of an active research programme. In response to this comment Dr Fox asked whether we should review CCPR membership regularly, something we have not done so far. The comment was made that the next CIPM meeting may do this. It was agreed that this issue should in any case be taken forward to CIPM.

Dr Ohno reported that membership of WG-KC had changed by the addition of one new member and the removal of one existing member. The President stated that the appointment of the new member, MIKES, had been already ratified by email and that there was no need to ratify the removal as it was required by the rules for membership.

## **15 OTHER BUSINESS**

### **15.1 Initiative on biological and physiological quantities**

Professor Wallard commented on the initiative on biological and physiological quantities. The aim is to hold an international meeting involving this community and the IR community.

### **15.2 BIPM Summer School**

Professor Wallard announced that BIPM is again holding a summer school for younger metrologists and that details have just been sent to NMI directors. Dr Zwinkels will be speaking at it but has only one hour for the whole of photometry and radiometry.

### **15.3 Documents on BIPM open website**

It was decided that only the working documents [CCPR/07-02](#) and [CCPR/07-05](#) should be available on the open website and that the other documents, including country presentations, RMO reports and the presentations from other organisations shall remain password protected. To complete [CCPR/07-02](#), Dr Fox undertook to provide the bibliography for the NPL's response and Professor Sapritsky agreed to arrange for a response from VNIIOFI for this document by early July.

### **16 REPORT TO THE CIPM AND RECOMMENDATIONS**

The President undertook to prepare this and to circulate the draft to all of CCPR for comment before submission to CIPM.

### **17 NEXT WORKING GROUP MEETINGS**

The President stated that an invitation has been received from Dr D.-H. Lee to hold working group meetings (WG-KC, WG-CMC and WG-SP) at KRISS in the third week of October 2008, in conjunction with the 10th NEWRAD meeting. No other meetings or institutions have been suggested as a venue. Following discussion at WG-SP earlier this week the tentative proposal is:

- WG-CMC on Sunday 12 October;
- WG-KC on Thursday 16 October in the afternoon and on Friday morning;
- WG-SP on Friday afternoon, with the possibility of extension of these meetings into Saturday.

There was agreement in principle to this proposal with a firm schedule to be announced to members in due course.

### **18 CLOSING OF THE MEETING**

The President thanked the participants for their contributions and closed the meeting at 13:25.

John Clare, Rapporteur

October 2007

## APPENDIX P 1. WORKING DOCUMENTS SUBMITTED TO THE CCPR AT ITS 19TH MEETING

Open working documents of the CCT can be obtained from the BIPM in their original version, or can be accessed on the BIPM website:

<http://www.bipm.org/cc/AllowedDocuments.jsp?cc=CCPR>

Document  
CCPR/

- 07-01 CCPR. — Draft agenda for the 19th CCPR (2nd draft, April 2007, 1 p. (restricted access))
- [07-02](#) CCPR. — Replies to the CCPR questionnaire, 140 pp.
- 07-03 CCPR WG-SP. — Impact of the proposed redefinitions of the kilogram, the ampere, the mole and the kelvin on radiometry and photometry, M. Stock, 1 p. (restricted access)
- 07-04 CENAM (Mexico). — CENAM Mexico application for CCPR membership, H. Nava, C. Matamoros and S. Echeverria, 6 pp. (restricted access)
- [07-05](#) CIE, CIPM. — Agreement between the CIE and the CIPM, 4 pp.
- 07-06 CCPR WG-SP. — The practical realization of the definition of the candela, F. Hengstberger *et al.*, 2 pp. (restricted access)
- 07-07 NPL (United Kingdom). — CCPR liaison with CCT WG 5, N. Fox, 2 pp. (restricted access)
- 07-08 NPL (United Kingdom). — CCPR liaison with WMO, N. Fox and W. Schmutz, 2 pp. (restricted access)