RECOMMENDATION OF THE CONSULTATIVE COMMITTEE FOR MASS AND RELATED QUANTITIES SUBMITTED TO THE INTERNATIONAL COMMITTEE FOR WEIGHTS AND MEASURES

RECOMMENDATION G 1 (2017)
For a new definition of the kilogram in 2018

The Consultative Committee for Mass and Related Quantities (CCM), at its 16th meeting in 2017,

recalling its previous Recommendations to the International Committee for Weights and Measures (CIPM) on the "Conditions for a new definition of the kilogram", CCM G 1 (2005); on the "Considerations on a new definition of the kilogram", CCM G 1 (2010); and "On a new definition of the kilogram", CCM G 1 (2013),

recognizing Resolution 1 (2014) "On the future revision of the International System of Units, the SI" adopted by the General Conference on Weights and Measures (CGPM) which, when implemented, will link the unit of mass to the Planck constant,

recognizing the need to review the situation regarding the criteria set in Recommendation CCM G 1 (2013),

considering

- continued progress at several National Metrology Institutes and the International Bureau of Weights and Measures (BIPM) with Kibble balance and X-ray Crystal Density (XRCD) experiments, which represent two distinct and highly-accurate routes to determining the Planck constant, with new and significantly improved data available since 2013, and additional results anticipated before the closing date of 1 July 2017,

- that as many determinations of the value of the Planck constant as possible should be considered,

- the approval of the final version of the *mise en pratique* for the realization of the new definition of the kilogram and its future dissemination,

- the implementation by the BIPM of an ensemble of reference mass standards,

- that, to date (16th CCM meeting), the following conditions set in Recommendation CCM G1 (2013) are met:

    - at least three independent experiments, including work from Kibble balance and XRCD experiments, yield values of the Planck constant with relative standard uncertainties not larger than 5×10^{-8},

    - at least one of these results should have a relative standard uncertainty not larger than 2×10^{-8},

    - the BIPM prototypes, the BIPM ensemble of reference mass standards, and the mass standards used in the Kibble balance and XRCD experiments have been compared as directly as possible with the international prototype of the kilogram,

    - the procedures for the future realization and dissemination of the kilogram, as described in the *mise en pratique*, have been validated in accordance with the principles of the CIPM MRA,

- that most recent measurement results with relative standard uncertainty below 5×10^{-8} do not pass the standard chi-squared test of consistency, but it is expected that the CODATA value and uncertainty for the Planck constant will be suitable for even the most demanding applications,

noting that the CCM will conduct an on-going key comparison of primary realizations of the kilogram that will capture and maintain a table of the experimental degrees of equivalence, which can be used to create a formal procedure for applying corrections relative to the consensus value,

encourages all National Metrology Institutes to continue research and further improve experiments in support of primary realizations of the SI unit of mass at appropriate levels of precision and at different mass values suitable for current and anticipated applications,

requests those National Metrology Institutes having a realization of the kilogram to avail themselves of the consensus value (as determined from the ongoing comparison) when disseminating the unit of mass according to the new definition, until the dispersion in values becomes compatible with the individual realization uncertainties, thus preserving the international equivalence of calibration certificates and in accordance with the principles and agreed protocols of the CIPM Mutual Recognition Arrangement,

reminds members of the CCM that all Member States not having realizations of the new definition of the kilogram will have direct access to traceability to the same consensus value as determined by the ongoing comparison through the calibration services of the BIPM,

recommends that the CIPM undertakes the necessary steps to proceed with the planned redefinition of the SI at the next meeting of the CGPM, acknowledging the measures to be taken by the CCM to ensure integrity and continuity in the dissemination of the kilogram.