IUPAP-C2
Commission on Symbols, Units, Nomenclature, Fundamental Constants and Atomic Masses
September 2008

Chair: Leslie Pendrill (Sweden)
Co-chair: Christian Bordé (France**)**
Secretary: Peter Mohr (USA)

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Juha ÄYSTÖ (Finland)
Jens DILLING (Canada)
Jeffrey FLOWERS (UK)
Joco JORNADA (Brazil)
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Atsushi ONAE (Japan)
Andrew WALLARD (BIPM)
Wolfgang WOEGER (Germany)

Associate Members:

Robert BLINC (Slovenia)
David DEAVER (USA)
Alexander DMITRIYEV (Russia)

SUNAMCO Awards and Medals

Since many years, IUPAP SUNAMCO awards Senior Scientist SUNAMCO medals in recognition of outstanding contributions by individuals or groups in these areas worldwide.

IUPAP SUNAMCO Senior Scientist Medals 2008

Heinz-Jürgen Kluge (Gesellschaft für Schwerionenforschung, Darmstadt, and University of Heidelberg, Germany) and **Georg Bollen** (Michigan State University, USA)

"For the innovation of the Penning trap mass spectrometry technique for short-lived isotopes and developing the highest precision in on-line mass measurements."

David E. Pritchard (Cecil and Ida Green Professor of Physics, Department of Physics, Massachusetts Institute of Technology (MIT), Cambridge, MA USA)

"For contributions to the use of Penning ion trap mass spectrometers in the ultra-high precision determination of atomic masses."

In addition, during the present reporting period, SUNAMCO has formulated a proposal to award SUNAMCO Young Scientists Medals to encourage promising individuals in the fields covered by the C2 mandate.

IUPAP Young Scientist Prizes in Fundamental Metrology 2008

Dr Sébastien BIZE, Laboratoire Systemes de Reference Temps-Espace (LNE-SYRTE), Paris (FR)

"For contributions to improvements in the precision of caesium fountain clocks, precise optical frequency measurements and measurements that test fundamental physical laws."

Mr. Dr. Frank HERFURTH, Gesellschaft für Schwerionenforschung (GSI) Darmstadt (DE)

"For contributions to the development of traps for high-precision mass measurement of short-lived isotopes and measurements that test fundamental physical laws."

Conferences

Two major conferences traditionally sponsored by IUPAP SUNAMCO during the reporting period:

- International Conference on Exotic Nuclei and Atomic Masses (**ENAM'08**), took place September 7-13, 2008 Ryn, POLAND http://enam08.fuw.edu.pl/ .
  - Widely attended by those members of C2 involved in Precision Atomic Mass Measurements.
  - Serves as a point of contact for those C2 members.
  - Awards of One IUPAP Young Scientist Prize in Fundamental Metrology (Herfurth) and Two IUPAP SUNAMCO Senior Scientist Medals (Kluge, Bollen) presented by C2 Member Jens Dilling at conference

- Conference on Precision Electromagnetic Measurements (**CPEM 2008**), took place June 8 – 13, 2008, Broomfield CO (USA) www.iCPEM.org/2008
  - Widely attended by those members of C2 involved in Precision Measurements.
  - Serves as a point of contact for those C2 members.
  - IUPAP sponsorship of the CPEM conference successfully resumed after an hiatus since 2002
  - Award of One IUPAP Young Scientist Prize in Fundamental Metrology (Bize) presented by C2 Member Andrew Wallard at conference

The C2 Commission has also offered encouragement of the International Conference on Atomic Physics (ICAP 2008) and several other conferences/workshops, together with IUPAP C15.

Publications

Update on status of 'color' books

The IUPAP 'Red' book SUNAMCO 87-1 "Symbols, Units, Nomenclature and Fundamental Constants in Physics, is by all accounts still popular 20 years after publication of the latest edition. Recently the SUNAMCO Commission has put on-line[1] an electronic version of the IUPAP 'Red' book, together with a number of links to relevant modern and complementary information.

Joint Committee for Guides in Metrology (JCGM)

During the reporting period, some Members of the C2 SUNAMCO Commission have represented IUPAP in the Joint Committee for Guides in Metrology (JCGM[2]) and its working

[1] http://www-v2.sp.se/metrology/IUPAP_SUNAMCO/IUPAP%20SUNAMCO%20Commission_files/IUPAP_Red_book_1987/introduction_red_book_iupap_sunamco_1987.htm
[2] http://www.bipm.org/en/committees/jc/jcgm/

groups (producing guides on Vocabulary in Metrology and Measurement Uncertainty). Recent major publications resulting from the JCGM are:

- International vocabulary of metrology — Basic and general concepts and associated terms (VIM[3])
- Guide to the Expression of Uncertainty in Measurement (GUM): [4]Supplement 1

Other documents under work in progress where IUPAP representatives are most active include a new guide to the "Evaluation of measurement data – The role of measurement uncertainty in conformity assessment".

Liaisons with other organizations

SI and CCU (Consultative Committee of Units)

The changes to the International System of Units (SI) that are being considered have been discussed within SUNAMCO. Several C2 members represented IUPAP at the meetings of CCU during the period of reporting.

IUPAC

Contacts between IUPAC and IUPAP SUNAMCO have continued during the period of this report:

- SUNAMCO represents IUPAP in the ICTNS[5] of IUPAC. In this context, SUNAMCO reports of its activities at regular intervals as well as is active as referee for a number of IUPAC publications.
- IUPAC has developed new terminology for the nanotechnologies and IUPAP, through SUNAMCO, has corresponded with IUPAC on a possible coordination of contacts with other international organizations - such as ISO and IEC – which are engaged in for example nanostandardisation.

Works by members

Atomic Mass Evaluations

During the International Conference on Exotic Nuclei and Atomic Masses ("ENAM'08"), an exploratory meeting on the future of the Atomic Mass Evaluation was held together with Georges Audi. Georges Audi was the leading person in preparing the 2003 Atomic Mass Evaluation which was published as *Nuclear Physics* **A, vol 729** number 1. The meeting was attended by 13 experts on mass measurements from Europe, USA and Canada, including Jens Dilling and Juha Äystö from C2. The meeting agreed unanimously to start the work towards the next Atomic Mass Evaluation which should be appearing before the next ENAM Conference.

[3] VIM 2007 BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, "International Vocabulary of Basic and General Terms in Metrology", third ed., ISO/IEC Guide 99

[4] GUM Supplement 1, BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, "Evaluation of measurement data — Supplement 1 to the "Guide to the expression of uncertainty in measurement" — Propagation of distributions using a Monte Carlo method", http://www.bipm.org/utils/common/documents/jcgm/JCGM_101_2008_E.pdf

[5] IUPAC Interdivisional Committee on Terminology, Nomenclature and Symbols (ICTNS)

The startup of this effort will be coordinated by Georges Audi and Dave Lunney both from CSNSM Orsay, France.

New Values for Fundamental Constants

A new adjustment of the values of the fundamental constants has been carried out. It is termed the 2006 adjustment, because the cutoff for data used in the adjustment was 31 December 2006. The new values of the constants are posted on the web at http://physics.nist.gov/constants. This work is described in two publications: P.J.Mohr, B.N.Taylor and D.B.Newell, *Rev. Mod. Phys.* **80**, 633 (2008) and *J. Phys. Chem. Ref. Data* **37**, 1187 (2008).

Discussions and recommendations

Proposed redefinitions of some SI units

Changes to the International System of Units (SI) that are being considered internationally have lead IUPAP formulating its own recommendation about the possible redefinition of the kilogram. After continued, lively discussion within SUNAMCO, a recommendation[6] was most recently been presented amongst others at meetings of the CCU. Individual SUNAMCO members have also participated in related discussions of this issue in a number of fora, including within the Metre Convention, for instance, the Consultative Committees for Mass (CCM) for Electricity & Magnetism (CCEM) as well as CODATA.

Definition of the kilogram

An active and extensive discussion of the recent proposal to redefine the kilogram (see "Redefinition of the kilogram: a decision whose time has come" by Ian M. Mills *et al.* in Metrologia **42** (2005) 71-80) among commission members resulted in the following recommendation to IUPAP:

- efforts be continued to refine experiments that link the unit of mass to fundamental constants with a view to improving the connection between macroscopic and microscopic masses and the realization of macroscopic mass measurements in terms of a fundamental definition of the kilogram
- the proper time for the redefinition of the kilogram and ampere would be when it can be determined that the advantages in having precision electrical measurements expressed in terms of the SI volt and ohm and in having improved precision of the values of the fundamental constants outweigh the disadvantage of using the prototype as the practical mass unit for macroscopic mass measurements

The full text of the recommendation may be obtained from the Chair of the commission C2: SUNAMCO.

[6] IUPAP SUNAMCO 2007 "IUPAP recommendation on possible redefinitions of the kilogram, ampere, kelvin, and mole"

Nanoscience and Nanotechnology

SUNAMCO has raised the issue of possible activities in IUPAP in the rapidly expanding area of international standardisation in the **nanotechnologies and nanoscience**. Most recently, we are collaborating with ISO (through their nanostandardisation TC 229) in the promotion of the following recommendation:

"ISO Technical Committee 229, Nanotechnologies, welcomes and encourages researchers in the field to participate actively in the Working Groups (Nomenclature and Terminology, Measurement and Characterization, and Environment, Health and Safety) by providing their expertise. The ISO TC229 Roadmap of Activities lays out the needs and priority areas for standardization in nanotechnologies anticipated over the next several years. Pre-normative and pre-competitive research efforts are clearly needed in physics, chemistry, biology, and engineering sciences, and hopefully Member Nations will encourage and support work proposals aimed to contribute to this important International effort."

Sincerely

On behalf of IUPAP C2 SUNAMCO

Adj prof Leslie R Pendrill

IUPAP C2 SUNAMCO Chair 2005 - 8

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