Symposium Fundamental Constants and new SI (SYSI)

jointly organized by
the Quantum Optics and Photonics Division (Q),
the Atomic Physics Division (A), and
the Mass Spectrometry Division (MS)

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Overview of Invited Talks and Sessions

(Lecture room U Audimax)

Invited Talks

SYSI 1.1	Wed	10:30–11:00	U Audimax	**The redefinition of the SI in November 2018** — •Terry Quinn
SYSI 1.2	Wed	11:00–11:30	U Audimax	**Quantum Hall effect and the new SI** — •Klaus von Klitzing
SYSI 1.3	Wed	11:30–12:00	U Audimax	**The electron charge for the definition and realisation of the ampere** — •Jan-Theodoor Janssen
SYSI 1.4	Wed	12:00–12:30	U Audimax	**The Planck constant and the realization of the kilogram** — •Stephan Schlamminger

Sessions

SYSI 1.1–1.4	Wed	10:30–12:30	U Audimax	**Fundamental Constants and new SI**

SYSI 1: Fundamental Constants and new SI

Time: Wednesday 10:30–12:30 Location: U Audimax

Invited Talk SYSI 1.1 Wed 10:30 U Audimax

The redefinition of the SI in November 2018 — •Terry Quinn — 92 rue Brancas, 92310 Sevres, France

The redefinition of the SI on 16th November 2018 by the 26th General Conference on Weights and Measures, marked the final achievement of the grand idea set out by Laplace, Lagrange, Condorcet Monge and Borda on 19th March 1791 for a system of units belonging to no one country, linked to no particular place and accessible to all. My talk will trace the story of how this happened.

Invited Talk SYSI 1.2 Wed 11:00 U Audimax

Quantum Hall effect and the new SI — •Klaus von Klitzing — Max Planck Institute for Solid State Research, Stuttgart, Germany

The delegates of the 26th General Conference on Weights and Measures recommended a revised international system of units based on fixed values for constants of nature. Beside the velocity of light which was fixed already in 1983, also the elementary charge e and the Planck constant h will adopt fixed values on 20.5.2019, when the new SI will be introduced worldwide. This development was strongly influenced by electrical quantum standards and the talk will summarize the impact of the quantum Hall effect on metrology.

Invited Talk SYSI 1.3 Wed 11:30 U Audimax

The electron charge for the definition and realisation of the ampere — •Jan-Theodoor Janssen — National Physical Laboratory, Teddington, UK

The electron charge, or more correctly the elementary charge e, was first accurately measured by Robert Millikan in his famous oil-drop experiment in 1909. With relatively simple equipment he managed to achieve a value for the elementary charge which is well within 1% of the recently fixed number for e = 1.602 176 634 $\times$ 10^{-19} C. This value was not determined through more accurate oil-drop type experiments but rather calculated from the fine-structure constant and the Planck constant which can both be determined more accurately. Nevertheless, fixing the elementary charge allows us to directly realise the unit ampere by counting a known number of electrons flowing through a circuit. Over the last two decades several technologies have been developed to achieve this quantised electron transport with increasing level of accuracy. High fidelity single electron current sources have several interesting applications both in metrology and quantum technology applications.

Invited Talk SYSI 1.4 Wed 12:00 U Audimax

The Planck constant and the realization of the kilogram — •Stephan Schlamminger — National Institute of Standards and Technology, Gaithersburg, USA

Up to May 20th this year, there was one mass on earth that we knew with zero uncertainty. This mass is the international prototype of the kilogram (IPK). On May 20th, the IPK will be just another mass and the mass unit will be defined via a fixed value of the Planck constant, which will be fixed to the value of $h = 6.62607015 \times 10^{-34)}$ J s with zero uncertainty on this day. In this presentation, I will explain how the kilogram, the unit of mass can be realized via the Kibble balance and the X-ray crystal density method.