Irfu
Institut de recherche
sur les lois fondamentales
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Séminaire DPhP

Lundi 14/10/2019, 11h00

CEA-Saclay Bât. 141, salle André Berthelot

Making the new International System of units compatible with $c = \hbar = \mu_\circ = \epsilon_\circ = 1$

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The new SI brought a huge progress by defining the kilogram from quantum physics. But, by fixing e, it requires to adjust the sizes of the coulomb and ampere, changing $\mu_\circ$ and the vacuum impedance $Z_\circ = \mu_\circ c$ into unfixed quantities, to be measured experimentally. Electrical units, now decoupled from mechanical ones, get modified in a way which depends on α.

We show how the SI may be embedded in a new framework in which the "fundamental constants of nature" are fixed and equal to 1, $c = \hbar = \mu_\circ = \epsilon_\circ = k_B = N_A = 1$. All SI units can be defined in terms of the second, with the coulomb, ohm and weber dimensionless, and the mole identified as the Avogadro number.

The m, J and kg are identified as fixed numbers of s or s^{-1}. The elementary charge, fixed to $e = 1.602\,176\,634 \times 10^{-19}$ C, is also equal to $\sqrt{4\pi\alpha} \simeq .3028$. The ohm, now dimensionless and $\simeq 1/376.730$, is such that the vacuum impedance, still $Z_\circ \simeq 376.730\ \Omega$, is the unit of impedance, identical to 1.

This reconciles the practicality of SI units with the elegance of having $c = \hbar = \mu_\circ = \epsilon_\circ = 1$, as suggested by relativity and quantum physics.

Le café sera servi 10 minutes avant.

NB : La présentation d'une pièce d'identité est exigée à l'entrée du centre. Tous les auditeurs extérieurs sont priés de prévenir à l'avance Martine Oger, tél. 01 69 08 23 50, e-mail : `martine.oger@cea.fr`.