The International System of Units and the Big Revision Coming in 2018

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In November 2014 the 25th meeting of the General Conference on Weights and Measures (CGPM) encouraged all parties concerned to complete work on a major revision of the International System of Units (SI) in time for approval by the 26th CGPM meeting in 2018, assuming that "the amount of data, their uncertainties, and level of consistency are deemed satisfactory." Although similarly hopeful statements have been made over the years, there is at last general agreement among those involved with producing the required data that the 2018 target will be achieved. We are approaching the end of a long and historic effort to revise our system of units. It is therefore timely to discuss how the SI will change and what the changes will mean for scientists and engineers presently making accurate and precise measurements expressed in SI units.

Much of the SI will not change perceptibly: it will have the same seven base units as today and the magnitudes of these units will also be the same. However, the definitions and primary realizations of the units will henceforth better suit contemporary science and technology. The kilogram, most notably, will no longer be defined by the mass of a unique cylinder of platinum-iridium dating from 1889. (Has its mass been stable for 125 years?) Instead, the kilogram will be defined in terms of a fixed value of the Planck constant (SI unit: J s = kg m^2/s) and the present definitions of the second and metre. A similar treatment is in store for three other base units: the ampere, the kelvin, and the mole. I will review some of the key issues still under discussion, experiments that make this program possible, and how the revised SI units will be realized in practice.