Kilogramme faces quantum diet after weight problem

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Fact file on the prototype one kilogramme measure, a platinum-iridium alloy block housed since the 1880s under lock-and-key at the International Bureau of Weights and Measures in Sevres, France.

The guardians of the world's most important standards of weights and measures have turned to the weird universe of quantum physics to try to resolve a dilemma.

To the bafflement of scientists, a cylinder of metal sitting in a closely-guarded strongbox that is the global benchmark for the kilogram is changing mass.

The enigma doesn't affect anyone who wants to buy 500-milligramme tablets of aspirin, half a kilo of carrots or a 50,000-tonne cruise ship.

But it poses a hefty theoretical challenge to physicists, and complicates the work of labs which need ultra-precise, always-standard measurement.

Since 1889, the kilogram has been internationally defined in accordance with a piece of metal kept at the International Bureau of Weights and Measures (known by its French acronym of BIPM), in the Paris suburb of Sevres.

Ninety-percent platinum and 10-percent iridium, the British-made cylinder was proudly deemed at its founding to be as inalienable as the stars in the sky.

It is kept under three glass cases in a safe in a protected building, the Pavillon de Breteuil.

In 1992 came a shock: the famous kilo was no longer what it should be.

Measurements made over a century showed that the prototype had changed by around 50 microgrammes -- the equivalent of a tiny grain of sand 0.4 millimetres (0.015 inches) in diameter -- compared to six other kilos also stored in Sevres.

"Actually, we're not sure whether it lost mass or gained it," Alain Picard, director of the BIPM's Mass Department, told AFP.

"The change may be to due to surface effects, loss of gas from the metal or a buildup of contaminant."

The skinnier (or fatter) kilo became more than a scientific curiosity.

It is a bedrock of the International System of Units (SI), the world's most widely-used system of measurement units for daily life, precision engineering, science and trade.

The SI has seven "base units" -- the kilo, metre, second, ampere, kelvin, mole and candela -- from which all other units are derived.

But unlike its counterparts, the kilo is the last unit that is still defined by a material object.

There used to be a platinum ruler that was the world's standard metre until its role was replaced by a fundamental constant, the time that light takes to travel 100 centimetres. The metal metre still resides in Sevres, but as a museum piece.

Moving at a pace best described as ponderous, the masters of the SI have now decided to phase out the kilo cylinder.

If all goes well, it will be replaced by a fixed value based on the Planck Constant, named after Max Planck, the granddaddy of quantum physics, who discovered it in 1899.

The Planck Constant, which uses the letter "h" in equations, corresponds to the smallest packet of energy, or quanta, that two particles can exchange.

On October 21, the General Conference on Weights and Measures (CGPM) agreed to use the constant to calculate the value of the kilo.

But adopting this "will not be before 2014," after experiments to assess the accuracy of measurement techniques to ensure accuracy to within 20 parts per billion.

If the Planck Constant is adopted, nothing in everyday life will change. The kilo will still be a kilo.

"However, the changes will have immediate impact in the excruciatingly accurate measurements carried out by highly specialised laboratories," the conference said in a press release.

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