

Date: Sun, 19 Jun 2011 19:32:05 -0400
From: "Taylor, Barry N." <barry.taylor@nist.gov>
Subject: RE: Acceptance by international metrology community?
To: "hill@math.gatech.edu" <hill@math.gatech.edu>
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Dear Ted,

I would have replied sooner but I was out of the country until late yesterday afternoon.

First, I must say that I was quite taken aback by your insinuation that I and my NIST colleagues Peter Mohr and Ed Williams are somehow promoting the New SI, and in particular the redefinition of the kilogram in terms of a fixed value of the Planck constant h , to justify expenditures of US tax payer's money on watt balance work. The point is that redefining the kilogram in terms of the mass of a specified number of carbon 12 atoms would not diminish in any way the need to have a comparatively easy to use and robust watt balance for realizing such a kilogram definition and for calibrating unknown mass standards.

As you may know from reading our and related papers, defining the kilogram in terms of a fixed number N of carbon 12 atoms fixes the mass $m(12C)$ of the carbon 12 atom from the relation $m(12C) = 1 \text{ kg}/N$ to have an exact value. It then follows that since the definition of the mole fixes the value of the molar mass of carbon 12, $M(12C)$, to be exactly 0.012 kg/mol , and the number of carbon 12 atoms in one mole of carbon 12 is equal to the numerical value of the Avogadro constant N_A when N_A is expressed in its SI unit inverse mol, we can write $N_A \times m(12C) = N_A \times 1 \text{ kg}/N = 0.012 \text{ kg/mol}$ exactly. This means that N_A will be exactly known and equal to $(0.012 \times N)/\text{mol}$. Finally, since $h = C/N_A$, where C is a group of well known fundamental constants with total relative one standard deviation uncertainty of less than 8 parts in 10^{10} , a watt balance, which allows an unknown mass to be directly related to the Planck constant, can be used to realize the new definition with an inconsequential additional component of uncertainty. There is no other way to do this as easily and routinely!

While I will not argue that a definition of the kilogram based on a specified number of carbon 12 atoms might be easier to understand by students, we do not believe it is worth the price of losing all of the other very significant advantages of the New SI. You will recall that these are spelled out clearly and concisely in our paper to appear in the September 2011 issue of the Philosophical Transactions of the Royal Society, a preprint of which Ian Mills recently sent to you (see section 7, pages 14-15 of that preprint).

With regard to your question as to exactly who is the "international metrology community" to which I referred in my email, I believe that Ian Mills has answered this question more than satisfactorily and thus requires no further response. However, I will close with the following two comments.

First, it is my observation based on 75 years of life on Earth that it is not at all uncommon that no matter what the subject, there are always a few but very vocal individuals who disagree with and therefore oppose and try to undo the consensus view. For example, there are the members of the Flat Earth Society as well as those who believe global warming is a hoax, that the Holocaust never happened, that the landing of men on the moon was faked by the United States government, that man as we know him is the result of "intelligent design" and not Darwinian evolution, that UFOs are real and the United States Government won't tell the people the truth, that President Obama was not born in the United States---the list goes on and on and on!

Second, you should know that Peter Mohr is the only member of the Mills, Mohr, Quinn, Taylor, and Williams "Gang of Five" who is still gainfully employed---the rest of us are retired and do what we do because we wholeheartedly believe that it is beneficial for the world's scientific and technological communities; there is absolutely no personal benefit to us, financial or otherwise. So although you may not agree with us, I must ask you to please refrain from questioning our motivation and insinuating that we might have a hidden agenda.

Kind regards,

Barry

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