Erratum: Improved Determination of G Using Two Methods [Phys. Rev. Lett. 111, 101102 (2013)]

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Three errors appeared in our recent publication of the BIPM G result. Two affect our result by less than 10 ppm, but one is more significant and together they increase our value of G by 13 ppm.

The more significant error concerns the effect of density gradients in the source masses which was inadvertently applied twice. In our Letter, we quote the magnitude of the effect as −32, −0.4, and +36 ppm depending on the orientation of the source masses. These figures come from analytical expressions given in Ref. [1]. For the 2013 result, more accurate values were obtained by including them in the numerical calculation of the gravitational coupling, they were found to be −22, +2, and +26 ppm. The orientation of the source masses was such that for the servo result the effect was −22 ppm and the Cavendish +2 ppm. Unfortunately, in the final calculation of G an additional correction of −32 ppm was added to the Cavendish value; i.e., the effects of density gradients were included twice and also to the result where the effect was actually smallest. To correct this, the Cavendish value should be increased by 32 ppm. The two small errors are:

(a) A correction of −13 ppm made to the Cavendish result, which was assigned an uncertainty of 4 ppm in Table 1 of the Letter, has been recalculated and it should now be −6 ppm with an uncertainty of 6 ppm. To correct this, the Cavendish result should be increased by 7 ppm.

(b) A correction of +8 ppm included in the calculation for G in both servo and Cavendish methods for an offset in the alignment of the source masses with respect to that of the test masses should not exist because the alignment procedure eliminates such a misalignment. To correct this, the results of both should be reduced by 8 ppm.

Also, a more accurate accounting for thermal effects in the dimensional metrology has decreased the correlation coefficient from −0.58 to −0.63; this has in turn reduced the uncertainty on the final value of G from 27 to 25 ppm without changing its value.

The net result of these changes is that we must increase the Cavendish result by 31 ppm and reduce the servo by 8 ppm. We thus find for the Cavendish method $G = 6.67586(36) \times 10^{-11}$ kg^{-1} m^3 s^{-2} (54 ppm) and for the servo $6.67515(41) \times 10^{-11}$ kg^{-1} m^3 s^{-2} (61 ppm). The weighted average is $G = 6.67554(16) \times 10^{-11}$ kg^{-1} m^3 s^{-2} (25 ppm). This is 13 ppm above our published result in the Letter. The difference between the Cavendish and servo results becomes 106 ppm, still compatible with the uncertainty of the difference, namely, 104 ppm.

A detailed description of the experiment, which includes the above errata, has been accepted for publication [2].

[1] T. J. Quinn, C. C. Speake, S. J. Richman, R. S. Davis, and A. Picard, Phys. Rev. Lett. **87**, 111101 (2001).
[2] T. J. Quinn, C. C. Speake, H. V. Parks, and R. S. Davis, Phil. Trans. R. Soc. A **372** (2014).

