Compactly reproducing the fine structure constant inverse and the muon-, neutron-, and proton-electron mass ratios

J. S. Markovitch
P.O. Box 752
Batavia, IL 60510
(Dated: May 14, 2011)

Compact equations are introduced that reproduce the fine structure constant inverse and the muon-, neutron-, and proton-electron mass ratios near their experimental limits.

PACS numbers: 06.20.Jr

The fine structure constant (FSC) and the muon-, neutron-, and proton-electron mass ratios can be economically reproduced as follows. Firstly, define

$$l_0 = \frac{1}{M^2} \qquad\qquad q_0 = \frac{1}{M^3}$$
$$l_1 = \frac{\left[M - l_0/3M^2\right]^2}{N^{-2}} \qquad\qquad q_1 = \frac{M^2 - q_0}{N^{-2}} \quad .$$

Similarly, define

$$l_2 = \frac{M^3 - l_0}{N} \qquad\qquad q_2 = \frac{M^3 - q_0}{N}$$
$$l_3 = \frac{\left[M - l_0/3M^2\right]^3}{N} \qquad\qquad q_3 = \frac{\left[M - q_0/3M^2\right]^3}{N}$$

which are symmetric under $l \leftrightarrow q$, so that for

$$M = 10 \qquad \text{and} \qquad N = 3$$

the FSC inverse can be approximated four ways

$$\frac{l_1 + l_2}{N^2} = 137.036\ 000\ 001\ 111 \qquad\qquad \frac{q_1 + q_2}{N^2} = 137.036$$
$$\frac{l_1 + l_3}{N^2} = 137.036\ 000\ 002\ 346 \qquad\qquad \frac{q_1 + q_3}{N^2} = 137.036\ 000\ 000\ 012$$

which are also symmetric under $l \leftrightarrow q$. Up to this point, all definitions and approximations exactly follow [1]. Now define three functions

$$R(n,p) = \frac{\left(n + M^2\right)^n}{\left(mn - M^n\right)^{n-2}} \left(|p| - M^{2p}\right)^p \qquad\qquad \begin{aligned} e(p) &= R(-1,p) \\ s(p) &= R(+1,p) \end{aligned}$$

where $n = \pm 1$, and p equals -1, 0, or $+1$. Then, for $m = 4$ these functions allow the muon- and neutron-electron mass ratios to be economically approximated by

$$\frac{e(1)/q_0 - 1}{l_2 - l_0} = 206.768\ 270\ 731 \qquad\qquad \frac{e(1)/l_0 - s(0)/q_0}{q_2 - q_0} = 1838.683\ 654\ 735$$
$$\frac{e(1)/q_0 - 1}{l_3 - l_0} = 206.768\ 270\ 724 \qquad\qquad \frac{e(1)/l_0 - s(0)/q_0}{q_3 - q_0} = 1838.683\ 654\ 734$$

each with three terms (of four) also symmetric under $l \leftrightarrow q$. Moreover, the proton-electron mass ratio can be approximated by

$$\frac{e(-1)/l_0 - s(-1)/q_0}{\frac{M^3}{N}} = 1836.152\ 675\ 237 \quad .$$

Also note that

$$\frac{M^3}{N} = \frac{10^3}{3} \approx l_2 - l_0 \approx l_3 - l_0 \approx q_2 - q_0 \approx q_3 - q_0 \quad .$$

With the exception of the less precisely measured muon-electron mass ratio, which above is reproduced at its experimental limit, all of these values are within just a few parts per billion (ppb) of their 2006 CODATA values [2]:

137.036 000 002	206.768 270 7	1838.683 654 7	1836.152 675 24
137.035 999 679 (94)	206.768 282 3 (52)	1838.683 660 5 (11)	1836.152 672 47 (80)

All values are identical to those produced earlier in [1, 3].

At this point the reader might speculate that n in the expression $n + M^2$ allows the above approximations to be *fine-tuned* to fit their corresponding experimental mass ratios. But n simply does not permit the precise fine-tuning needed to fit these ratios. Two out of three of the mass ratios are known and fit to within a few ppb, whereas the value n (equaling ± 1) represents 10 *million* ppb of M^2. It follows that although n is responsible for *some* fine-tuning, it cannot begin to explain the precise fit achieved for the mass data. Identical reasoning applies to p.

In the same way, the neutron- and proton-electron mass ratios may be viewed as having values close enough to each other to assure that a good approximation of one can readily be fine-tuned into a good approximation of the other (which is to say that their earlier approximations are not truly independent). Actually, the neutron- and proton-electron mass ratios differ by 1.4 *million* ppb, an enormous gap to overcome by fine-tuning.

Likewise, the use of -1 in the muon equation's numerator $e(1)/q_0 - 1$ might also be seen as a case of fine-tuning. But letting $m = 0$ causes $e(1)/q_0 - 1$ to equal 0, implying that -1 actually reflects underlying order.

Similarly, M and N may be regarded as "adjusted to fit experiment." But, as demonstrated elsewhere (see [1]), the values used for M and N (10 and 3, respectively) are the smallest positive integers that cause all four of the above FSC inverse approximations to produce nearly equal values. Hence, M and N are not adjusted to fit experiment, but acquire their values automatically.

Moreover, in [4] two simple symmetric mathematical identities are employed as a starting point to automatically generate the values 10, 3, and 137.036, while in [5] a brute-force computer search for efficient approximations of the FSC inverse also automatically finds 10, 3, and 137.036 (more specifically, it finds $(q_1 + q_2)/N^2 = 137.036$).

And, perhaps most significantly, in [6] a mixing model from 2007 is described, one which employs the constants 10 and 3 in a way that derives from $(l_1 + l_3)/N^2$. This model is shown to have correctly predicted the (arguably improbable) changes subsequently observed in the experimental quark mixing angles.

More generally, in [7] information theory and number theory are employed to demonstrate that even the comparatively primitive 2004 versions of the above muon- and neutron-electron mass ratio approximations manage to *compress* the mass data they reproduce, something one would not expect to happen by chance (see Eqs. (14a) and (14b) in [7]).

Finally, note that:

$$
\begin{array}{llll}
l_0 = 0.01 & l_1 = 899.99400001 & l_2 = 333.33 & l_3 = 333.330000011111\ldots \\
q_0 = 0.001 & q_1 = 899.991 & q_2 = 333.333 & q_3 = 333.333000000111\ldots
\end{array}
$$

And:

$$
\begin{array}{ll}
e(+1) = +4.1^3 & -s(0) \quad = 600 \times 101 \\
e(-1) = -4.1^3/9.9^2 & -s(-1) = 600 \times 101/0.99
\end{array}
$$

[1] J. S. Markovitch, "Symmetric equations that reproduce the fine structure constant and the muon-, neutron-, and proton-electron mass ratios" (2011) http://vixra.org/abs/1103.0082.

[2] P. J. Mohr, B. N. Taylor, and D. B. Newell (2007), "The 2006 CODATA Recommended Values of the Fundamental Physical Constants," (Web Version 5.0). This database was developed by J. Baker, M. Douma, and S. Kotochigova. Available: http://physics.nist.gov/constants [2007, July 12]. National Institute of Standards and Technology, Gaithersburg, MD 20899.

[3] J. S. Markovitch, "The economical expression of the muon-, neutron-, and proton-electron mass ratios" (2010) http://vixra.org/abs/1011.0004.

[4] J. S. Markovitch, "The fine structure constant derived from the broken symmetry of two simple algebraic identities" (2011) http://vixra.org/abs/1102.0012.

[5] J. S. Markovitch, "Approximations of the fine structure constant reciprocal" (2009) http://vixra.org/abs/1008.0077.

[6] J. S. Markovitch, "A mathematical model of the quark and lepton mixing angles (2011 update)" (2011) http://www.vixra.org/abs/1102.0021.

[7] J. S. Markovitch, "Coincidence, data compression, and Mach's concept of 'economy of thought'" (2004) http://www.cogprints.org/3667/.