Subatomic Mass, Recalculated

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Having recently received a copy of *Physical Review*, which contains everything known about subatomic particles, I decided to put the *Reciprocal System* to the test—to see if Larson's original calculations would still hold up under the scrutiny of today's accurate measurement systems. The results, some of which are related here, have been quite interesting.

All observed particle measurements were taken from *Physical Review D, Particles and Fields*.[1] Values were calculated with "C" language programs, compiled with SAS/C, version 6.51, using standard, double precision floating point with an accuracy of 15 significant digits. The code was executed on an Amiga 3000 computer under AmigaDOS version 2.1.

Mass Components

The calculated values for subatomic particle mass,[2] in terms of natural units, are listed in Table 1. In keeping with Larson's original tabular format, not all the significant digits are shown (though they are used in all computations).

Table 1: Mass Components (natural units)

	Component	Calculated Value
p	primary mass	1.000000000000
m	magnetic mass	0.006392045455
p+m	gravitational mass	1.006392045455
E	electric mass (3 dim.)	0.000868055556
e	electric mass (2 dim.)	0.000578703704
C	mass of normal charge	0.000044944070
c	mass of electron charge	-0.000029962713

Observed Mass

The observed mass values for the various subatomic particles have changed since the publication of *Nothing But Motion*, and tentative neutrino and "massless neutron" mass now exist.

The observed neutrino mass is taken from the electron neutrino, which is listed with a "formal upper limit" of 5.1 eV, and a "95% certainty level."[3] To maintain consistent units in the table, this value was converted to unified atomic mass units (u) with the conversion factor of 931.49432 MeV/u.[4]

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1 *Physical Review D, Particles and Fields* (The American Physical Society through the American Institute of Physics, 1 August 1994).
2 Larson, D.B., *Nothing But Motion* (North Pacific Publishers, 1979), page 164.
3 *Physical Review D, Particles and Fields*, *op. cit.*, page 1389.
4 *Ibid.*, page 1396, note on electron mass precision.

The mass of the "massless neutron" is taken from the muon neutrino, as suggested by Larson: "…and the logical conclusion is that the particle now called the muon neutrino is the particle required by the theory: the massless neutron."[5]

The mass of the muon neutrino is inferred from measurements of muon momentum in the decay of a pi^+ particle, and results in a mass of 0.27 MeV, or (0.00028985683 u).[4,6]

The observed proton is included in both the charged and uncharged proton entries, for comparison. (The uncharged proton is listed as "unobserved" by Larson in *Nothing But Motion*.)

Table 2 lists the subatomic mass in natural units, as compared to the unified atomic mass units based on the ^{12}C isotope.

Table 2: Calculated Mass (natural) vs Observed Mass (u)

Component	Particle	Calculated	Observed	Difference
e+c	charged electron	0.00054874099	0.00054857990	0.00000016109
e+c	charged positron	0.00054874099	0.00054857990	0.00000016109
e	electron	0.00057870370	massless	
e	positron	0.00057870370	massless	
e	neutrino	0.00057870370	0.00000000548	0.00057869823
p+m+e	massless neutron	1.00697074916	0.00028985684	1.00668089232
p+m+2e	proton	1.00754945286	1.00727647000	0.00027298286
p+m+2e+C	charged proton	1.00759439693	1.00727647000	0.00031792693
p+m+3e	hydrogen (^1H)	1.00812815657	1.00794000000	0.00018815657
p+m+3e+E	compound neutron	1.00899621212	1.00866490400	0.00033130812

The values calculated for the neutrino and "massless neutron" are considerably out of line with the observed values. Given that the observed values were deduced indirectly from the decay of other particles, there are undoubtedly numerous factors involved that were not taken into account. See the section on Rethinking Neutrinos for a possible explanation.

The calculated values for the charged electron/positron, proton, ^1H isotope, and the compound neutron are reasonably close, but not as close as they should be, given the number of significant digits in both the calculations and the observed values. This is due to the measuring system involved, that of the *unified atomic mass unit* (u). The observed values are based on the ^{12}C isotope. Larson uses observed values in the ^{16}O scale, which are closer to the natural mass units of the *Reciprocity System*, but still not exact.[2]

Applying Conversion Factors

Instead of converting values from the ^{12}C to ^{16}O scales, it may be prudent to avoid both scales and determine a conversion factor from natural mass units to unified atomic mass units based on an isotope-free, easily measured particle—the *charged electron*. Of all the particles there are mass values for, the charged electron is, in all probability, the most accurate. Also, the charged electron mass is known more

5 Larson, D.B., *Nothing But Motion*, *op. cit.*, page 213.
6 *Physical Review D, Particles and Fields*, *op. cit.*, page 1392.

precisely in unified atomic mass units than in any other unit.[4]

Thus, the conversion factor between natural (n) and ^{12}C (u) mass units can be determined by the ratio between the measured and calculated charged electron:

$$\frac{0.00054857990\,u}{0.00054874099\,n}=0.99970644\,u/n \quad (1)$$

Applying this factor to Table 1, the mass components in "unified atomic mass units" are obtained:

Table 3: Mass Components (u)

	Component	Calculated Value
p	primary mass	0.999706441403
m	magnetic mass	0.006390169015
p+m	gravitational mass	1.006096610417
E	electric mass (3 dim.)	0.000867800730
e	electric mass (2 dim.)	0.000578533820
C	mass of normal charge	0.000044930876
c	mass of electron charge	-0.000029953917

Recalculating Table 2 with the values in Table 3 results in:

Table 4: Calculated Mass (u) vs Observed Mass (u)

Composition	Particle	Calculated	Observed	Difference
e+c	charged electron	0.00054857990	0.00054857990	0.00000000000
e+c	charged positron	0.00054857990	0.00054857990	0.00000000000
e	electron	0.00057853382	massless	
e	positron	0.00057853382	massless	
e	neutrino	0.00057853382	0.00000000548	0.00057852835
p+m+e	massless neutron	1.00667514424	0.00028985684	1.0063852874
p+m+2e	proton	1.00725367806	1.00727647000	-0.00002279194
p+m+2e+C	charged proton	1.00729860893	1.00727647000	0.00002213893
p+m+3e	hydrogen (^{1}H)	1.00783221188	1.00794000000	-0.00010778812
p+m+3e+E	compound neutron	1.00870001261	1.00866490400	0.00003510861

With the exception of the neutrinos, the calculated values are now extremely close to the observed values. The error for hydrogen is only 0.011%. The error in the compound neutron is 0.0035%.

Notice, however, the proton. The difference between the calculated and observed mass in the uncharged proton is *almost the same* as the charged proton, but in the *opposite direction*. This is rather suspicious, and one could theorize that the observed proton in the laboratory may actually be a 50/50 mix of charged and uncharged protons. Calculating the atomic weight based on a 50/50 mix yields:

Table 5: Mixed Sample Protons

Comp.	Particle	Calculated	Observed	Difference
p+m+2e	proton	1.00725367806	1.00727647000	-0.00002279194
p+m+2e+C	charged proton	1.00729860893	1.00727647000	0.00002213893
	50/50 mixed protons	1.00727614350	1.00727647000	-0.00000032650

Which is 0.000032% from the observed value (though still outside the stated error of ±0.000000012 u.)

This calculation indicates that there is a high probability that the values obtained for the observed proton are a mix of both the charged and uncharged states, if the *Reciprocal System* is correct. Back calculating for this set of data, the proton sample would be 50.72668125% charged, and 49.27331875% uncharged (which reproduces the observed value exactly.)

Rethinking Neutrinos

Considering how close Larson's calculated values are to the observed values for other subatomic particles, it seems incongruous that both the muon and electron neutrinos should have such enormous error. In checking into the mass measurement procedure, I found that the observed values for both neutrinos *should* be correct, and concluded that there may be conceptual problems in Larson's interpretation of mass for these two particles.[7]

Muon Neutrino (massless neutron) Mass

The logic Larson uses to determine mass is, "The massless neutron [muon neutrino], the M ½-½-0 combination, has no effective rotation in the third dimension, but no rotation from the natural standpoint is rotation at unit speed from the standpoint of a fixed reference system. This rotational combination therefore has an initial unit of electric rotation, with a potential mass of 0.00057850, in addition to the mass of the two-dimensional basic rotation, …"[8]

As I understood the convention, a displacement of zero means a scalar value of unity—uniform motion, the natural datum. If "no rotation from the natural standpoint" is "rotation at unit speed" with potential mass, then every location not occupied by matter should exhibit a mass of "e," that of the electron or positron. This is not observed, and I submit that no rotation in any dimension is exactly that, *no rotation*, and *no potential mass*. Thus, since the muon neutrino has no rotation in the 3rd dimension, it contributes no mass to the particle.

Secondly, when Larson adapts the ½-½ convention over the 1-0 convention for the description of the massless neutron, he states, "If the addition to the rotational base is a magnetic unit rather than an electric unit, …" and "… half units do not exist, but a unit of two-dimensional rotation obviously occupies both dimensions."[9]

This makes the massless neutron, or muon neutrino, the two-dimensional version of a positron, having a single, two-dimensional temporal rotation instead of a single, one-dimensional temporal rotation, not

7 Text incorporated into this article from "Subatomic Mass, Recalculated, Update," *Reciprocity* XXV, #2 (Autumn, 1996), page 25.
8 *Nothing But Motion*, *op. cit.*, page 165.
9 *Ibid.*, page 141.

necessarily occupying both dimensions, but *distributed* over both dimensions, and resulting in the appropriate ½-½-0 notation.

Since $1^2 = 1$, the applicable mass is "e," not "p+m." And because this mass is distributed over two dimensions, the potential mass for the muon neutrino is e/2.

The new calculated mass is therefore e/2 times the conversion factor of natural units to unified atomic mass units (nu->u):

$$\begin{aligned}\frac{e}{2}\times(nu\rightarrow u) &= \frac{0.00057870}{2}\times 0.999706441403 \\ &= 0.00028926691\,u\end{aligned} \tag{2}$$

Or, approximately 0.26945 MeV. Comparing to the observed value of "less than 0.27 MeV (CL = 90%)," is as close to perfect as can be expected, given the uncertainty of the observed value.

Electron Neutrino Mass

The electron neutrino, ½-½-(1), is the muon neutrino with an additional 1D spatial (electric) rotation. This gives the particle no net motion, and hence no potential mass. Larson indicates, "But since the electric mass is independent of the basic rotation, and has its own initial unit, the neutrino has the same potential mass as the uncharged electron or positron, 0.00057870."[8]

I disagree with this statement for the neutrino. It may be true for the "p+m" mass conditions, but here we have "e-e," akin to a stable positron-electron combination due to the additional rotation in time on the positron component, and hence is massless.

But, the electron neutrino does have an observed mass of 5.1 eV. The measurement process deals primarily with charged particles and I believe this observed mass is the mass due to the interaction of a charge on the neutrino with the charge on the atoms of the detector.

The charged neutrino has a mass of "c," the normal electron charge. The charge of atoms in the detector have a mass of "C," the mass of normal charge. Their interaction will be "C+c" (where "c" is positive, because we are on the same side of the unit boundary).[10]

Because charge is an effect of a "third region,"[11] the charge needs to be brought across the unit boundary to measure the mass effect. This is a relation similar to "equivalent space," and results in the effect being the square of the value, "$(C+c)^2$."

The observed electron neutrino mass, due to charge interaction, is:

$$\begin{aligned}(C+c)^2\times(nu\rightarrow u) &= (0.00004494+0.00002996)^2\times 0.999706 \\ &= 0.0000000560\,u\end{aligned} \tag{3}$$

Or, approximately 5.21 eV. The observed value is 5.1 eV, again, extremely close to the calculated value.

Updating Table 2 with these computations, and replacing "massless neutron" with "muon neutrino," yields the results:

10 *Ibid.*, page 164.
11 *Ibid.*, page 163.

Composition	Particle	Calculated	Observed	Difference
$(C\text{-}c)^2$	neutrino	0.00000000561	0.00000000548	0.00000000014
e/2	muon neutrino	0.00028935185	0.00028985684	-0.00000050499

Noting that in the calculations, “c” is negative, so to C+c = C-(-c). Updating Table 4 with these additions:

Composition	Particle	Calculated	Observed	Difference
$(C\text{-}c)^2$	neutrino	0.00000000561	0.00000000548	0.00000000013
e/2	muon neutrino	0.00028926691	0.00028985684	-0.00000058993

Conclusion

After compensating for differences in measuring systems, the Reciprocal System’s 1959 calculations of mass agree quite closely with the 1993 observed values.

The observed proton appears to be a near-even mix of charged and uncharged protons. If this is actually the case, other measurements may also be adversely affected, such as electric dipole moments or polarization.

Because physics does not recognize the charged and uncharged states of subatomic particles, observed values may become increasingly unreliable, tending to be more of a statistical distribution than a direct measurement. This will undoubtedly play havoc with any proposed unified system of theory.

The mass effects of the structure of neutrinos appear to be conceptually incorrect as presented in *Nothing But Motion*.

1. The mass of the muon neutrino (massless neutron) is one-half of the electric mass, being distributed over two dimensions, and having a mass of 0.27 MeV.
2. The mass of the electron neutrino is zero.
3. The observed mass of the electron neutrino is due to the interaction of a charged electron neutrino with a charged atom in the detector instrumentation, producing an apparent mass of 5.2 eV.

It would be interesting, however, if someone familiar with particle measurement techniques could examine the process of determining proton mass, and propose a method to eliminate either the charged or uncharged protons in the sample. The results should precisely match the values obtained from the *Reciprocal System*, when corrected for unified atomic mass. This could lead to the acceptance of the charged and uncharged states of subatomic particles (of the proton at least), and maybe even an objective look at Larson’s work.