PROBABLE SYNTHESIS OF PROTONS FROM MUONS

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Starting from three equal but unknown energy / mass fermions (Q), each carrying a unit positive or negative elementary charge, the electromagnetic potential energy of their attraction (E_{pot}) has been utilized to forge them into proton: $Q^+, Q^-, Q^+ (E_{pot}) \rightarrow q^+: q^-: q^+$ (p). This study employs the equal assimilation of the attractive energy by the three Primary or the starting fermions to convert them by compression into the Forged fermions (q) which constitute the proton. The value of the mass / energy deduced for the Primary fermions (Q = 204 e), equivalent to the mass or energy of 204 electrons, strongly supports my earlier suggestion for the candidacy of the well-familiar Muons (207 e) for forging them into protons. The present report also examines the viability of a triangular structure for proton.

I recently analyzed three alternative schemes for the forging of protons by harnessing the attractive electromagnetic potential energy (E_{pot}) of the oppositely charged so called quarks:

$$Q^+, Q^-, Q^+ (E_{pot}) \rightarrow y^+: z^- : y^+ \text{ (p)}$$

According to the arguments and analysis developed in that study [1], the mutual attraction of the contiguous interacting partners compresses them, adding energy and bringing them even closer, thereby further increasing the energy of their interaction. Eventually, the compression comes to a halt when the reaction to compression counterbalances the total attraction in the forged proton.

In the previous schemes or models, the total attractive energy was assumed to be shared unequally between the flanking (y) and the central (z) quarks, because the central member is being squeezed from both sides. The values of the primary quarks (Q = 193.845 e or 196.98 e) deduced in two of the model schemes suggested that the well familiar muons (207 e) could be playing the role of the alleged and illusive quarks.

The present study evaluates the feasibility of forging protons by the equal sharing of the total attractive energy among the three partners, which renders the three forged quarks (q) equal in all respects: energy content, their size or the reduced wavelength (r_q), the amount of compression, the $q^+: q^-$ attractive forces, etc., except the opposite charge of the one member:

$$Q^+, Q^-, Q^+ (E_{pot}) \rightarrow q^+: q^-: q^+$$

In accordance with the earlier arguments and the quantum restraints for the energy, mass, and other parameters of these simple fermions ($\mathbf{m_q c r_q = h/4\pi = \hbar/2; m_q c^2 = \hbar c/2r_q; r_q = \hbar c/2m_q c^2}$), the attractive energy of each $\mathbf{q^+, q^-}$ interaction in the forged proton is given by $\mathbf{E_{pot} = \hbar c/2r_q = m_q c^2 = q}$, where the particle's symbol q also stands for its energy content [2]. Thus, the total energy (2q) of two such interactions is being shared equally and assimilated by the three primary quarks (Q), leading to the forged proton $p = q^+: q^-: q^+$.

Hence, Q + 2q/3 = q, affords the value of the **forged quark q = 3Q.**

As the proton (1836 e) is composed of three forged quarks (3q), each **q = 612e**, which provides the energy content of the **primary or nascent quark Q = q / 3 = 204 e.** Consequently, the major portion of the forged proton's mass, equivalent to the mass of 1224 electrons (1224 e = 2 q), is contributed by the attractive potential energy of the oppositely charged building blocks.

Incidentally, the mass of the **forged quarks** deduced here (**612 e**) corresponds to some of the early guesses for the quark masses during the infancy of the "Quark Hypothesis", presumably based on an equal division of the nucleon mass among the three partners. Speaking about a quark's mass does not make much sense these days, because several new members and numerous special attributes have been added to the original modest list. Presently, the highly sophisticated disciplines, such as the Standard Model and the Quantum Chromo Dynamics (QCD), elaborate on the classification and interactions of quarks based on their colors, flavors, charge, and other esoteric properties [3].

The above small detour was deemed necessary to point out that QCD invokes the **Current, bare, or naked quarks**, which are then *clad* by the propitious **gluon field** to convert them into the **Constituent quarks** to furnish the composite particles [3]. Thus, the roles played in QCD by the **naked quarks** and the **constituent quarks** correspond, in my studies, to the respective roles played by the **Primary (or nascent) quarks** and the **Forged quarks**. In these unconventional and very low-tech schemes, **the attractive electromagnetic potential energy plays the role of gluons!**

Apparently, this proposal is a blunder that flies right in the face of the legitimate physics. After all, it is well known that the mainstream physicists long ago rejected any role for the EM forces in the syntheses of the nucleons and for binding them in the nucleus, because these forces are estimated to be puny or insignificant for these mighty tasks. Instead, the **Strong Force** hypothesis has taken over the care of these extraordinary matters. Thus, my proposal to harness the attractive electromagnetic potential energy of the oppositely charged particles to forge protons is really far out from the accepted physics and demands some justification.

Although the necessary justification and explanations have already been offered [4], I shall do it again briefly. In the first place, the elementary building blocks employed in my schemes are fermions with a unit charge, instead of the fractional values (1/3 or 2/3 of e) expediently attributed to the hypothetical quarks, which further weaken the conventional elementary charge interaction by a factor of 1/9, 2/9, or 4/9, depending on the charges of the interacting quarks.

In the second place, as these fermions are assimilating extra energy by the mutual compression of their **EM field structure**, thereby shrinking their reduced wavelength (r) to conform with their new total energy and in accordance with the quantum restraints (**$r = \hbar c/2E_0$**), I employ the compound constant ħc ($3.1653819 \times 10^{-17}$ erg-cm) for their EM interaction, because this constant determines the energy and other quantum parameters of the EMR and the elementary Fermions.

Fortunately, it turns out that ħc is 137 times stronger than the conventional elementary charge interaction ($e^2 = 23.1 \times 10^{-20}$ erg-cm or dyne-cm^2) and thus corresponds to the estimated superiority (~100) of the Strong Force over the conventional EM interaction. Incidentally, the compound constant ħc is no stranger to the professional physicists, as it also represents the value allotted to the postulated **Planck charge** (q_p) interaction: $q_P{}^2 = \hbar c = e^2/\alpha$, where α is the familiar Fine Structure Constant or the Coupling Constant of Electromagnetic interaction.

*Thus, I would like to highlight here that while **ħc** corresponds to the charge interaction of the **EMR** and **fermions** with the **Internal Medium (or field)** of their respective EM structures, **e^2** represents the interaction of **the manifest charges** in the **External Medium***. And, of course, the above mentioned Fine Structure Constant (α) connects the one to the other [5].

Now just check it for yourself: The energy content of photons (EMR), despite their overall neutral charge, is given by $E = \hbar c/r = hc/2\pi r = hf$. But when a photon with an energy above the threshold value is subjected to the pair production (e^+, e^-), the threshold energy is split into the two halves and any excess goes towards the respective kinetic energy of the pair. Moreover, it is very important to note that the spin of the photon (ħ) is also split into two halves. Consequently, the rest mass energy (E_0) of the half spin (ħ/2) fermions is given by $E_0 = \hbar c/2r$, where r *represents the reduced wavelength of the progenitor threshold-energy photon and also that of the resulting fermions*.

After this brief apology and returning to the forging scheme analyzed in this report, it is very gratifying to note that the deduced value of the starting fermions or the **Primary quarks (Q = 204 e)** is so close to the known rest mass / energy of muons (207 e). And I would like to add here that the balance of extra energy (rest mass + any kinetic energy) from the three starting muons provides the kinetic energy of the freshly minted protons.

This close resemblance of the alleged quarks with the well-known and almost ubiquitous muons is of great significance concerning the probability and ease of their conversion into protons, because the three particle encounter is among the equal energy muons, which are expected to be generated under the same energy environment. Moreover, the forging agent employed in the present case as well as in my earlier study is the well-known electromagnetic attraction among the oppositely charged particles – *albeit under the very special conditions of being in boundary contact with each other, as explained and justified earlier above*, rather than the revolving partners at a distance from each other.

On the other hand and in a very sharp contrast, the almost miraculous encounter of three fleeting quarks, having unequal energy content (up quark = 3.33 – 6.46 e; down quark = 8.02 – 11.35 e) and thus produced under very different energy environments – *even without counting the profusion of their colors and flavors - , plus the added variables of the eight varieties of "gluons"* [3], has all the elements of a supernatural happening!

Well, these arguments about the comparative ease of muons encounter, under the proper energy density conditions, bring to mind the possibility of such encounters among the high energy photons, having at least the threshold energy for the production of muon pairs, which could thus directly lead to the synthesis of protons.

Finally, further examination of the present scheme, involving equal energy starting partners (Q = 204 e or muons = 207 e) and also the equal energy forged quarks (q = 612 e), reveals possible flexibility for their configuration during the forging process and also in the structure of proton, because deviations from the linear set up become feasible. Let us investigate if it is really possible.

In the linear arrangement, the centers of the contiguous (or 1, 2) quarks are $2r_q = d$ apart, while the 1, 3 quarks' distance is twice this amount ($2\ d = 4\ r_q$). Therefore, the 1, 3 repulsive force is just one fourth (1/4) of the each attractive component.

Now consider any triangular configuration, where the external q^+ and q^+ each subtend an angle of theta (θ) degrees with respect to the linear structure. The 1, 2 (q^+, q^-) separation (d) stays constant, thus preserving the values of their EM force (**$F = \hbar c/d^2$**) and potential energy ($E_{pot} = \hbar c/d$). However, each attractive force (F) now splits into the two components: **F cosine θ and F sine θ.** While the sine vectors tend to restore the linear set-up, the cosine forces try to bend it and *bring together the 1, 3 similarly charged (q^+, q^+) partners!* From 0^o to just below 45 degrees the cosine θ dominates over the sine θ, at 45^o both functions are equal (√2/2), and above 45^o sine θ wins the race: $F \cos 30^o = F\sqrt{3}/2$; $F \sin 30^o = F/2$; $F \cos 45^o = F \sin 45^o = F\sqrt{2}/2$;

$F \cos 60^o = F/2$; $F \sin 60^o = F\sqrt{3}/2$.

q^+ --→-- q^- --←-- q^+

←(q^+)→ ←(q^+)→

These trigonometric facts might induce one to think that there could be some kind of truce at 45^o. Therefore, let us now bring in the 1, 3 repelling partners. The 1, 3 separation, which amounts to just 2 d in the linear structure, is now governed by 2d cos θ and evidently varies according to the angle θ, thereby influencing both the force and E_{pot} of the q+, q+ repulsion. Thus, the 1, 3 repulsive force, which in the linear structure equals F/4, is given by $F/4 \cos^2 \theta$ in the triangular configuration. Consequently, the two opposing vectors will be equal when F cos θ = F/4 $\cos^2$ θ or $\cos^3$ θ = 0.25, which gives cos θ = 0.63 and leads to θ = 50.95°. Now let us compare the values of this repulsive force with the respective values for the attractive (bending) vectors at just four different angles:

Angle θ:	30°	45°	50.95°	60°
F cos 30°:	0.866 F	0.7071 F	0.63 F	0.5 F
F/4 $\cos^2$ θ:	0.333 F	0.5 F	0.63 F	1 F

Thus, it is verified that the approximation of the positively charged 1, 3 fermions is possible up to 50.95°, when the opposing vectors become equal and the repelling members are at the corners of a triangle, separated by a distance of 2 d cos 50.95° = 1.26 d. ***Well, this description of the forged proton looks very much like the familiar picture of the three quarks in the proton structure*** [3]!

However, this rosy picture is somewhat spoilt when we recall that in the above analysis the restoring action (torque) of the two F sin θ vectors has been neglected. Therefore, let us compare the respective torques of the different vectors:

The **Restoring torque**, 2 F sin θ x d cos θ = **2F x d sin θ cos θ**;

The **Bending torque,** 2 F cos θ x d sin θ = **2F x d sin θ cos θ**;

And the **Repulsive torque** = 2 (F/ 4 $\cos^2$ θ) x d sin θ = **F x d sin θ/2 $\cos^2$ θ**.

Well, the Restoring and the Bending torques are equal at all angles and thus favor neither the linear nor the triangular structure. But the ever present Repulsive torque, though having negligible values at small angles, makes it difficult to conclude emphatically in favor of the above triangle.

On the other hand, the two opposing forces **F cos θ** and **F/4 $\cos^2$ θ** and especially their resultant value (**F cos θ** - **F/4 $\cos^2$ θ = Δ**), undergo great variations with θ and the distance (2d cos θ) between the 1, 3 fermions, as can be verified by the values tabulated below:

Theta (θ):	0°	15°	30°	45°	50.95°	60°
d cos θ; (A):	2 d	1.9318 d	1.732 d	1.4142 d	1.26 d	1 d
F cos θ; (B):	1 F	1.9318 F	0.866 F	0.7071 F	0.63 F	0.5 F
F/4 $\cos^2$ θ; (C):	0.25 F	0.2679 F	0.333 F	0.5 F	0.63 F	1F
(B - C) = Δ:	0.75 F	0.6639 F	0.533 F	0.2071 F	Zero F	-0.5 F

As expected, the distance (A) between the 1, 3-fermions and also the attracting vectors (B) are decreasing with the increase of the bending angle (θ). On the other hand, the 1, 3-repulsive force (C) is increasing with the increasing θ but the decreasing distance 2d cos θ, which forms the denominator of the force formula used for the derivation of the expression C. **Consequently, the net attractive force (B - C = Δ) between the 1, 3 partners becomes weaker with the decrease in their distance and actually becomes zero when they are separated by 1.26 d, at θ = 50.95^{o}. Trespassing this limit, results in net repulsion.** This observation coupled with the other trends noted in the above Table, remind us of the so called **Asymptotic Freedom** and its related attributes described by the Quantum Chromo Dynamics [3, 6]:

"The concept that strong interaction becomes weaker at short distances. More specifically, effective color charges, which govern the power of the strong interaction, become smaller at short distances…-".

In conclusion, it is very satisfying to verify that, without any prior knowledge about the real identity of my building blocks, the energy / mass of the Primary fermions (Q) deduced in the present study (Q = 204 e) further supports my earlier proposal for the candidacy of the well-familiar muons for forging them into protons. Thus, the total now amounts to 3 out of 4 (75%) analyzed model schemes in favor of the muons. Let us now wait and watch for the decisive verdict of the experimental physicists.

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References and Notes

1. Mahajan, Jaswant Rai. THE COSMIC FORGING OF PROTONS BY THE ELECTROMAGNETIC COMPRESSION OF QUARKS: vixra.org/pdf:1207.0086.
2. The described parameters apply only to the simple or elementary fermions, such as electrons, muons, quarks, etc., but not to the composite fermions: protons, neutrons, and other baryons.
3. The Google search and especially the Wikipedia links provide useful information and the original references on all the topics discussed in this report.
4. Ref. 1, especially p. 3, "The Forging Process and its Requirements".
5. Verification of the use of ħc in other Strong Force interactions and in the nuclear binding could be very instructive, but is beyond the scope of the present report.
6. Wilczek F. The Lightness of Being – Mass, Ether, and the Unification of Forces. Basic Books, New York, 2008. *The verbatim quotation is from Glossary, page 222*.