

“NETWORK CHARGE” INTERPRETATIONS OF THE STANDARD MODEL OF PARTICLE PHYSICS INCLUDING INSIGHTS ON QUANTIZED CHARGE, FIRST SPECTRAL LINE OF HYDROGEN (i.e. RYDBERG UNIT OF ENERGY), PROTON /NEUTRON MASS, NEW THEORIZED PARTICLES RELATING TO GLUON-LIKE DARK MATTER, QUANTUM GRAVITY, A 5TH FORCE, AND A NEW THEORY - GENERAL PROJECTIVE RELATIVITY (GPR)

Thomas Preusser

tompholmen@gmail.com

In mid-2016 scientists at the Large Hadron Collider (LHC) announced that a possible new subatomic particle beyond the Higgs in mass/energy at $750 \text{ GeV}/c^2$ went statistically unconfirmed at new higher collider energies. This paper offers new theoretical concepts predicting a gluon-like dark matter subatomic particle, called the netwon, at $750 \text{ GeV}/c^2$. Since dark matter is “dark”, it is detected even more from inference than from actual observation. Moreover, particles with fractional “network charge”, a new theoretical concept developed in this paper, seem observationally troublesome because of variability. This includes neutrinos, gluons, and the new $750 \text{ GeV}/c^2$ particle. The new Electron-Ion Collider (EIC) is proposed in part to deal with these troublesome variabilities. **Therefore the hunt at $750 \text{ GeV}/c^2$ at the LHC should continue, but modified with this new theoretical basis to be more inferential.**

The initial announcement of a possible particle at $750 \text{ GeV}/c^2$ triggered hundreds of papers relating to the new particle’s properties and ramifications. The following is a sampling of particular papers which share common ground with this paper. Paper arXiv:1604.05319 New Forces And $750 \text{ GeV}/c^2$ Resonance (M.Duerr, F. Perez, J. Smirnov) discusses new vector-like heavy quarks and a new 5th force. Paper arXiv:1604.01127 A Visible QCD Axion From An Enlarged Color Group (T. Gherghetta, N. Nagata, M. Shifman) discusses a model having new vector-like heavy quarks, axions, gluons, and dark matter. Paper arXiv:1603.08913 A $750 \text{ GeV}/c^2$ Graviton From Holographic Composite Dark Sectors (A. Carmona) discusses a 5D model having spin-2 dark matter connected to ordinary matter via vector resonance. Paper arXiv:1603.05574 Theoretical Interpretation Of A Spin-Two Diphoton Excess (V. Sanz) discusses a spin two resonance aka graviton that couples to two standard model particles and infers holography. In general the hundreds of arXiv papers following the initial $750 \text{ GeV}/c^2$ announcement mostly tried to extend current QCD mathematics to explain the $750 \text{ GeV}/c^2$. These explanations fall short of dealing with the networked processes at $750 \text{ GeV}/c^2$. This paper comes at $750 \text{ GeV}/c^2$ from a higher level networked complex adaptive systems perspective. Ultimately this involves a new concept, **Network Charge**, new predicted **Axion**

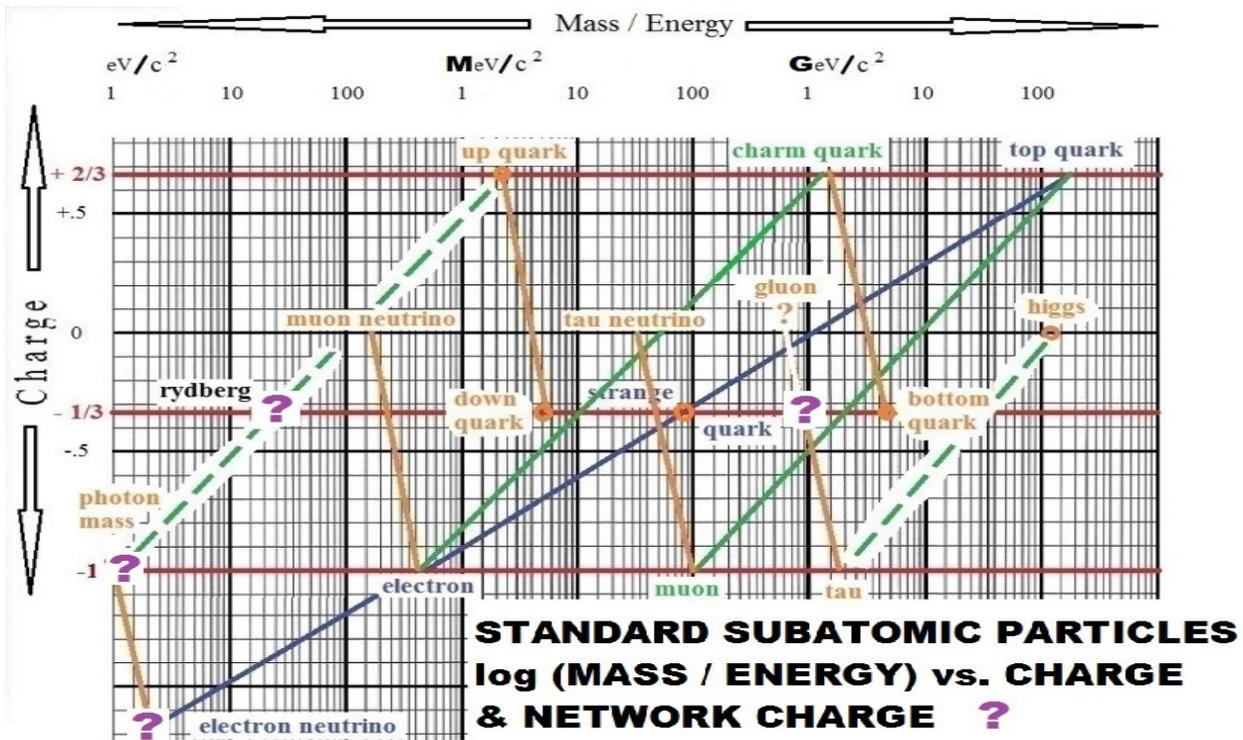
and **Netwon** particles, and a new theory, **General Projective Relativity (GPR)**, which is based on probabilistic computational entanglement in a projection geometry that goes beyond holographic and ultimately offers promise in furthering scientific knowledge across a wide spectrum including dark matter and dark energy.

The Standard Model of particle physics essentially denotes the particle components (quarks, leptons etc.) and properties (mass, charge etc.) of ordinary matter. Ordinary matter constitutes some 4.9% of the total energy allocation of the universe, with some 26.8% being dark matter and 68.3% dark energy. The current scientific paradigm of using high powered mathematics, usually in the context of matrix formulation or string theory, to make predictions with subsequent observational verification, is stymied because that which is “dark” cannot be “observed” and is primarily “inferred” from a connectedness to other phenomenon such as galactic rotation rates or cosmic light redshift.

Thus the Standard Model of particle physics, and the current scientific paradigm, while big successes, have issues that need to be addressed hence this scientific paper, which attempts to address some of these issues. Those issues are:

1. Neutrino oscillation and mass are not adequately incorporated into the Standard Model.
2. The rationale for the value of some masses that are networked, such as neutrino mass and proton / neutron mass, are not conceptualized nor adequately linked to photon spectra or gluon processes that ultimately lead to a surfeit of ordinary matter in the universe not totally annihilated by antimatter processes.
3. The Standard Model does not provide a theory for **quantum gravity** in the context of having a particle boson mediating gravitational force, i.e. graviton.
4. The Standard model does not unite all four forces, EMF, WNF, SNF, nor gravity in what is called a **Theory of Everything, or TOE**.
5. In the context of a very large issue that extends beyond the Standard Model to all of physics, there is no theoretical framework for understanding dark matter and dark energy while linking up with what we already know about ordinary matter, for which a new entangled computational information theory **General Projective Relativity (GPR)** explaining progression to complexity is proposed.

Subatomic particle mass/energies vary greatly. This points to mathematics at a logarithmic scale and hence this paper uses the following semi-log plot of subatomic particle charge versus subatomic particle mass/energy to shed light on the prior listed issues.



The prior diagram, which is at the visual and geometric end of the mathematics spectrum, has a great deal of utility. Isaac Newton realized the utility of such diagrams, and had well over 200 such visual and geometric diagrams in his seminal book *The Principia*.

“Therefore geometry is founded in mechanical process, and is nothing but that part of universal mechanics which accurately proposes and demonstrates the art of measuring.”

Quote from Isaac Newton’s book *The Principia*

The colored lines in the prior diagram “project” a networked charge - mass / energy interconnectedness. I introduce here the term “projective geometry”. The mathematics of “projective geometry” is at a high visual mathematical level. The advantage of this is it is less computationally complex, and concepts are easier to grasp with simple visuals. “Projective geometry” is the study of geometric properties, some aspects of which are invariant under spatial projective transformations. The aspects which are invariant involve the relative “entangled” interconnectedness of points in a given geometry, i.e. the points remain connected despite changes in distance, angle, and orientation of connection. In this case the given geometry represents an informational semi-log charge versus mass / energy space.

➤ The projective geometry principles of invariance and constancy of relative “entangled” connectedness underpin vision. Consider for example the ability of human vision to recognize a face even if the face is transformed by reflection in a mirror, or a facial expression, or a given distance or angle or movement, or the process of aging. The combination of the brain’s visual system and two sensing eyes is architected towards constancy and relative “entangled” connectedness. Mathematically this is Group Theory.

First note that the prior diagram has a long blue line starting at the upper right top quark that slants down to the lower left neutrino while passing through the strange quark and electron en-route. In the Standard Model the neutrino has 0 charge so why is it plotted at charge $-1 \frac{2}{3}$ as indicated by the lower left purple question mark? Quite simply the blue line, after passing through the electron at charge -1 takes it there. The most obvious inference is that the extra $-\frac{2}{3}$ charge beyond the electron's -1 charge, call it **"network charge"**, is a networked interconnectedness with charge $-\frac{2}{3}$ antiquark processes symmetrically opposite to the charge $+\frac{2}{3}$ up-quark. **This theoretical concept of "network charge" addresses issue "1" concerning adequate incorporation of neutrino oscillation and mass in the Standard Model**

➤ In the late 1920's physicist Paul Dirac developed much of the mathematics behind current quantization concepts in the quantum world including the concept of antimatter, which at the time was referred to as **Dirac's sea of negative energy**. In this context the prior discussion represents a complementary **sea of negative charge**. One of the main mysteries of the universe is why ordinary matter exists at all, since conservation of energy would dictate that antimatter processes totally annihilate ordinary matter. Theoretically the surfeit of ordinary matter could be due to a nuanced view of antimatter processes as relating to negative time, i.e. the past. In this context antimatter processes would be the start of probabilistic processes that use the past to create the future. Ultimately this evolves into future oriented self-organized complexity (as opposed to entropic randomness). Theoretically the sea of negative charge presented in this paper, driving a networked interconnectedness, could be the reason ordinary matter exists.

Next note the prior diagram has one set of "4" roughly parallel green lines and a second set of "6" roughly parallel orange lines. These lines represent a networked interconnectedness between subatomic particles. Subatomic particle stability is achieved by shedding mass. Thus the "4" green lines in conjunction with the "1" blue line, with their rather steep mass / energy slopes, are the primary pathways for stability via shedding mass. Subatomic particle stability is also achieved by oscillation. Thus the "6" orange lines, with their rather steep charge slopes, are the primary pathways for stability via oscillation. The fact that each set of lines is roughly parallel points to similar underlying processes, shedding mass for green and charge oscillation for orange. From an "entangled" information viewpoint, shedding mass can be viewed as going down in dimensionality whilst charge oscillation can be viewed as going up in dimensionality. From a projective geometry viewpoint, shedding mass can be viewed as bounding position (i.e. projective vanishing point) whilst charge oscillation can be viewed as bounding momentum (i.e. projective vanishing line). From a reflect / rotate viewpoint, the blue and green lines are more rotate dominated and the orange lines are more reflect dominated. **These are all General Projective Relativity (GPR) concepts, a theory which would take an entire book to adequately introduce and are discussed here as needed.**

➤ The terminology and concept of "pathways" as previously discussed are perhaps more familiar to particle physicists as QCD theory flux tubes or "currents". More specifically chiral currents are associated with fermion dynamics (quarks, electrons, neutrino's). These are most akin to the green lines. Vector currents are associated with gluon dynamics. These are most akin to the orange lines. One could also make the case that the green lines

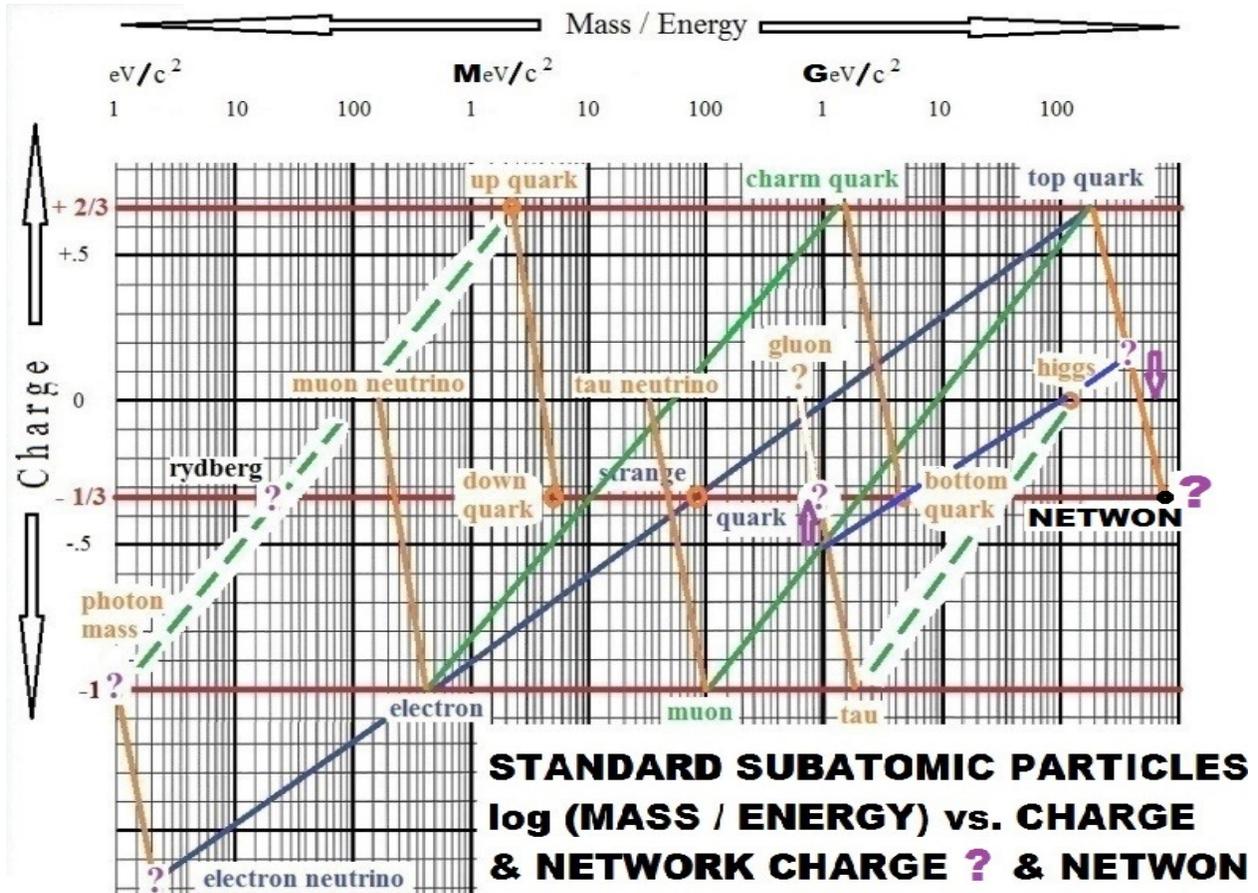
represent pathways associated with the four known forces starting with EMF at the left most green line, then WNF at second green line, then SNF at third green line, and finally gravity at the right most green line, as will be discussed later in this paper.

Notice that there are “3” other purple question marks on the prior diagram in addition to the one at the electron neutrino. In the Standard Model the photon has 0 charge and no mass so why is it plotted (purple question mark) at the lower left at charge -1 with a given albeit small mass? Quite simply this gives us one of the “4” green lines (dashed), and one of the “6” orange lines. The left most dashed green line interconnects roughly through the muon neutrino and up quark. Furthermore at charge $-1/3$ there is an interconnection (another purple question mark) representative of the Rydberg energy constant ($13.6 \text{ eV}/c^2$) and the first spectral line of hydrogen. **In essence “network charges” of $-1 \frac{2}{3}$ for the neutrino, -1 for the photon, and $-1/3$ for first photon / electron quantization, when interconnected to the muon neutrino and up quark, represent a networked pathway for molecular processes. This “network charge” enabled pathway, bounded by the electron and up quark, addresses in part issue “2” concerning conceptualization and linking of photon spectra leading ultimately to the surfeit of ordinary matter in the universe via molecular processes, which represent “entangled” complexity as opposed to entropic randomness.**

There seems to be an anomalous problem at the right of the prior diagram with the networking methodology used thus far in prior discussions. Specifically the tau particle at charge -1 seems to be out there on its own without any networked interconnectedness - might this be another network charge at work? The problem is solved by extending an orange line from the tau particle to the upper left but connecting to what particle? If network charge is at work might this not be a boson such as the gluon? Did we not do the same thing with the photon by connecting it via an orange line to the electron neutrino which gave us a green line connection to Rydberg constant energy, the up quark, and ultimately molecular processes. The gluon has 0 rest mass, 0 charge, and is a source of oscillation giving a networked mass. Extending the orange line to 0 charge, at the orange question mark in the prior diagram, yields no meaningful connections and no network charge. However extending the line to only $-1/3$ charge gives us a line identical in length to that from the electron neutrino to the photon on the left and a $-1/3$ network charge. Moreover the orange line intersection with the $-1/3$ network charge at the purple question mark is at a level indicative of the $938.3 \text{ MeV}/c^2$ proton and $939.6 \text{ MeV}/c^2$ neutron, both of which get most of their mass from gluons. **Thus this fourth $-1/3$ network charge associated with gluons is also part of a networked pathway for molecular processes, and addresses the other part of issue “2” concerning conceptualization and linking of gluon processes leading ultimately to the surfeit of ordinary matter in the universe via molecular processes, which represent “entangled” complexity as opposed to entropic randomness.**

There is still some unfinished business at the tau particle. More specifically if we extend the dashed green line up to 0 charge we arrive at a level indicative of the $125.1 \text{ GeV}/c^2$ Higgs boson which begets mass which begets gravity. Thus since gluon and gravitational processes both have a networked pathway through the tau particle this might be a good place to look for a theory of quantum gravity, which addresses issue “3”. But gravity involves “2” bodies like the earth and the moon - should not there be “2” bodies in quantum gravity?

➤ The strange quark seems to be at the center of everything in the prior semi-log plot, and for good reason. The term “strangeness” was coined to denote particles that were relatively easily created, in pairs, but also exhibited a relative long time delay before decaying into more stable subcomponent particles. Pairing and time aspects are indicative of entanglement and computation of information.



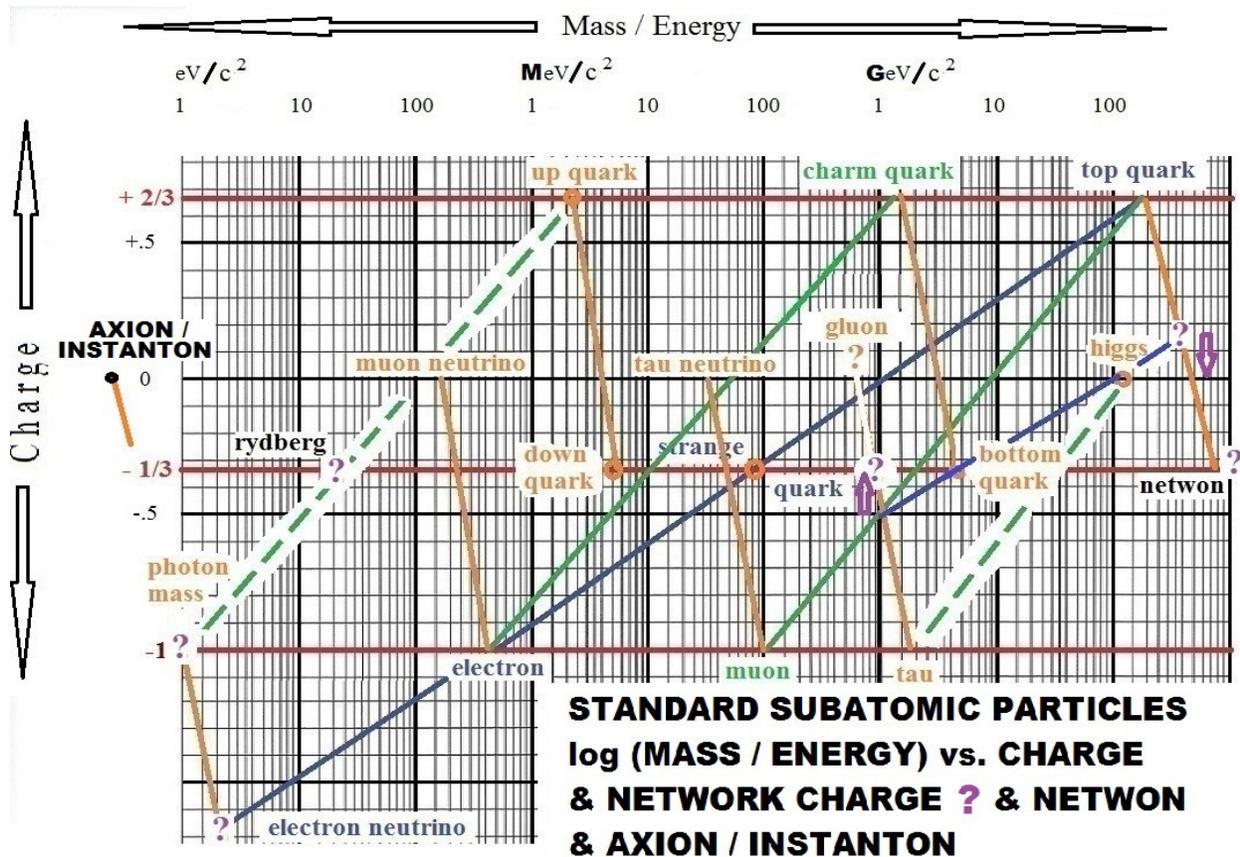
One need only look to the higgs boson in the prior diagram to find “2” bodies. The higgs boson can produce a bottom / antibottom quark “pair”, “2” W bosons, “2” gluons, a tau/antitau “pair”, “2” Z bosons, and “2” photons. Downstream from the higgs boson via a second blue line is the bottom quark. The bottom quark is unique in that it has an entanglement with gluons which mathematically gives it “2” masses depending on the mathematical magic used to deal with problem infinities. Continuing down the second blue line from the bottom quark to charge -.5 gets us to a busy intersection where blue line meets green line meets orange line. There is only one other busy intersection like this and that is at the electron. Serendipitously the busy charge -.5 intersection is -.167, or minus 1/6th charge, below the gluon/proton mass/neutron mass purple question mark as indicated by the purple arrow. The proton/neutron molecular nucleus has “6” oscillating quarks which fits this -.167, or minus 1/6th charge differential, as well as the fact there are “8” types of gluons “2” of which are associated with the higgs, leaving “6” for the purple question mark intersection. The -.167 appears to be another network charge. Thus there are two “busy intersections” involving network charge, one at the first blue line going to the electron and another at the second blue line going to the proton/neutron molecular nucleus via a -.167 network charge oscillation.

It seems there could be another problem in the prior diagram at the upper right top quark. Specifically, if the electron neutrino at lower left has an orange line connected to it could not the top quark also have an orange line connected to it as well? Serendipitously when we do this we get a new orange line that at a **network charge of $-1/3$, the same as that for the gluon, we can theorize a new particle I will call the “netwon” at roughly $750 \text{ GeV}/c^2$. Notice that the intersection of the second blue line with the new orange line is at a charge of $+0.167$ as indicated by the new purple arrow. This mirrors the -0.167 network charge at the gluon and represents a related but opposite process. Since gluons “glue” together subatomic particles, “netwons” probably also “glue” things together, but at a cosmic level. Could this “netwon” underlie gravity? Yes! Could this “netwon” underlie ordinary matter and dark matter? Yes! This addresses issue “3” concerning quantum gravity in the context that gravity is more of a network “glue” property than a particle property and is complementary to gluon “glue”.**

Current dark matter hypotheses contain both dark matter and what is termed “cold” dark matter. Dark matter is matter arising from top down, i.e. higher energy processes such as on the right of the prior semi-log plot. Conversely “cold dark matter is matter arising from bottom up, i.e. lower energy processes which would be on the left of the prior semi-log plot. If the “netwon” on the right of the semi-log plot is behind dark matter top down higher energy processes might there not be another particle in the semi-log charge versus mass / energy diagram behind subatomic cold dark matter bottom up lower energy processes? Two such particles have been hypothesized, the “axion” and the “instanton”.

The “axion” is a hypothetical particle similar to the higgs that has been hypothesized to solve what is termed the strong CP problem of quantum chromodynamics theory (QCD) which deals with gluon processes such as already discussed towards the right of the charge versus mass / energy semi-log plots, or what could termed the top down higher energy dark matter side of the semi-log plot. There are two very interesting “axion” aspects that connect it to network charge processes to the left of the semi-log diagram. First of all neutrinos also have a major theoretical problem, a symmetry problem, in that only left handed neutrinos have been observed. Secondly “axions” can theoretically produce photons when in a rotational magnetic field, such as the rotational dominated green line at the plotted photon represents.

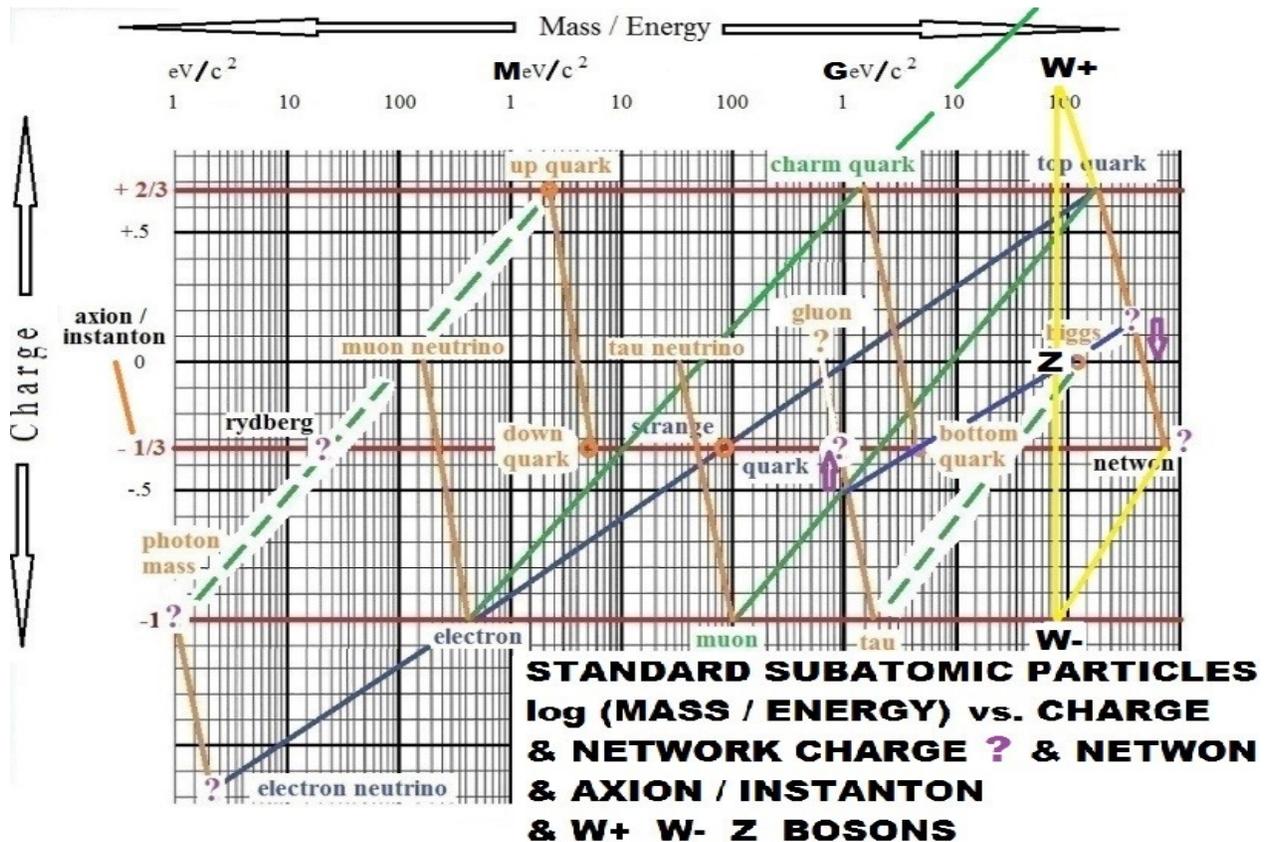
The “instanton” is a hypothetical particle that comes out of mathematics dealing with pathing including the possibility of tunneling (i.e. wormhole effects). There is one very interesting “instanton” aspect that connects it to network charge processes to the left of the semi-log diagram. “Instanton” mathematics can lead to photons having mass (such as in the semi-log plot) when coupled with a scalar field (such as “axions” might represent. Based on the prior discussion an “axion” / “instanton” has been plotted on the far left of the following semi-log plot at charge 0.



As mentioned previously the “4” green lines can be associated with the “4” known forces electromagnetic (EMF), weak nuclear (WNF), strong nuclear (SNF, and gravity (G). More specifically the leftmost dashed green line starting naturally at the photon can represent EMF. The second green line starting naturally at the electron can represent WNF. The fine structure constant α , which is related to the strength of electroweak binding (i.e. electromagnetic force EMF and weak nuclear force WNF) is only constant at and below the energy scale of the electron. Starting at the electron, the strength of electroweak binding increases logarithmically with energy scale until it unifies strength-wise with the strong nuclear force SNF. In terms of the prior diagram this infers the long blue line is associated with the fine structure constant α . This also infers there is another constant associated with the shorter blue line on the right, and this is probably the gravitational constant G which would be explanatory of the gravitational force falling off logarithmically until it is very weak at the energy scale of the molecule.

The third green line intersecting naturally at the gluon can represent SNF. The rightmost dashed line intersecting naturally at the higgs and networked with gluon and netwon processes can be linked to gravity. The long blue line is associated with EMF and WNF whereas the short blue line is can be linked with SNF and gravity. The networked pathways between the two blue lines therefore represent the unification of all “4” forces, sometimes called the Theory of Everything or TOE, thereby addressing issue “4” In this sense this is not a simple single unification, but rather a complex networked unification.

Some readers may have noticed the W and Z bosons have not been plotted thus far. When this is done as in the following semi-log plot in yellow some interesting aspects present themselves. First of all the “netwon” is connected to the W+ by what amounts to an orange slope line and the W- by what amounts to a green slope line. **If green lines represent force this then is a 5th force that is associated with the “netwon”.** Some theorists posit a 5th force that is related to hypercharge. This seems to connect “network charge” from all prior discussions with hypercharge which is in turn linked via quantization/conservation frameworks with strangeness, charm, bottomness, topness, and baryon number. W bosons are mediators of neutrino absorption and emission. The fact that there is a yellow line extension of +1/3 charge up to W+ from the “netwon” symmetrically links W+ to the electron neutrino at the bottom left. The fact that there is a yellow line extension of -2/3 charge down to the W- from the “netwon” symmetrically links W- to the muon neutrino and tau neutrino towards the top left. There also appears to be a +1/3 charge from W+ up to an intersection with the green line representing the weak nuclear force (WNF). **This links W+ and W- to electron neutrino, muon neutrino, and tau neutrino in what looks like a networked oscillation. Moreover these yellow line pathways to W+ and W- from the new 750 GeV/c² particle are perhaps a means for the LHC to inferentially detect the new particle.**



In the prior diagram one could also make a case for a line connecting the dual aspect higgs at the upper right to the photon plotted in the lower left (i.e. diphoton processes) thru the strange quark, which is of course involved in producing particle pairs. **All the prior discussion from network charge to “netwon” to “axion” to “instanton” to TOE addresses issue “5” concerning a theoretical framework for understanding dark matter and dark energy while linking up with what we already know about ordinary matter. Furthermore, this**

theoretical framework follows from an even larger theoretical framework based on a new entangled computational information theory General Projective Relativity (GPR) explaining progression to complexity. General Projective Relativity (GPR) represents a new way of thinking (i.e. paradigm), and ultimately led to this paper.

➤ Substantive theories typically generate a flurry of scientific activity because they raise many if not more questions than they answer. The following discussion pertains to what some of that scientific activity might be. If the universe has network “glue”, theories of multiple universes could be supplanted by theories where a universe processes iteratively in object/image fashion in much the same way a molecular nucleus has proton/neutron processes which ultimately drive molecular complexity. Thus in a network “glue” universe what is driven is universe complexity. If photons exhibit Lorentz covariant bound states (i.e. spooky action at a distance) and in the context of prior discussion are part of networked molecular processes, might not neutrino’s and gluons also have this property since photons, neutrinos, and gluons have network charge? If neutrinos apparently oscillate between their electron neutrino, muon neutrino, and tau neutrino versions and the electron neutrino has network charge might not the muon neutrino and tau neutrino have network charge and might this not be networked with color charge gluon molecular processes? This all leads to the big supposition that networked molecular processes create information forever entangled independent of space and time.

Acknowledgements:

M. Duerr, F. Perez, J. Smirnov arXiv:1604.05319

T. Gherghetta, N. Nagata, M. Shifman arXiv:1604.01127

A. Carmona arXiv:1603.08913

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