Some unifications needed in Particle Physics

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Abstract

The current crises in Elementary Particle Physics requires a few new unification ideas: fermions and bosons, leptons and quarks, spin-parity and flavor etc. in order to resolve several problems in fundamental physics. Some possibilities involving some well known mathematical models are suggested and a few questions are raised.

By now it is clear that the four fundamental interactions of the Standard Model can be related at low energies, with a natural change of viewpoint regarding what quarks are and replacing the pointwise particle concept, beyond String Theory, with that of qubit as a basic state, at the level of Quantum Computing.

Understanding the role of the neutrino is also a recognized major point of today's Physics.

1 Introduction

There is a "grand divide" between Particle Physics and Cosmology, and corresponding scientific communities and approaches, e.g. QFT vs. GR; but "As above so bellow" ...

Understanding Gravity is at the core of the development of the Standard Model, from which Cosmology will benefit too.

Previous articles of the author documented that Gravity, beyond Newton-Einstein, is of a quantum origin, due to the quark structure of nucleons [6, 4, 19] and nuclear spin-spin interaction. This was initially understood intuitively [13], based on a Platonic symmetry of qubit space / quark states (Quantum Computing paradigm) and then confirmed by previous theory and experiments by Alzofone, and extensive observations of alternative space travel technology. Further confirmations come from experiments of E. Podkletnov, Ning Li etc. [7].

Additional arguments why Gravity is not a classical force (Newton's Theory), nor just geometry (Einstein's GR) were presented [12].

That Gravity is "almost already part of the SM" was claimed by other physicists [14]. In fact that the four "fundamental" interactions are "independent" in the SM, is clearly due to the historical development of science and SM [8].

At this stage a few new "unifications" are needed to go beyond the SM, beyond the unification of the four fundamental interactions which are related at low energies [8, 4, 1].

2 Proposed Unifications

We will start with the core ideas behind the unification of the four fundamental interactions. In fact, part of this consists in just changing the point of view regarding what quarks are (3D-frame of principal directions of the quark field) and what flavors are (Platonic geometries). This will take care of Weak Force and Strong Force as being "independent" interactions.

2.1 Quark Field Unification

The author proposed the unification of the four interactions via the homogeneous space $U(1) \to SU(2) \to S^2$ as a Hopf fibration, as a "pixel of Universe" (and Quantum Computing), instead of the concept of *string* S^1 (and String Theory), as a natural progression of "blowing-up" the pointwise singularities of Point Form QFT (PFQFT, e.g. of Weinberg).

Here $SU(3)$ plays the role of a symmetry group of a local RGB-quark frame, with quark state $SU(2)$ vectors as principal directions of the quark field, *not* $SO(3)$-invariant (e.g. neutron udd has 2 lines of field directions oriented "in" and one "out", as *one field* with one singularity if modeled in PFQFT) .

One main consequence is that color-QCD need not confine quarks anymore, expecting a much more tamable theory and amenable computations.

A second major consequence comes from 3rd quantization: finite Platonic subgroups of symmetry in $SU(2)$. The corresponding Klein geometries should model quark flavors (3 pairs of dual geometries) and the representation theory should naturally replace the gauge theory approach to the Weak Force, which in fact models "phase transitions" and vibration modes (3D-cymatics, with 2D-CW complexes as analogues of Bohr's model for the electron's orbits as Z/n; with rep theory for the modes [11], instead of Schrodinger eq.).

2.2 Boson-Fermion Unification

This was proposed in [10] to resolve other "paradoxes": s-slit experiment, entanglement etc. The basic idea is that the Space-Time model should be replaced by a Network Model of quantum computing, with input from String Theory and Quark Line Diagrams of the SM.

2.2.1 Quantum Channels

An interaction propagates as a "boson" through a fermionic quantum channel, e.g. photon pulse / "soliton" in an electronic "conductor" (2-slit / non-trivial topology), well described by Schrodinger's equation: the macro-orbital with non-trivial topology is an analog of atomic orbitals etc.

In nuclei, nucleons are binded by mesonic bonds (analog to $U(1)$-Chemistry), also (duplex / $SU(2)$) channels for qluonic transmissions.

2.2.2 From QFT to String Theory

This unification within the Network Model just models together the Feynman propagators for charge of a QFT (e.g.. electron) and quanta (e.g. photon) as one unit quantum channel (the Feynman diagram "straight line" and "wavy line" in QED).

As is well known, a "String Diagram" (punctured Riemann Surface) is a fat Feynman graph ... But one should go on to Quark Line Diagrams and 3D-Cobordisms: Thurston Geometry of 3-Manifolds [20] ...

These would join Block spheres of qubit spaces (from Hopf fibration) as "Space-Time Networks", as fibrations over the 3D-cobordism (see Voltage Graphs for a 1D-version and unitary tangent bundle of punctured Riemann surfaces as a 2D version).

2.3 Other Unifications Needed

But how $U(1)$-theory relates to $SU(2)$-theory and "hardware" (math-physic models), needs to be modeled, beyond the Electroweak Theory, yet consistent with it?

How to unify massive bosons as fermionic mesonic channels for color carrying (3+1D-connection between RGB-quark frames of the quark fields of two interacting baryons) gluonic transmissions with zero mass photons propagating via fermionic electronic channels?

This should reflect $U(1)_{EM} \to SU(2)$ unification and Weinberg angle, of EW theory. It should also explain CKM and PMNS mixing, when taking flavors (finite 3/4D-symmetry groups and their geometries / rep. theory) into account and how this corresponds to the massive "geometry carrier" bosons $W^{\pm}, Z^0$.

2.4 What is Mass?

Note that inertial mass should equal gravitational mass (charge) and correspond, when including other energetic-momentum etc. contributions, to the famous $E = mc^2$. Note also that mass, as a gravitational charge is NOT invariant: Gravity can be controlled (the response of a body to another body, via nuclear spin orientation). Mass is rather a "resistence" to change of momentum, akin to an inductance in the theory of electric circuits.

So, mass should be derivable from more fundamental concepts: distribution of spin directions and coupling constants.

2.5 Quarks-Leptons Unification

Another unification reducing the number of "fundamental particles" in SM is that of quarks and leptons. It is clear by now that the colors RGB reflect the spatial property of quarks and the electron was associated to a 4th color by other authors. This points towards their role as a basis in the fundamental representation of $SU(2)$ (qubit space), or Hopf bundle, with "local periodic time" governed by $U(1)$ with Lie algebra generator the electronic charge.

2.6 Unifying Mesons and Leptons

A future article will focus on understanding and attempting to unify pions and muons, reflecting the above relation between leptons and quarks ("Time and Space" break of symmetry, with quantum phase e^{iwt} as a local clock and quark frame R, G, B of a local 3D-Space frame), but this time corresponding to a break of symmetry $U(1) \to SU(2)$.

This is probably an algebraic version rephrasing the Weak Force theory, yet beneficial towards a uniform use of groups of symmetry and theory of transitions, instead of a force with a range so small, that it does not make sense to talk about space, time, acceleration etc. (Not a "proper use of the term force; propagator yes, but there is no evidence that the W's are real, beyond energetic resonance peeks).

The decay of a pion $\pi \to \mu + \nu$ should be related to beta-decay of a neutron $n \to p^+ + e^- + \bar{\nu}$, allowing to see the relation between quarks and electrons, as a 4th-color T (time). This is perhaps just a Lorentz transformation (conformal) at the level of fermions (Hopf bundle $U(1) \to SU(2)$), for a QC transition ($C \oplus C$ formalism). And maybe it also involves CPT and mirror symmetry (From QC to Special Relativity and Symplectic Mechanics; see below).

2.7 New Models Needed!

New models, both Mathematical and Physical are needed.

A discrete version of these should relate, most likely, with the concept of "time crystal" (quantum systems periodic in Space-Time), Hopf fibration, punctured Riemann surfaces as channels (the "skin" of quantum conductors/ channels) etc.

Tessellations of Riemann Surfaces will allow to introduce nodes and edges, to understand their "color" vibrations and flavor geometry.

2.8 Break of Symmetry and Conservation Laws

In view of Noether Theorem, we should be open to see some quite "radical" transformations, leading to some new unifications. This is similar to "non-conservation of energy": there must be another form we are missing, and ways to transform one energy into another.

An example is how a pion transforms into a muon, and what the neutrino really is (outside of the PFQFT where Pauli solved the scattering paradox).

On the other hand if the group of symmetry changes (Functors Res and Ind), then the "classical" (even quantum) conservation laws will break (conservation of lepton numbers in Weak Interactions). But then, this is a similar situation with "energy conservation", which is re-established via a new type of energy, or here using a new physics concept.

2.9 CPT and Mirror Symmetry

Another "unification" is that of spin, parity and isospin. We claim that the complex structure / symplectic structure duality is of essence here: $C \equiv T^*R$ and doubling to get $C \oplus C = H = R^{3,1}$ (qubits vs. space-time picture).

The correspondence between "algebraic doubling" $R \to C \to H$ and the symplectic doubling $C = T^*R, H = T^*C$, at the core of mirror symmetry (between complex structures and symplectic

structures [17]), is claimed to be responsible of CP-violation. Namely, we claim that the true" symmetry group for CPT is the dihedral group, not $Z/2^3$.

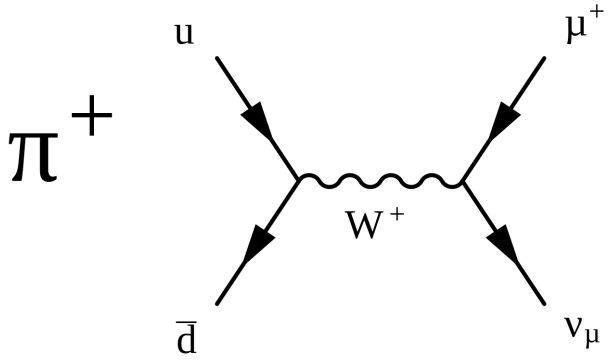
3 On Pions, Muons and Neutrino

SM of Particle Physics is a computationally successful theory explaining the experimental data, based on the Point -Form QFT applied to the quark model of baryons and mesons, justified by representation theory approach to classification of "elementary" particles. But it results in "independent" interactions, which are in fact one at usual energies (not as GUT requires); "hints/clues": effective potential in the One Boson Exchange model of nuclear force [3, 4] etc.

The success of Quark Line Diagrams and Electroweak Theory suggest that String Theory could be a useful theory to model the "skin effects/properties" of the QC Network Model (qubits / quark frames [8, 1] etc.)[1].

3.1 Unifying Quarks and Leptons

The Weak Force was designed to describe the transitions between baryons, mesons and leptons, e.g. $\pi \to \mu + \nu_\mu$ [9]; this is viewed as a quark-lepton interaction: $u + \bar{d} \overset{W^+}{\to} \bar{\mu}^+ + \nu_\mu$, although there is no such thing as a stand alone quark. Note the role of the massive boson W^- and compare with the decay of the μ lepton.



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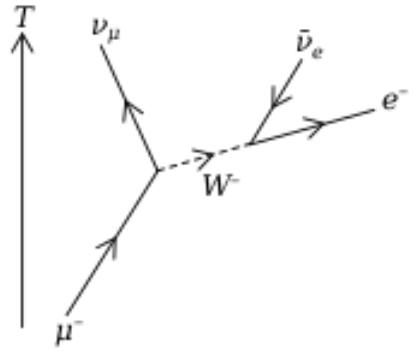

In the first Feynman diagram (lab) time goes vertical, in the down direction (reversing it yields the decay of π^-).

Note first the complete similarity of the topology and exchange of W. So in what sense leptons are the 4th colors, besides RGB color of quarks? and what does it mean, in terms of Space-Time and gauge field (connection).

It is tempting to reinterprete the process in terms of Quark Line Diagrams and String Theory ("fat" Feynman graphs).

3.2 Quark Line Diagrams and String Theory

Pointed Riemann surfaces of CFT unify several Feynman diagrams, reducing their number for one process. QC is an "upgrade" of ST, with baryons and meson bonds between them modeled by 3D-cobordisms. Unfortunately we lack a model for leptons, which are not pointwise particles (see the Network Model [1]).

At this stage it is unclear how to reformulate the SM in terms of QC and the quark field, meson channels (Nuclear Force) and electronic channels (Chemistry).

What seams to be the main point, is the understanding of how RGB quarks and T electrons (channels for light quanta), reminiscent of quaternions (Space-Time) correspond to a QC picture, in terms of the isomorphism $H \equiv C \oplus C$ (Lorentz transformations vs. Mobius transformations, space-time vectors vs. spinors/qubit picture: $Aut(R^{3,1}) \equiv SL_2(C)$ and $Aut(C) = PSL_2(C)$). The symplectic vs. complex structure correspondence is of essence here.

[1] Hint to the theory of electric currents in solid conductors and $U(1) \to SU(2)$.

Another point is to understand how the mixture of different flavors, e.g. u, d, s, corresponds to Platonic symmetries (Tetrahedral and Cubic, in this example) and their dual geometries / representation theory.

On the other hand, maybe the duality relates flavors as triples $(u, d, s)^* = (c, b, t)$. The relation between these subgroups is not simple: $T \xrightarrow{j} C \xrightarrow{k} Ico$ (various embeddings).

Returning to the main point, the unification of the descriptions of a decay process like proton-neutron interaction and pion-muon decays, unifying QCD and Electro-Weak Forces need a mathematical model with "smooth transitions", beyond "point-line" of Feynman diagrams or QLD.

A candidate is a Network of pointed Riemann spheres, modeling the Bloch sphere of qubit space / $SU(2)$ Hopf bundle together with quark field sources and sinks (fractional charges), joined by leptonic / mesonic bonds / quantum channels ($U(1) \to SU(2)$) modeled as Riemann surfaces with "string boundary" (topological circles) as cobordisms. The Space-Time coordinates are now of a type used in CFT and ST.

3.3 Neutrino

In the SM the neutrino is a fermion, companion of a lepton, with spin 1/2. The prospective graviton should have spin $s = 2$.

Now the elusive neutrino[2], is needed in the Point Form of QFT to account of the variable energy-momentum of the *particles* resulting in the beta decay (Pauli's solution).

3.3.1 Is the neutrino really needed?

Since Heisenberg, we "know" these are not pointwise quantum objects, hence modeled as Strings S^1 or using Quark Model S^3 (Quark Line Diagrams) could in principle solve this "Newtonian Mechanics paradox", if not present.

3.3.2 ... and Gravity

It could also be related to Gravity, if we inspect beta decay in terms of quark structure, and the spin dependence of Gravity, due to quark structure of nucleons. Note that conceptually the neutron yields the constituents of a Hydrogen atom, hence it is not just a matter of baryon transitions. The "split" of Hopf bundle could be associated with the break of symmetry into $U(1)$ (electron) and $SU(2)$ (proton), hence playing a more complex role then just carrying the missing momentum and energy.

3.3.3 Neutrino and break of symmetry

Also the neutral neutron, source of G-force only when "free" (not in a nucleus), when decaying into the proton and electron yields a break of the symmetry into $U(1)$-EM and $SU(3)$ (orientation of quark frame, which is associated to the spin), which controls Gravity (interaction between two nucleons, depending on the local 3D-orientation of the two triples of quarks, with various fractional electric charges: "Tensorial Coulomb Law").

3.3.4 Neutrino as a Boson?

Neutrino has to be a fermion, to have fermion number conserved, at least in Feynman diagrams (What about Riemann pair of pants in ST?).

Yet the neutrino seams to model an interaction of the neutron with another nucleon, which destabilizes the (until then "free") neutron (symmetric, unstable state in the quark model) into a "lower energy state" which breaks the symmetry of the system, separating "radially" the electron and proton (EM from G). This is typical of the breaking of symmetry mechanism.

Moreover, a neutrino was not detected in a direct way; it is detected via another interaction where it is "absorbed", e.g. capture in a transmutation of Gallium-71.

Hence, we suggest that the neutrino is in fact the "true" carrier of the Gravitational interaction, in this theory of Gravity of quantum origin.

[2] [16] "neutrinos typically pass through normal matter unimpeded and undetected".

But then it would be a companion of the photon $(\gamma, \nu_e, \nu_m u, \nu_\tau)$, still correlated maybe with quark generations (the three Platonic symmetry groups: A_4, S_4, S_5).

But then, is the photon not quantized too γ_n? associated to a 2D-symmetry group Z/n? (transition of an electron between two bound states)[3].

[4]

3.3.5 Why u/d is not an exact symmetry?

These considerations are also related to why the 1st generation, supposedly associated to the self dual geometry of the tetrahedral symmetry, does not yield an exact symmetry between the up and down quarks, at the level of quark flavors.

The charge asymmetry involves the electron somehow, or is the result of a polarization in a magnetic field (electron / EM interaction).

3.3.6 ... and CPT

It also suggests a correlation with the spin, parity and conjugation: orientation of the Lie group $U(1)$, topologically S^1 and the cubic roots of unity as "fractional charges" $\omega = \bar{\omega^2}$, the center of $SU(3)$ (Lie algebra of non-compact form $SL_2(C)$ and root vectors $\pm 1, \pm\omega, \pm\omega^2$ or compact form $SU(2)$, with the same Lie algebra; cyclotomic units of $Z[\omega]$[5]) ...

3.3.7 ... and Higgs boson

But Higgs particle is a boson of a really high energy, yielding mass to particles, equivalent to gravitational mass according to Einstein ... So, are Higgs and the neutrino related? a pair of fermion-boson associated to Gravity? ...

3.3.8 Neutrino oscillations

"Forget Higgs ..." [15], understanding the neutrino may be the key to go beyond SM.

The oscillations suggest a change of geometry for the leptons, akin to that of quark flavors modeled by PMNS matrix: transitions between neutrino flavors. Is it a fermionic channel together with a boson propagating through it? (Network Model).

3.3.9 ... and "quark flavor oscillations"?

Are the 6 flavors eigenvalues of superpositions and involving similar oscillations (isospin $n \to p$ exchange / transition in deuteron, modeled via u/d mesons, responsible for Nuclear Force, could be compared with oscillations ...).

The CKM matrix models the transitions between the three generations of down type quarks, similar to PMNS for the three generations of leptons, and hence neutrino oscillations (Weak Force transitions) maybe compared with gluonic and $W^{\pm}, Z^0$ exchanges between quarks (Weak Force and color QCD).

CKM and PMNS seem to be associated to the groups themselves, not with the actual geometries (representations), at least for quarks (up-type of quark flavors, in a proposed model, are dual to the down-type flavors from the same generation).

3.3.10 Why not electron-muon-taon oscillations?

Since these are just different flavors of electrons, as quanta of EM-charge ($U(1)$-interaction), why we do not have similar mixing of states with different flavors, corresponding to PMNS mixing matrix? Since their masses are quite different, that is not expected to happen, except from large mass to smaller: $\tau \to \mu$ and $\mu \to e$, with associated neutrino.

But then, why would the neutrino oscillate, if it does not interact and has no underlying structure!?

[3] An accelerated "free' electron is also subject to an interaction, and the radiated photon is "quantized" too ... ?

[4] Of course, these speculations are not yet to have the SM rewritten at this stage!

[5] Galois closure $Z[i, \omega]$.

3.3.11 Flavors and CPT

The dihedral group $D_6 \equiv S_3$, is suspected as being responsible for flavor mixing, while D_4 for CP-violation, instead of Klein group, part of instead of the abelian group $Z/2^3$ (CPT Theorem).

The relation between Platonic groups and "Mirror Symmetry" (complex / symplectic duality) with the above, is an interesting topic to investigate.

On the other hand if we have the $(u, d, s) \sim (c, b, t)$ duality, then D_4 may be relevant. And finally, a Hodge diamond duality may also be at work [18][6].

3.4 What are fractional electric charges of quarks?

The charge in electromagnetism and QED is a Lie generator of $U(1)$.

There are three magnetic charges g_M, corresponding to R, G, B colors of quarks, as units of magnetic vector potential flow. These are related to $w^3 = 1$ and the "real fractional charges" of a neutron $(++, -, -)$ (or $Q = diag[1, 1, -2]$; see also Cartan matrices).

Thus we expect $u, d, d)$ to be associated to $1, \omega, \omega^2$ as root vectors for $SU(3)$ (multiples of $1/3$ as angles on the $U(1)$-circle). They are related to quarks as $SU(2)$-dublets U, V, T, in the "Galois closure" ($Z[i]$ and $Z[w]$).

Then, can the complex charges relate EM (electron / positron charges $z^2 = 1$) and Strong Force ($SU(3)$ of 3D-quark frame and gluon theory? 8 gluons $g = C\bar{C}'$ generated by 3 fundamental generators $C : R, G, B$, like in the case of mesons? $3 \times 3 = 8 + 1$, with γ the photon? [7]).

4 From Math to Physics Beauty

Commenting on [21], Einstein's "Mathematical beauty" (implementation) needs upgraded to conceptual "Physics beauty" (interface), which the SM lacks for now.

Scientific Models demonstrate the growing role in Sciences of the idea of Structure (Conceptual, in the interface and specialized Language) and Mathematical (from DE paradigm to Abstract Algebra).

4.1 GUTs and TOEs

One merit of TOEs is to point towards the relevance of Platonic symmetries as Weyl group to QFT path dynamics governed by E6-8 exceptional Lie algebras (see kaleidoscopes as generalizations of beam splitters [22]).

GUTs maintain the gauge theory paradigm, unifying symmetry groups and fundamental interactions at high energies, without a conceptual unification via more complex math structures (Hopf bundle $U(1) \to SU(2)$ with $SU(3)$ as a symmetry group for 3D-quark frames, local with quantum phase as a local "clock"). Such a conceptual unification (Physics beauty) at all energies, also explains Gravity as a component of the quark field, of quantum origin, within spin dependence of nuclear force (hiding quark structure) and experimentally verified (F. Alzofon, E. Podkletnov, Ning Li etc. [7]). It also justifies the meson bond model of Nuclear Physics, analog to Chemistry (again $U(1) \to SU(2)$), limiting QCD scope to the role of gluons as bosons through meson channels (color and flavor theory), avoiding the "quark confinement role", since quarks are not "particles" (color is Space-gauge, flavor is Platonic geometry).

Weak Force is not a force, but rather a theory of transitions (geometry / change of symmetry: "phase transitions"), similar to electron transitions in spectroscopy; (n, l, m) have role of "geometry" ($Z/n \to U(1)$, spin relation with $SU(2)$ and EM / magnetic interactions).

In principle, a Quantum Computer based on 3D-kaleidoscopes ([22]; root systems and reflection paths) could implement Feynman path integral quantization as a "ray tracing method" for amplitudes and feasible outcomes.

The $ST \to QC$ pair of theories could in fact implement the $U(1) \to SU(2)$ unification mentioned above.

[6] Low dimensions are tricky: lots of coincidences!

[7] Partners of $W^{\pm}, Z^0$? Related to neutrinos?

4.2 Automata vs. Diffential Equations

Physics can benefit in moving forward from hierarchic structures (systems build from elementary "particles") towards complex, yet irreducible structures (Network Model, Quantum Computing).

Physics theories and models are largely the result of "quantization' (discretization) of Mechanics and Field Theory. The "tree hierarchy" is reflected in representing complex systems as built of parts, all the way to "elementary particles", governed by groups of symmetry (Noether Theorems and Weyl's gauge theory paradigm).

More specifically, a baryon is an irreducible object with quarks akin to a basis of an algebraic structure or geometric object (fundamental representation, e.g. of $SU(2)$.

The Network Model of Quantum Physics is based on Quantum Computing as a basic quantum programming language of reality.

4.3 "Simplifying" the Standard Model

Instead of 24 elementary particles of the SM [23], we should understand conceptually:

1) Antimatter results from the description of a closed, macroscopic bound state typical of Feynman Diagrams with loops, needed for QFT corrections to match experimental data. Such feedback loops are responsible for resonance and quantum interference phenomena. The embedding of such a process in an ambient Space-Time, with a macroscopic defined global time, is the origin of splitting the process into matter and antimatter.

2) Quarks and leptons are not elementary particles, but rather "bases" of some irreducible algebraic-geometric structures. They "split" into quarks on one hand and leptons, when viewing the QC process as a Space-Time process (introducing Lab time and Space reference frame, with Lorentz transformations for the various such coordinate and time systems).

3) Baryons, mesons and leptons are unified via structural properties of Quantum Networks: nodes label baryons and connections label leptons (Objects and Morphisms). This also unifies fermions and bosons. Mesons are nuclear bonds, a different type of connection between baryons.

4) Charge and color, mesons and leptons, are identified separately as such when investigating the $U(1)$ vs. $SU(2)$-interactions. The Mathematical way to unify them is via break of symmetry (Reduction and Induction functors).

The main idea to achieve this is to use more complex mathematical structures, beyond manifolds and groups of symmetry.

Then there is only ONE fundamental object, the Hopf fibration, with channels and a connection between 3+1 basis (RGB & T) when QC is related to Relativistic Physics.

Quark flavors are just the discrete geometries (quantum), when breaking the continuous symmetry $SU(2)$ to Platonic (binary 3D point groups).

A mathematical treatment of, for instance the "decay" $\pi^- \to \mu \to e^-$ (with neutrinos) is still needed, beyond the idea presented above ($qq*$ as a time-like loop maybe? or just channel / algebraic structure). Electronic orbitals are generic (also open channels); in some sense this is similar to how Einstein postulated that photons are quanta not just when emitted or absorbed, as introduced cautiously by Planck, but also in between).

In order to view the various transitions via the Weak / Strong Force in a unified way, one may look for functors between categories of morphisms that describe such transitions.

5 Conclusions

GUTs and TOEs fulfill just one goal regarding SM: unify the fundamental interaction *formally*, at high energies unattainable in particle accelerators, maintaining them "independent" at usual energies.

The Theory of Gravity from a quantum origin is part of a unification of forces at all energy levels, based on a conceptual change of perspective, where the three quarks of a baryon are associated to a quark field, including Gravity.

Now the Weak Force modeling transitions of states and geometries of "particles" should be modeled via functors associated to a change of symmetry group, mainly $U(1) \to SU(2)$ and $SU(3)$ for the 3D-RGB frame bundle of a Quantum Network (QC) / Riemann surface cobordism (CFT point of view).

This also addresses the need of a unifying point of view regarding: a) fermions and bosons; b) quarks and leptons (RGB&T as a new color); c) baryons, mesons and leptons, using Riemann Surfaces

cobordisms modeling channels joining the nodes of the Network, modeled as punctured Bloch spheres (base of Hopf fibration: qubit space of quark states of a baryon); alternatively one can use just Abstract Algebra structures: functors between representation categories (Res and Ind); d) understand better the role of the neutrino, in connection with Gravity form quark model.

Unifications in general require more advanced mathematical structures, capable of unifying the concepts, from Mechanics / Field Theory DEs to QC Networks; functors between categories of reps, not just TQFTs and FQFTs. But this should start from a unification via conceptual understanding. Perhaps the first step consists in considering irreducible quantum systems as "elementary", not just looking for "elementary particles"[8]

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