TOPOLOGICAL COMBINATORICS OF A QUANTIZED STRING GRAVITATIONAL METRIC

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ABSTRACT

A string-theoretic structure of the standard model is defined having a 4-D quantum gravity metric consistent with topological and algebraic first principles. Unique topological diagrams of string states, strong and weak interactions and quark families are evolved from this metric but published separately. The theoretical structure includes known static and dynamic symmetries. A philosophical perspective on modern physics originates numerous opportunities for formal mathematical discussion.

Consider a-priori the Theorem: The topology of a three-point spinning metric is a necessary and sufficient basis for 4-dimensional physical objects. The pregeometry of a two-point metric has been shown to provide the basis for physically interesting theories of quantum gravity. Here \( g_{\mu\nu} = \langle g_{\mu\nu}(Y_{r,y,b}) \rangle \). Similar topological mechanisms of mass generation have been explored previously.

This topological metric is equated combinatorially with Rishons using two orthogonal intrinsic spin orientations. Local colored gauge fields are identified without formal mathematical definition to be compatible with QCD. Perturbations of the topological structure are not used to construct the static and dynamic symmetries of Standard particles and interactions.

Ten dimensional topological objects are constructed with the 3-point metric as a basis. Three identical preons can be assembled in two distinct ways, corresponding to the electron (TTT) and neutrino (VVV). It is evident that the 10-D internal properties of the object literally “curl up”, \( R^{10} \supset R^4 \), to form the 3+1-D electron. The formal mathematical description of the topological electron is postulated to be rigid. The string’s ground state results from minimized internal tensions under a three-color partition, so it is called the Tripartite String Theory. The usual Nambu-Goto action of the Tripartite String becomes

\[
S = \mu \int_t \int_{\text{color}} \sqrt{h(Y_{r,y,b})} d^2 \xi.
\]

Rishon combinatorics are easily identified with the standard model group \( SU(3)_c \times SU(2)_L \times U(1)_y \). A material analog of this group is provided by restricting Rubic’s cube. Spontaneous symmetry breaking is analogous to the requirement that the corner cubies be restricted to their respective positions. An electron is modeled by a left-hand twist of the r-y-b corner cubie, combinatorially similar to an isolated quark. Charged quarks are modeled by twisting other cubies as follows.

The electric charge quantum numbers of particles are defined by the orientation of the intrinsic curvature tensor. Orientation may be graphically indicated by dark and light sided objects. The quark’s color is determined by the orientation of the spin axis with respect to the color gauge fields. The oriented string allows two permutations of color order (r-y-b, r-b-y) which naturally models antimatter.
The cubic symmetry of the electric and color charge diagram is exploited to define the colored combinatorics of Rishonic string states. A unique Rubic's cube color scheme is defined to map quark color and anticolor. Spin is modeled in this paradigm by rotation of the cube to avoid the superficial assignment of spin quantum numbers.

A Tripartite String proton diagram was copyrighted several years ago. Color copies of the figures discussed in this paper may be requested via E-mail from lundberg@emsmtp.wpafb.af.mil. The author assumes some artistic license by altering the scaling so that the Planck length is of the order of the proton scale. The true scaling accounts for the relative success of open string theories.

The combinatoric model of a proton on Rubic's cube requires the operator 
\[(Y−GYG−)(G−OGO−)(O−YOY−)]^2, \] 
where \( G = \bar{R} \). Thus the algebraic group suggested by Golomb is defined. Three such proton states exist which may be related by a strong algebraic operation. The spin content of the proton is evident even in the algebraic model although the majority of it stems from gluons. It is certainly a finite-sized constituent-quark model which is responsible for experimental measurements of spin dependance in proton collisions.

Consideration of the toroid-compact string and the spin-orientation basis of color charges determines the topology of the Tripartite String strong interaction. This is a fundamental tree-level diagram wherein the string is compacted to wind once through the handle rather than around it. The two-loop diagram is dissimilar to that of a second generation quark in that the world sheet self-intersects at the interaction point. Triangulating the moduli space of closed-string geometric field theory is required at interaction vertices.

An algebraic gluon operator such as \( G_{y→b} = B−P_yO(GB−G−B)^2O−Y_yB \) is applicable to the proton modeled previously. Multiple gluon exchanges are modeled by superposition using the dynamical symmetry breaking rule that only r-y-b edge-cubie states are used. Therefore only a defined subset of Rubic's cube (R-cube) is required for complete representation of \( SU(3)_c \times SU(2)_L \times U(1)_y \).

The toroid compact tripartite string allows three "unmixed" knot states. The topological quantum gravity model does not allow world-sheet self-intersections for non-interacting strings. The \( \tau \) state resembles a trefoil knot and gives intuitive motivation to seek mass generation as a function of the volume of the twisted toroid. The three families explicitly evolved by the theory have been proven empirically.

The six colored gluons are defined in the R-cube algebra. All possible r-y-b edge states (gluons) have been mapped and shown to correlate identically with the three knot-states arrived at via the topological approach. For a particle to be in a bound state a gluon must be present on the cube, disallowing three colorless edge states. The number of particulate states is now 256; fewer than the number of generators required for the standard model group.

The 26-dimensional Tripartite String weak interaction world sheet comprises two 10-D closed, oriented, bosonic strings (4-D quarks) and a 6-dimensional gauge superfield, or gluon. Extrinsic curvature may be fixed while the intrinsic curvature tensor describes the shape of the quark, which must change during weak interactions.
Thus temperature can be modeled by the extrinsic curvature of the world sheet. A weak interaction may only be modeled on one R-cube with the stipulation that the two interacting particles be superimposed. The two interacting quarks are operated on via an intermediate vector boson such as \([R_sP_s R^2](OR^\ominus O^\ominus R)^2 \times (RP^\ominus R^\ominus P)^2[R^2 P_r R^\ominus]\). The assembly is then decomposed since no binding gluon exists and due to spatial separation. This method supplements that used in the Standard Model with a more detailed notation of the operators used.

The topological model of a \(\pi^0\) meson reveals an ‘extra’ symmetry. The R-cube model also requires an extra symmetric operator to model \(r\bar{r}\) quarks, i.e. \(J_r = G_s G^2 B_s Y^2 B_s G^2 B^2 R^2\). The total number of allowed states is now 512. Since a colored supersymmetric operator is meaningless for the uncolored electron and neutrino, 16 cube states are disallowed, leaving the correct number of generators for the Standard Model.

1. Conclusion

A description of a quantum gravitational string theory which evolves uniquely to the Standard Model is given. A mathematically well-founded proof of such a physical theory is potentially realizable in the near future.

2. References

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