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STANDARD MODEL OF ELEMENTARY PARTICLES AND THE GEOMETRY OF SPACE WITH ADDITIONS AND CORRECTIONS

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Abstract

Aims/Objectives: Our aim is to provide mathematical evidence for the validity of the Standard Model of particle physics [1][13]. The analysis of the theory covers all of the SM's aspects, with the possible exception of the Higgs boson, whose addition may later be adjusted using experimental data or as a factor in the equations given by the article [2]. The symmetry of space, which the SM has been trying to prove for a long time, may be mathematically refuted due to its heterogeneity. On the other hand, the given approach enables a researcher to calculate mass density and its distribution on a cosmic level, which, in the author's opinion, is the reason why the universe's matter distribution is heterogeneous. The simplicity and link between the four known fundamental forces is taken into consideration as a factor that affects the geometry of space as we know it. We can even visualize the so-called 'fabric' of space in the universe and categorize all known elementary particles based on their energy levels [8].

Keywords: Square Matrix, Particle Physics, Standard Model, Space, Theory of Gravitation

1. GENERAL INFORMATION

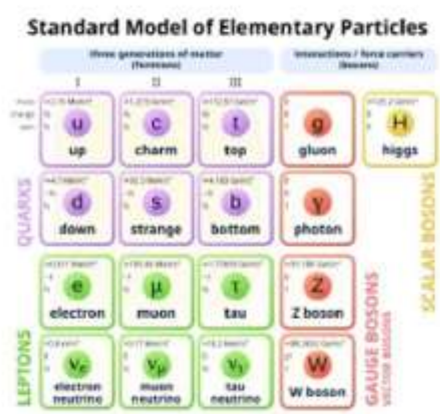
We begin with a well-known fact regarding matrix properties [15]

$$Q^tQ = QQ^t = I \qquad (1)$$

This property concerns square matrices only, e.g., the ones of the type:

$2 \times 2, 3 \times 3, \ldots n \times n$; It allows us to group data in such a way that the cross product of the two gives us an identity matrix [12]. Please check the following:

Standard Model of Elementary Particles



e000
0g00
00c0
000h
$: | e \equiv$ *elementary charge*, $g \equiv$ *Newtonian constant of gravitation*, $c \equiv$ *speed of light in vacuum*, $h \equiv$ *Planck constant*

Figure 1: Standard Model of Elementary Particles.

The transpose of a given matrix is clearly not equal to it's inverse:
$Q^t \neq Q^i \rightarrow Q^tQ \neq QQ^t \neq I$ Therefore we have to look for a matrix/vector such that:
$QQ^t = I$

$$\begin{pmatrix} e & & & \\ & g & & \\ & & c & \\ & & & h \end{pmatrix} \begin{pmatrix} \frac{1}{e} & & & \\ & \frac{1}{g} & & \\ & & \frac{1}{c} & \\ & & & \frac{1}{h} \end{pmatrix} \quad (2)$$

This rule applies to all square diagonal matrices by definition:

$$DD^i = I: |D = d_{i,j}; \forall i,j \in \{1,2..n\}, i \neq j \Rightarrow d_{i,j} = 0 \text{ [7]}$$

The aim of our research though is to show how mathematical rules apply in the world of physics [6][11]

2. MATERIALS AND METHODS

Let's turn our sights to the properties of square matrices for a minute A determinant of a 4 × 4 matrix is defined as the sum of products of the cofactors and respective triangular matrices [3][4] Let's look at an example:

$$\begin{matrix} x-1 & y-2 & z-3 & d-4 \\ 5 & 6 & 7 & 8 \\ 7 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{matrix} \quad (3)$$

The determinant of the matrix (3) is equal to: $16 * d + 16 * y - 32 * z$. In other words, we have an equation (3) whose result is a 3-component vector that defines an *R*3 *Space.* Can the same matrix define a different space? Yes, it can [10]. Let's take a look:

$$\begin{matrix} x-1 & y-2 & z-3 & d-4 \\ 5 & 6 & 7 & 8 \\ 7 & 10 & 11 & 2 \\ 13 & 14 & 15 & 16 \end{matrix} \quad (4)$$

The determinant of the same-size matrix is now a 4-component vector, $16 * d - 80 * x + 176 * y - 112 * z$, that defines an R4 *Space*

3. METHODOLOGY

If we now correlate the sum of the 4 vectors forming a matrix and calculate its determinant by plugging in the same numbers we used in formulas (3) and
(4) and compare it with the energy entries (5),

$$\begin{matrix} x-e & y-g & z-h & d-c \\ E_1 = k_e\frac{|q|}{r^2} & E_1 = mgh & E_1 = h\nu & E_1 = mc^2 \\ E_2 = k_e\frac{|q|}{r^2} & E_2 = mgh & E_2 = h\nu & E_2 = mc^2 \\ E_3 = k_e\frac{|q|}{r^2} & E_3 = mgh & E_3 = h\nu & E_3 = mc^2 \end{matrix} \quad (5)$$

we will see that in the first case we have a $16 * d + 16 * y - 32 * z$ result, while in the second this result is different: $16 * d - 80 * x + 176 * y - 112 * z$. With regard to the Energy Conservation Law and Conservation Law in general, the input amount of energy should be equal to the output, but the same input equation $(x - e)(y - g)(z - h)(d - c)$ gives different output in terms of numeric value, depending on which dimension we use It is always possible to findnd a set of entries that, although differ as inputs, produce the same energy-wise output value [14][16].

4 PROOF

Even though the amount of energy measured in various dimensions is different, it might be the same using various measurement techniques. [5] Energy distribution might vary, and we should speak of a density of it. If we use our formulas (3) and (4), we still might equalize them using the cofactor:

$((x-1),-(y-2),+(z-3),-(d-4))$ or more generally:

$((x-e),-(y-g),+(z-h),-(d-c))$

5 CONCLUSIONS

The Standard Model is thought to be theoretically self-consistent and capable of making some experimental predictions. When paired with vector calculus, it can explain physical phenomena that cannot be explained, like the matter/antimatter paradox, incorporate the full theory of gravitation as described by general relativity, or explain the universe's accelerating expansion, which may be explained by dark energy. The model does include data with all the necessary characteristics inferred from observational cosmology. Additionally, wave theory and other methods of characterizing micro- and macrophysical phenomena can be incorporated. [9] On the other hand, we can expand this model presenting it with the formula that includes an extra dimension or extra dimensions provided that $a_{5,5}$ element is a Higgs Boson scalar and adding an extra dimension to the given pattern or by adding components to the diagonal matrix thus adding extra dimensions (please see the formula below)

$$\Delta \begin{bmatrix} h &&&&& \\ & e &&&& \\ && c &&& \\ &&& g && \\ &&&& \cdots & \\ &&& \vdots & \ddots & \vdots \\ &&&& \cdots & \end{bmatrix} = \left|\bar{E}\right| == \bar{E} : |a_{5,5} = H\,(HiggsBoson) \qquad (6)$$

Conversely, one can look at the conservation of energy law from another perspective. Namely, instead of the sum of 'energies,' we will be using their scalar representation or matrix product just the same as in Formula (2):

$$\begin{pmatrix} e &&& \\ & g && \\ && c & \\ &&& h \end{pmatrix} \begin{pmatrix} \frac{1}{e} &&& \\ & \frac{1}{g} && \\ && \frac{1}{c} & \\ &&& \frac{1}{h} \end{pmatrix}$$

The question might arise, "...and where is our Higgs Boson?" It's right here. The inverse of a matrix A is the Higgs Boson With that said, let's formulate the 'Conservation of Energy Law': 'The amount of energy remains the same, and it's equal:

$$A \cdot U = I : \text{U is the inverse of matrix A} \qquad (7)$$

If we analyze it further, we can se that A can be a matrix of variables a_i and U a matrix of coefficients b_i: Please check:

$$\sum_{i=0}^{n} a_i b_i - 1 = 0 \qquad (8)$$

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