Tetrons

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Abstract

Four tetrons make matter and anti-matter. Quarks are tetrahedrons with a tetron at each vertex. There are 4 new quarks: yyz, yyz', wxy and wxy'. The spin converted into a spin field in a gluon is partially responsible for the strong force and entirely responsible for gravity.

Keywords

quark, sub-quark, tetron, gravity

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Claims of Novelty

- Four tetrons are neither matter nor antimatter, but make all matter and antimatter. They are the permutations without repetition of unit spin, charge and time such that the mutual cross products are time X spin = charge, spin X charge = time and charge X time = spin.

- Quarks are tetrahedrons with a pair of tetrons at each vertex. PCT opposite tetrons coexist at each vertex congruent with the PCT normal tetrons. For example, if a ww tetron exists at a vertex, then a zz tetron exists there also.

- The spin field created in a gluon of four tetrons is partially responsible for the strong force, and entirely responsible for gravity

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Naming Conventions

This paper uses 3 different tools (MS Access, MS Excel and AutoCAD), each of which has a unique set of formatting limitations. The following have identical meaning:

To accommodate for the Excel and Access lack of subscripts:

u' = anti-u quark
To accommodate for AutoCAD's lack of subscripts
chg^{-1} = anti-charge

Mathematical Foundation

This paper does not refer to tensors, which are useful in rotations and boosts in the same coordinate system in the same dimensions. Spacetime mixes space with a single understanding of time, which I believe are necessarily left separate, given the reciprocal relationship of time rate and elapsed time. This paper's mathematical method uses vectors because they don't refer to arbitrary coordinates. Unit values are used in equations so empirical constants are not necessary. In particular, vector cross products are used to define values in another dimension.

- The symbol is × or x or X means cross product or vector product or directed area product.
- A new operator $\underline{\times}$ or $\underline{x}$ or $\underline{X}$ means the inverse cross product, which amount to division.
- For example, v X v is the directed area product of velocity and velocity.
- The scalar v^2/c^2 can be written as a vector (v X v) $\underline{X}$ (c X c).

Cross products preserve the sign of the input vectors. In normal algebra (-c) * (+c) = $+c^2$, but the cross-product yields (-c X +c) and the resultant sign depends on choosing right- or left-hand rule for vector products.

Multiplication

We do multiplication with numbers so readily and always come up with the correct answer. When we do a unit analysis of multiplication, thought is required. Take for example the formula for gravitation.

$F = G * (m_1 * m_2 /r^2)$
Neglecting the constant to make the units correct, the gravitational force is $m_1 * m_2/r^2$
Since multiplication is associative and commutative, it is also $(m_1/r) * (m_2/r)$

The inverse square law: $F = 1 / d^2$, which we visualize as the spherical wavefront coming from a light source where intensity at the wavefront is the inverse square of distance. This makes sense because if a certain number of photons are emitted per unit of time, the density of photons landing on a spherical surface is per the inverse square law. The same number of photons is less dense (less intensity) the further from the source.

What are the "m/r" units? Kilogram per meter or $kg*m^{-1}$
The units of the gravitational constant G are $m^3*kg^{-1}*s^{-2}$
$m^3*kg^{-1}*s^{-2} * kg * kg * m^{-2} = m*kg*s^{-2}$

What does "m/r" mean? The best description is the gradient (slope) of a mass field. What is the cross product of two mass fields as in (m_1/r) X (m_2/r)? The best description is the attractive force between two objects due to their mass. Their response to this force depends on their inertia and all other forces acting on the tetrons.

Another instance is the electromotive force. The gradient (slope) of a charge field is q/r. The electromotive force between two charges bodies is $(q_1/r) X (q_2/r)$. The attractive force is electrostatic force. The gradient of a magnetic field is B/r. The magnetism between two magnets is $(B_1/r) X (B_2/r)$.

The net force vector on a tetron is the sum of mass, charge, magnetism fields:
$F = (m_1/r) X (m_2/r) + (q_1/r) X (q_2/r) + (B_1/r) X (B_2/r)$

In a later section, it is claimed tetrons are the four building blocks of quarks. Each tetron has a unit charge and unit spin, and each tetron both creates fields and responds to fields. If the net force vector produced by unit charges and spins in a field creating tetron acts on the unit charge and spin in a field responding tetron, the resulting interaction among any set of tetrons is an “n-body problem”[1], which was difficult to calculate in classical mechanics with just three bodies, given moving charges create magnetism and vice versa.

Chapter 2 Introduction

Dedication
This work is dedicated to Ginger

Previous Work
The text and diagrams are substantially the same as my paper posted on the physics archive https://vixra.org/abs/2209.0057. The term Sub-quarks are used in that online document. In this paper, the term “Tetrons” is used to emphasize they are a discovery and to avoid usage of a generic term “sub-quarks”. Other authors have published using “subquarks” with different characteristics. The word “tetron” is descriptive because this entity is located at a vertex of a tetrahedral quark. Four tetrons are the four vertices of a quark.

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Chapter 3 Tetrons

Decomposing Quarks into Sub-Quarks, named Tetrons
Tetrons are sub-quarks, and are defined by creating least common denominators of spin and charge. The units of spin found in nature are +/- |1/2| spin. The units of charge found in nature are +/- |1/3| and +/- |2/3| charge. The time rate vector is +/- 1. Performing a least common denominator method on spin and charge, the absolute unit of spin is 1/4 and the absolute unit of charge is 1/6. The 4 fundamental units are named tetrons and the 4 tetrons are shown below as: ww, xx, yy, zz.

[1] n-body problem - Wikipedia

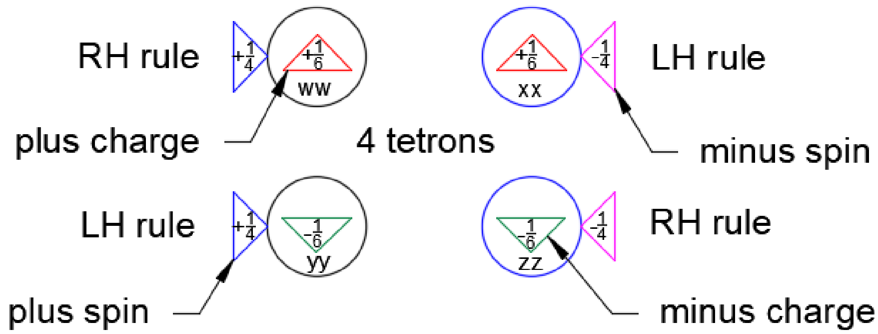

Figure 1 - The Four Tetrons

Mutual Cross Products

Four tetrons are neither matter nor antimatter, but make all matter and antimatter. They are the permutations without repetition of unit spin, charge and time such that they form mutual cross products: time X spin = charge, spin X charge = time and charge X time = spin.

Each tetron relates to three other tetrons. The opposite tetron has the same time. Adjacent tetrons have the same spin or charge. Spin is the axis of parity. "Time" is time rate. None of the four tetrons has an anti-tetron that is a Parity, Charge, Time (PCT) mirror image. Each of the four tetrons has three relationships which together form a PCT mirror. The four tetrons' spin, charge and time unit vectors are as follows. All have unit quantity.

ww = +spin, +chg, +time
xx = -spin, +chg, -time
yy = +spin, -chg, -time
zz = -spin, -chg, +time

Looking at the double lines in the below diagram connecting the tetrons, the double line connecting ww and xx is labeled, "chg^{+1}, spin^{-1}, time^{-1}". The exponent location is used to place +1 or -1 to denote same or opposite. The phrase in this double line between ww and xx means charge is the same, spin is opposite and time is opposite. Relative direction of the arrows reinforces this idea. The isometric diagonal adds 3D arrows up or down for the time direction. Examples:

- chg^{-1} between xx and yy means the charges are opposite
- spin^{+1} between xx and zz means the spins are the same

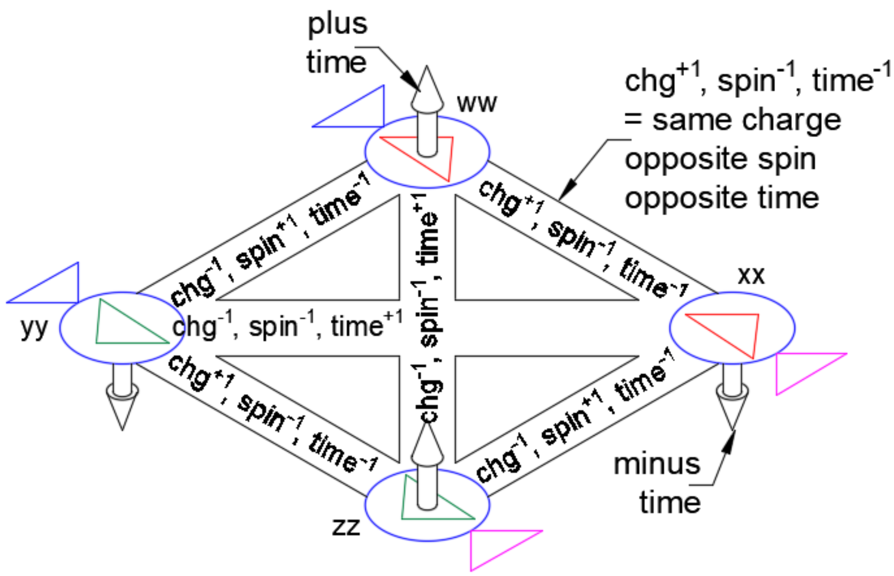

Figure 2 - Define Tetrons with Spin, Charge and Time

Recomposing Sub-Quarks into Quarks

Add these four tetrons together in different combinations to get +/- 1/2 spin and +/- 1/3 and +/- 2/3 charge, which are the values found in nature.

How many quarks can 4 tetrons make? The answer can be found either by a math formula or structured query language (SQL). The formula for permutations is $4^4 = 256$, but this result contains duplicate quarks. The position of tetrons in a quark does not matter if we exclude the case where all 4 tetrons are different. Such a 4 different tetrons quark would be zero spin and zero charge since all quantities cancel with their opposites. There cannot be a quark with all tetrons the same because the spins would sum to 1 or -1.

That leaves us with quarks with either 2 or 3 kinds of tetrons. The SQL solution is easier to understand than the permutation equation. Four identical SQL tables containing the 4 tetrons with no join predicate gives all possible 256 combinations.

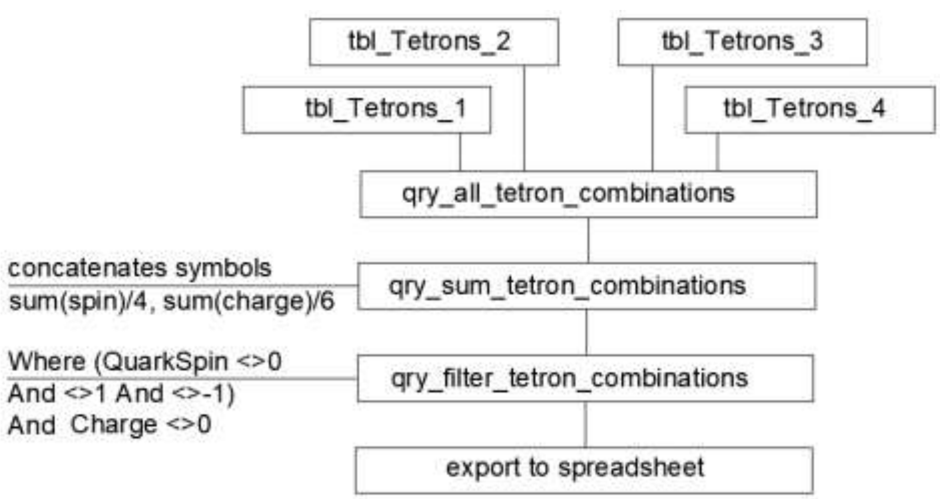

Figure 3 - Cascade of Queries to Discover All Quarks Possible

The procedure employed is to make lists of all possible non-repetitive permutations instead of just making a calculation of the quantity. Such a list is helpful in identifying new particles made from quarks. Note the four new quarks: yyz, yyz', xyy, xyy', wxy, wxy', zww, zww', which are new quarks beyond the u, u', d, d' quarks.

In the below spreadsheet, there are three separate sections. The upper section contains the raw results of non-repetitive permutations. In the lower right section below the gray line, the phrase, "Count of tetrons" means how many quarks have the above tetron in the quark. For example, in the next to last row, the "Count of tetrons" is 3 tetrons of each tetron type ww, xx, yy and zz. It is considered a self-check but not a proof that each tetron is represented equally in the collection of all quarks.

Although new quarks yyz, yyz', xyy, xyy', wxy, wxy', zww, zww' are postulated, xyy, xyy', zww, zww' are isomers of xyy is an isomer of d, xyy' is an isomer of d', zww is an isomer of wxy and zww' is an isomer of wxy'. This leaves yyz, yyz', wxy and wxy' as the only new quarks.

Spin	Charge	Tetrons	ww	xx	yy	zz	Quark	Like
-1/2	-2/3	zz, yy, zz, zz	0	0	1	3	u'	
+1/2	-2/3	zz, yy, yy, yy	0	0	3	1	yyz	
-1/2	-1/3	yy, zz, zz, xx	0	1	1	2	wxy'	
+1/2	-1/3	yy, yy, xx, yy	0	1	3	0	xyy	d
-1/2	+1/3	xx, yy, xx, xx	0	3	1	0	xyy'	d'
-1/2	-1/3	zz, zz, zz, ww	1	0	0	3	zww'	wxy'
+1/2	-1/3	yy, ww, yy, zz	1	0	2	1	d	
-1/2	+1/3	xx, xx, zz, ww	1	2	0	1	d'	
-1/2	+2/3	xx, xx, ww, xx	1	3	0	0	yyz'	
+1/2	+1/3	ww, yy, xx, ww	2	1	1	0	wxy	
+1/2	+1/3	ww, ww, zz, ww	3	0	0	1	zww	wxy
+1/2	+2/3	xx, ww, ww, ww	3	1	0	0	u	

Quark	Count	Spin	Charge						Quantity
u'	1	-1/2	-2/3	Count of tetrons	0	0	0	0	
yyz'	1	-1/2	+2/3	Quantity	5	5	5	5	(5 zeroes)
d', xyy'	2	-1/2	+1/3	Count of tetrons	1	1	1	1	
wxy', zww'	2	-1/2	-1/3	Quantity	4	4	4	4	(4 ones)
yyz	1	+1/2	-2/3	Count of tetrons	2	2	2	2	
u	1	+1/2	+2/3	Quantity	1	1	1	1	(1 two)
wxy, zww	2	+1/2	+1/3	Count of tetrons	3	3	3	3	
d, xyy	2	+1/2	-1/3	Quantity	2	2	2	2	(2 threes)
	12								
	4	unique							
	8	duplicate							

Figure 4 - Analysis of Tetrons in Quarks

Have We Seen This All Before?

Are tetrons like preons? The short answer is tetrons belong to the set of preon theories, but tetrons have unique characteristics. The Wikipedia article on preons explains as follows:

“A number of physicists have attempted to develop a theory of "pre-quarks" (from which the name *preon* derives) in an effort to justify theoretically the many parts of the Standard Model that are known only through experimental data. Other names which have been used for these proposed fundamental particles (or particles intermediate between the most fundamental particles and those observed in the Standard Model) include *prequarks*, *subquarks*, *maons*, *alphons*, *quinks*, *rishons*, *tweedles*, *helons*, *haplons*, *Y-particles*, and *primons*. *Preon* is the leading name in the physics community.”[2]

What makes this tetron model different is the tetrons are derived using the least common denominator method. All known quarks are re-constituted from the four tetrons. Additionally, eight new quarks are postulated, although

Tetron Geometry

All quarks are composed of four tetrons, each tetron at a vertex of a tetrahedral quark. Why a tetrahedron? It is the simplest structure to be formed with the fewest corners. It is also the most stable, regardless of what is at each vertex.

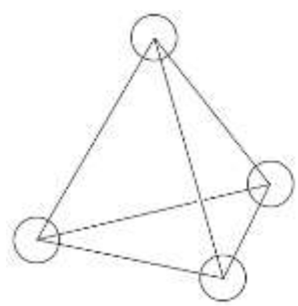

Figure 5 - Four Tetrons in a Quark

Charge, Spin and Time Balance

When four different tetrons are located at the same point, charge, spin and time are balanced. This occurs at a gluon between two quarks.

[2] Preon - Wikipedia

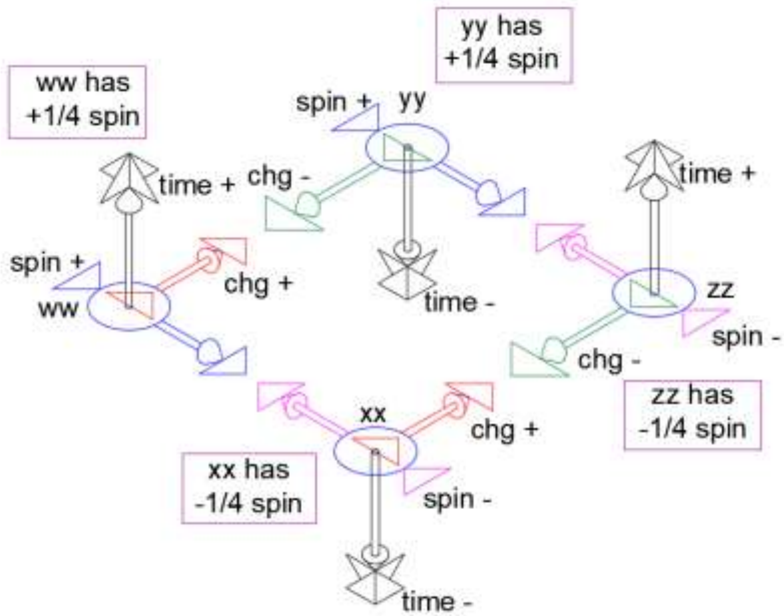

Figure 6 - Four Different Tetrons Balance Charge, Spin, Time

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RH Rule in the Spin-Charge-Time Coordinate System

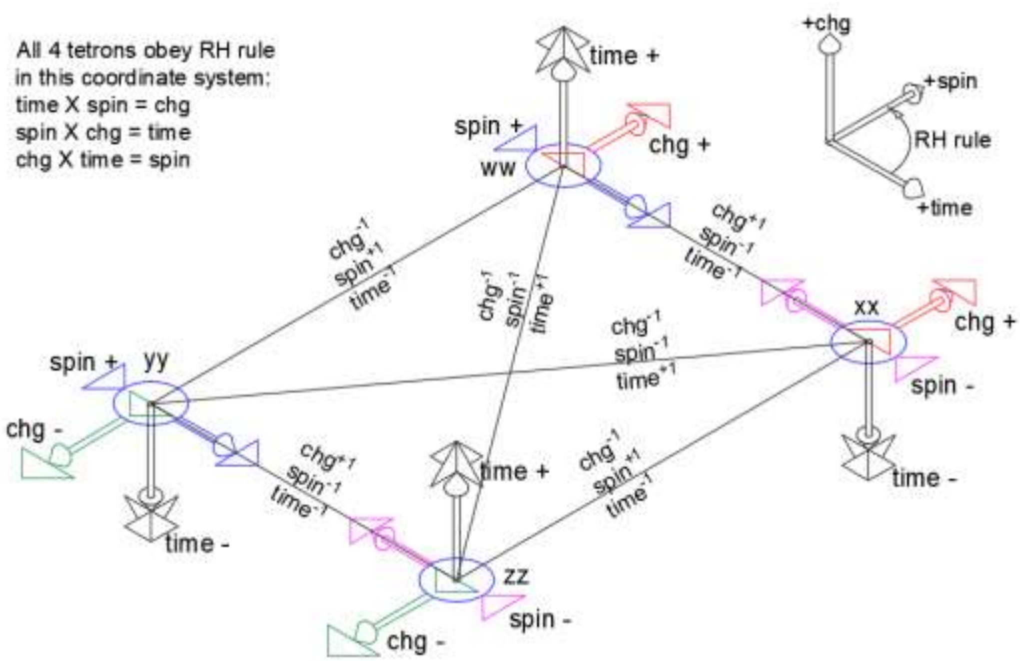

Figure 7 - All 4 Tetrons Obey RH Rule in this Coordinate System

Define Existing & New Quarks as Combinations of Tetrons

Each first level quark has 4 tetrons. Second level has 6 and third level has 8. Quarks and tetrons are never free particles because they would rotate.

Uniqueness rule: 2 types of tetron per quark yields a unique quark

Non-uniqueness rule: 3 types of tetrons per quark yields a pair or quarks that are charge, spin and valence tetrons identical, but composed of different non-valence tetrons. Non-valence tetrons that are spin and charge opposite cancel one another, and are shown on opposite corners of the tetron diamond.

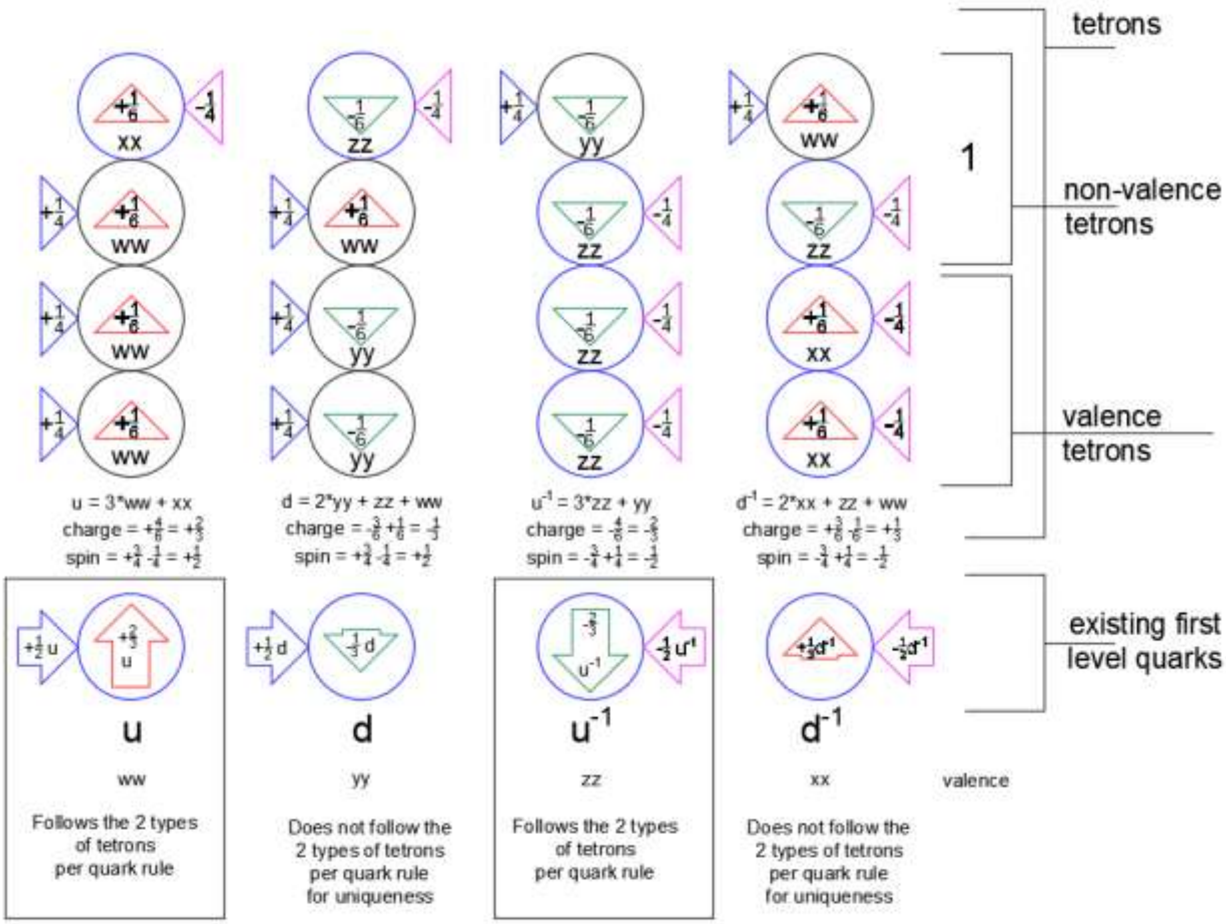

Figure 8 - Existing First Level Quarks

Higher Level Quarks: Charmed and Strange

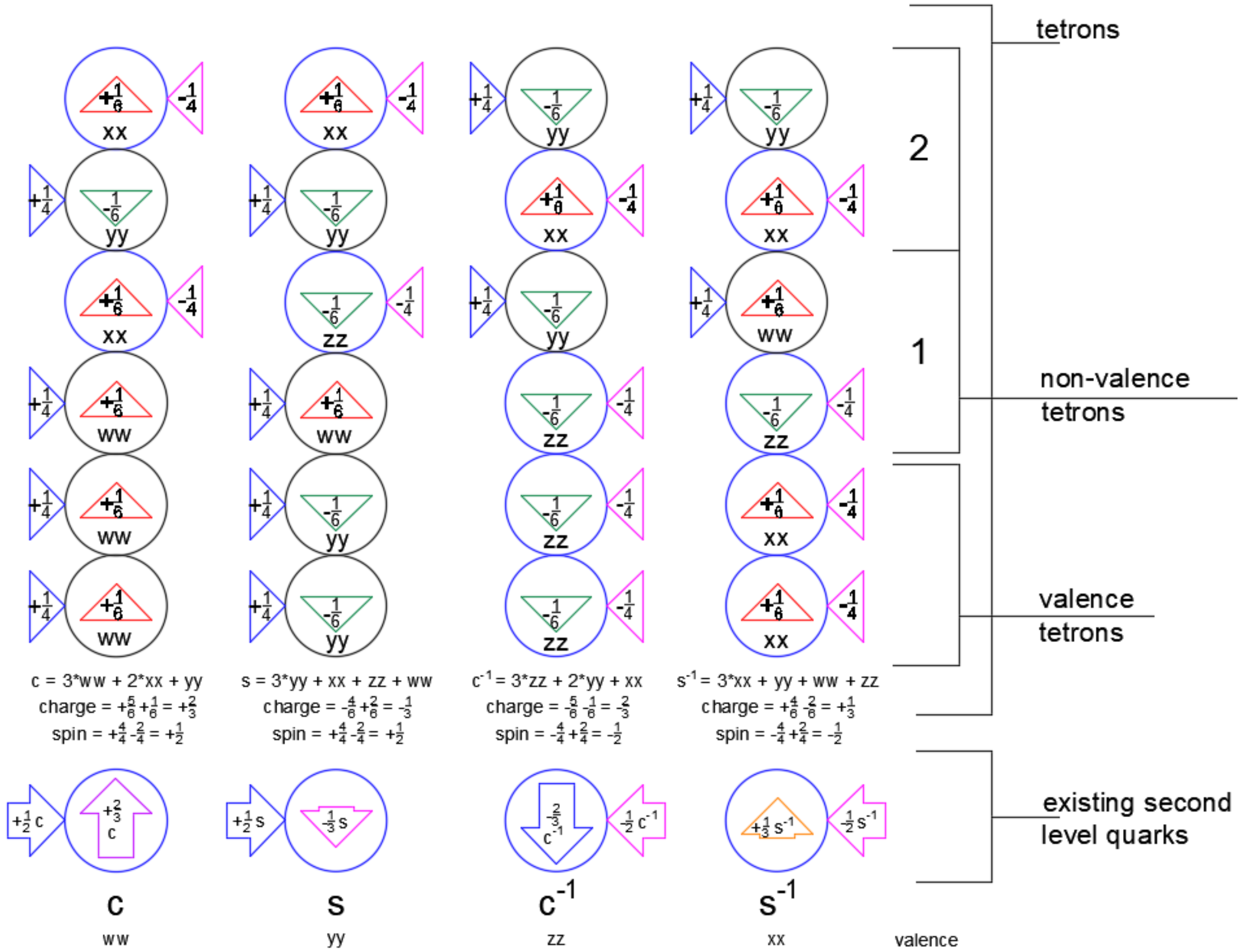

Figure 9 - Existing Second Level Quarks

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Higher Level Quarks: Top and Bottom

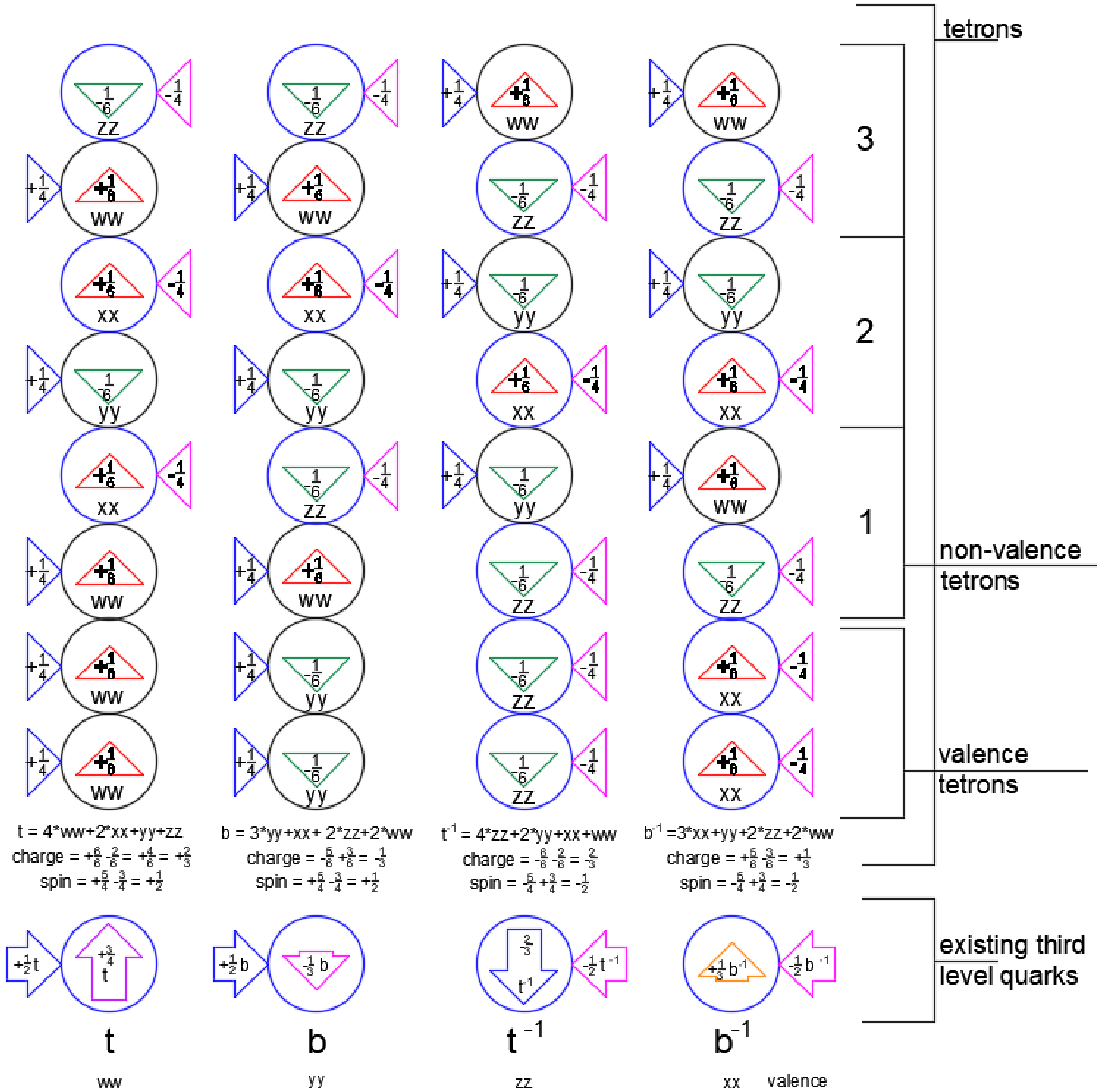

Figure 10 - Existing Third Level Quarks

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New Quarks: WXY, YYZ, WXY^{-1} and YYZ^{-1}

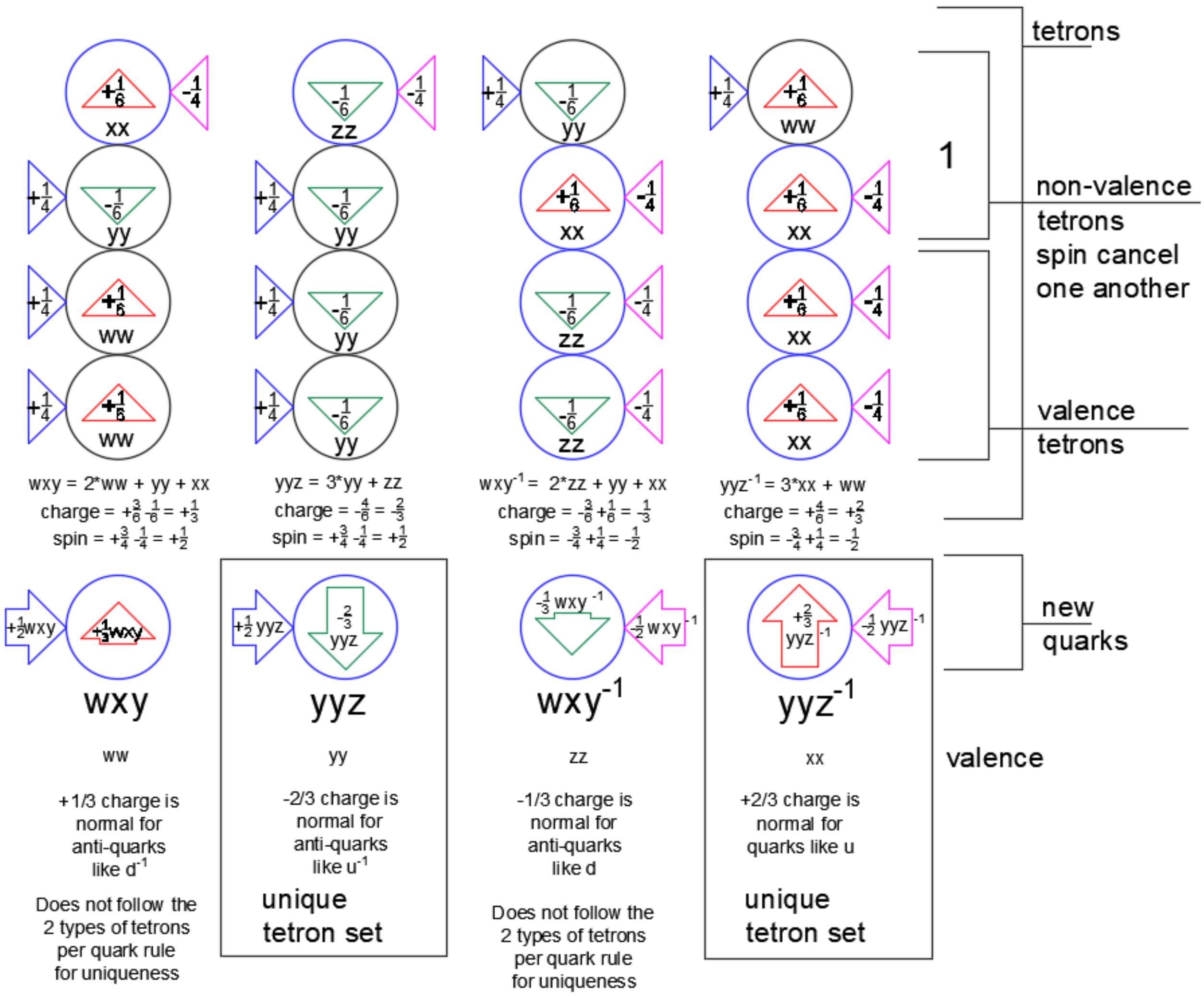
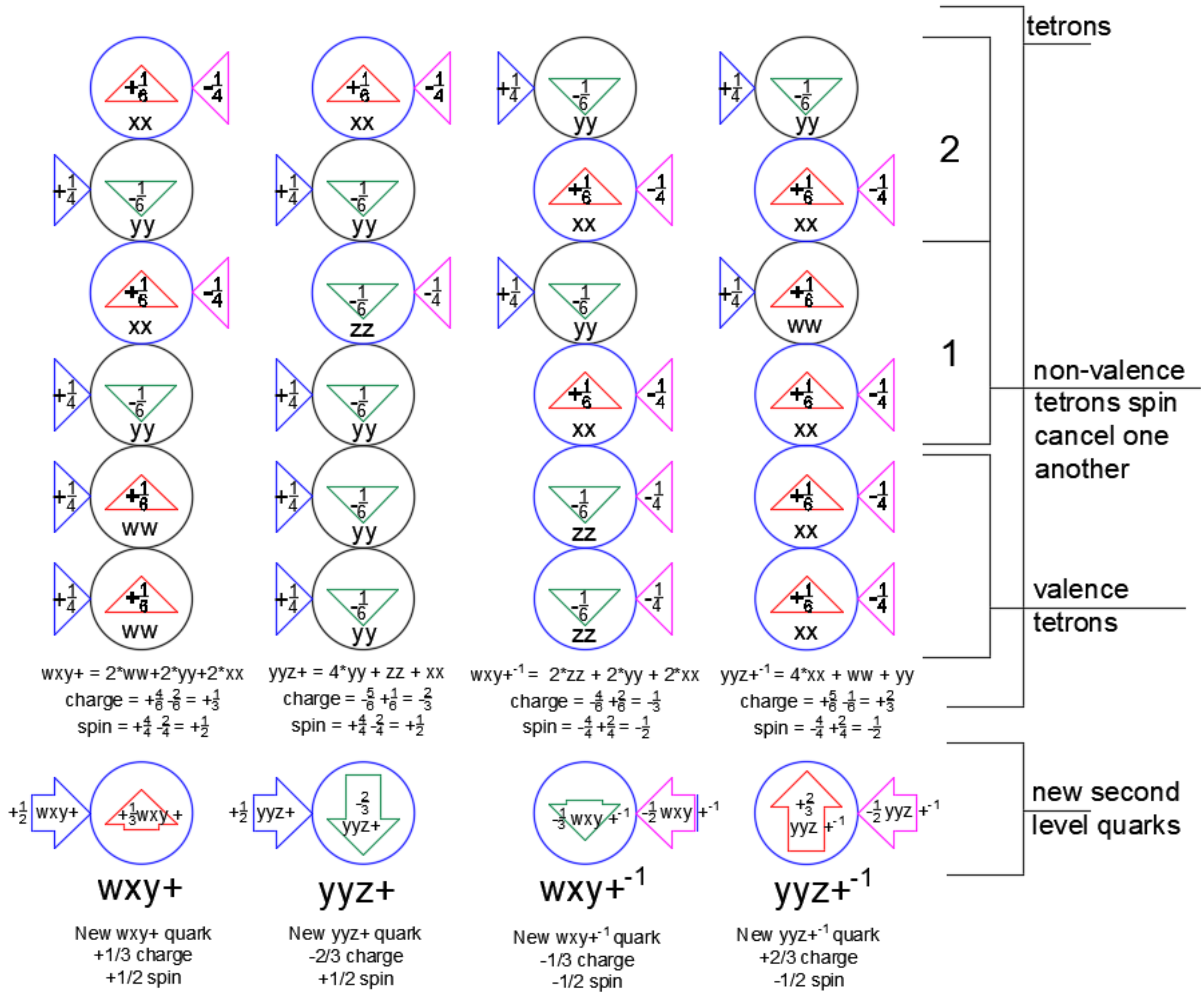


Figure 11 - New First Level Quarks

New Quarks: WXY+, YYZ+, WXY+$^{-1}$ and YYZ+$^{-1}$



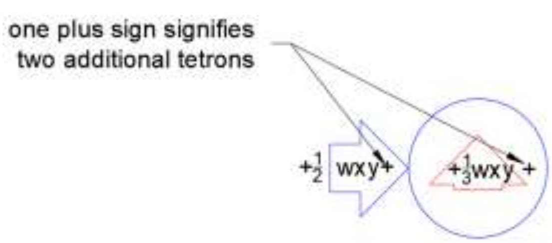
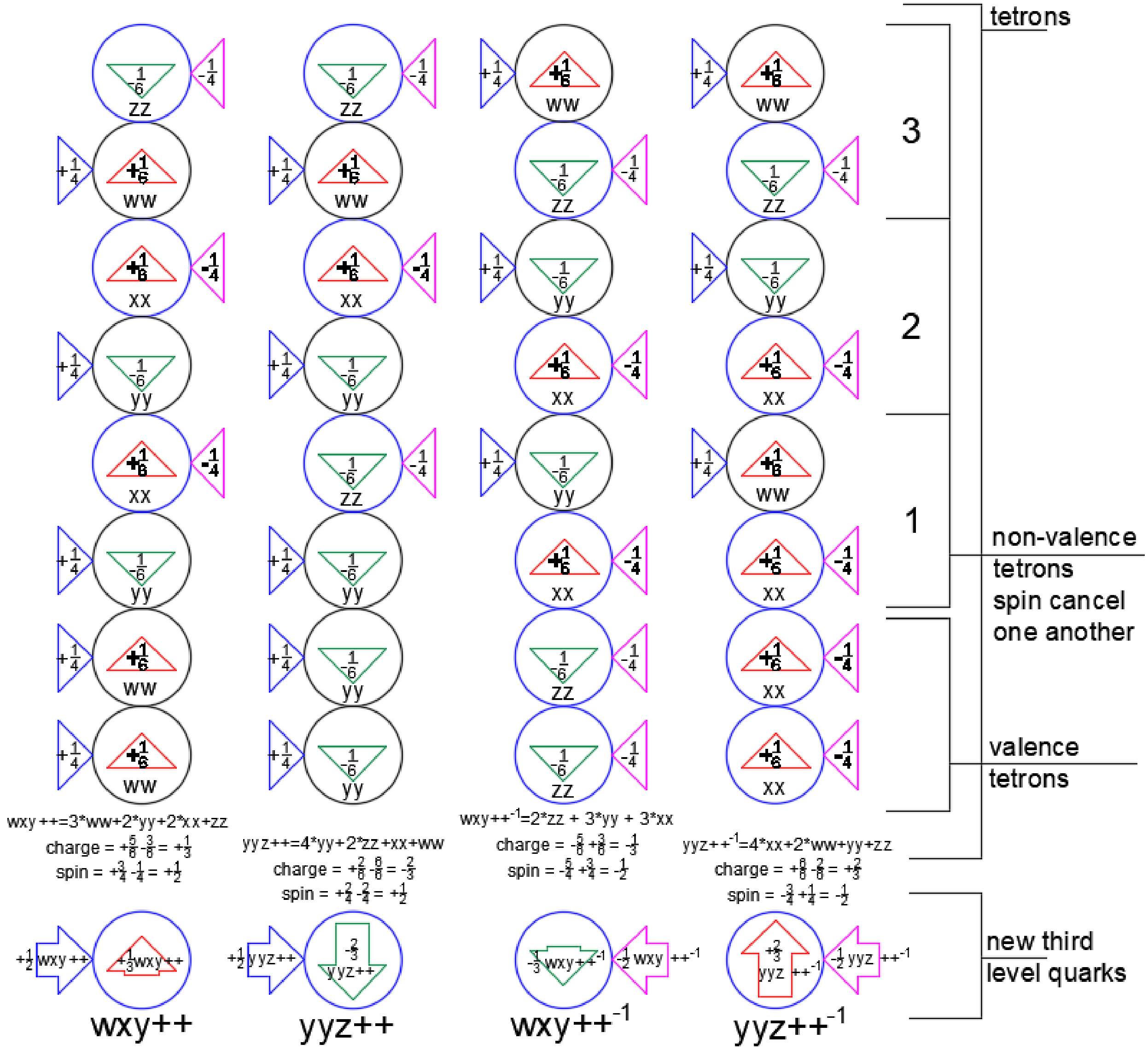


Figure 12 - New Second Level Quarks

New Quarks: WXY++, YYZ++, WXY++$^{-1}$ and YYZ++$^{-1}$



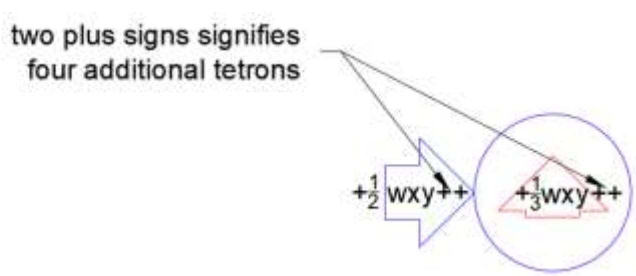


Figure 13 - New Third Level Quarks

Isomers

- The molecular definition of isomer is, "two molecules with identical molecular formula but with different structural arrangements"
- The nuclear definition of isomer is, "two atoms with an identical number of protons and neutrons in their nuclei but with different structural arrangements"
- The quark definition of isomer is, "two quarks with the identical charge, spin and valence tetrons but with different non-valence tetrons". Since the tetrahedral quark is a simple geometry, any four tetrons make a unique isomer. There are no special structural arrangements of four tetrons.

The wxy and d isomers are used in the remainder of this discussion for brevity of illustration. The zzw and d2 quark isomers will be checked for tetron validity in reactions where the tetron identities play a role.

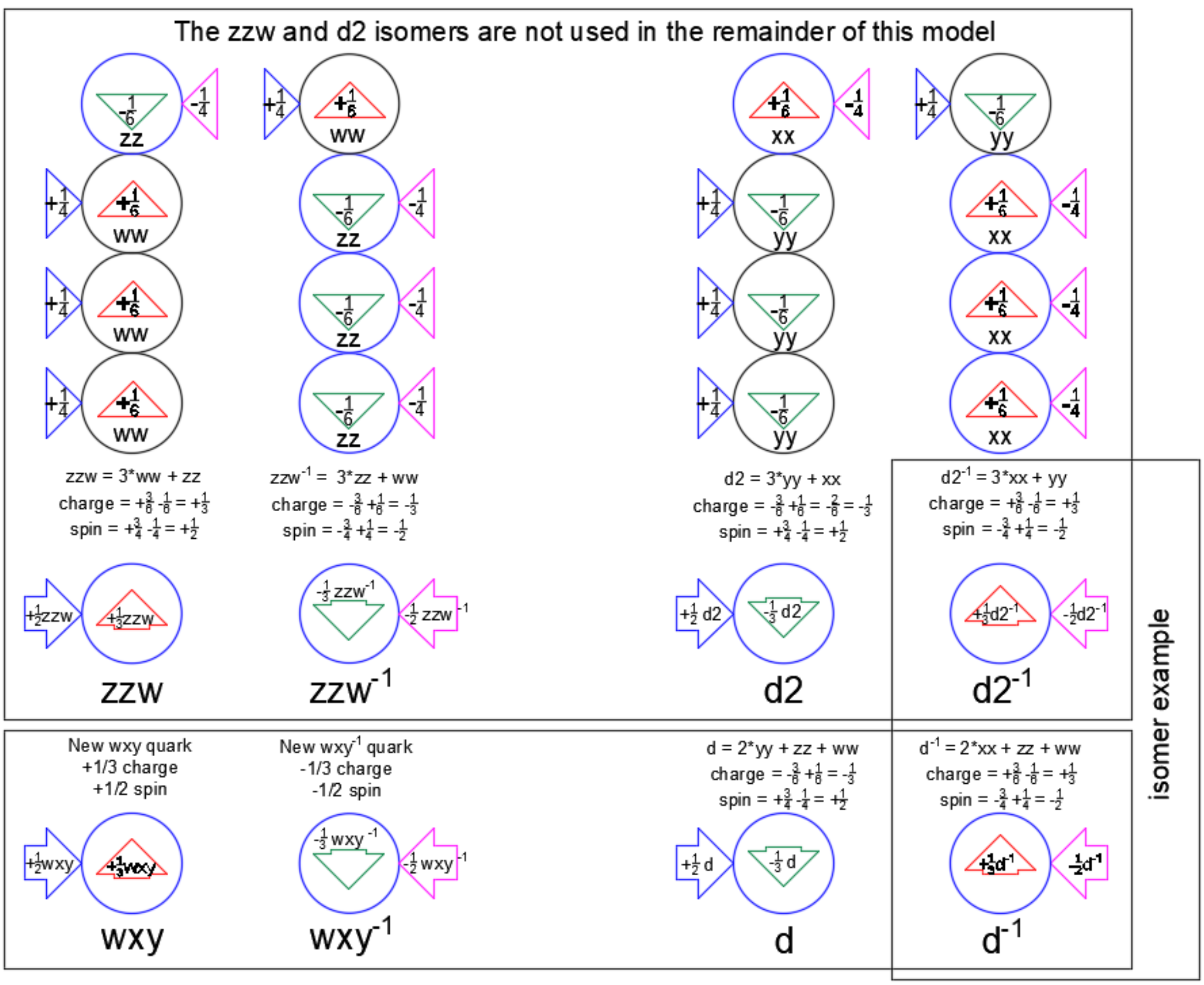


Figure 14 - Quark Isomers

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Two or Three Quarks in a Particle

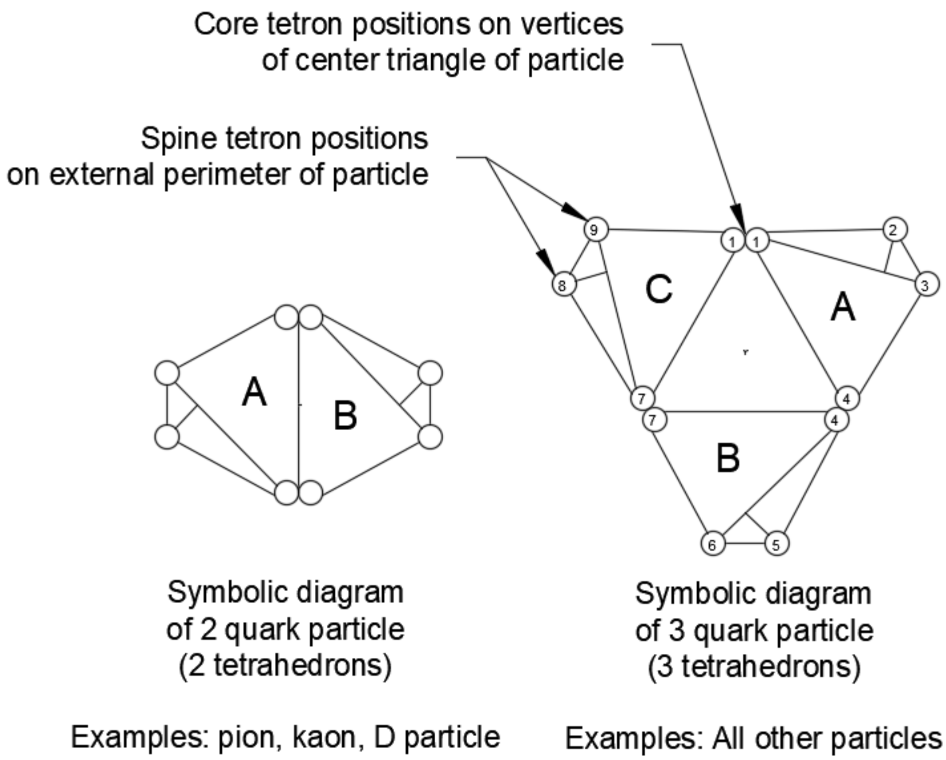

Figure 15 - Two or Three Quarks in a Particle

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Up Quark

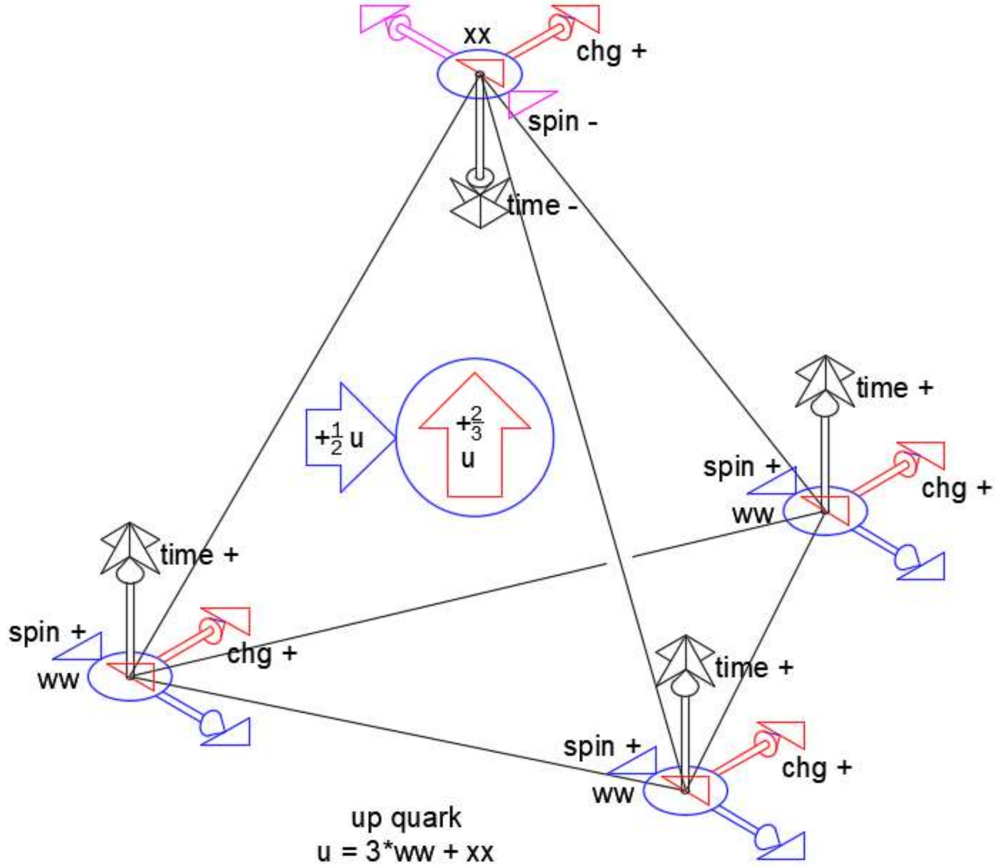

Figure 16 - Up Quark

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Anti-Up Quark

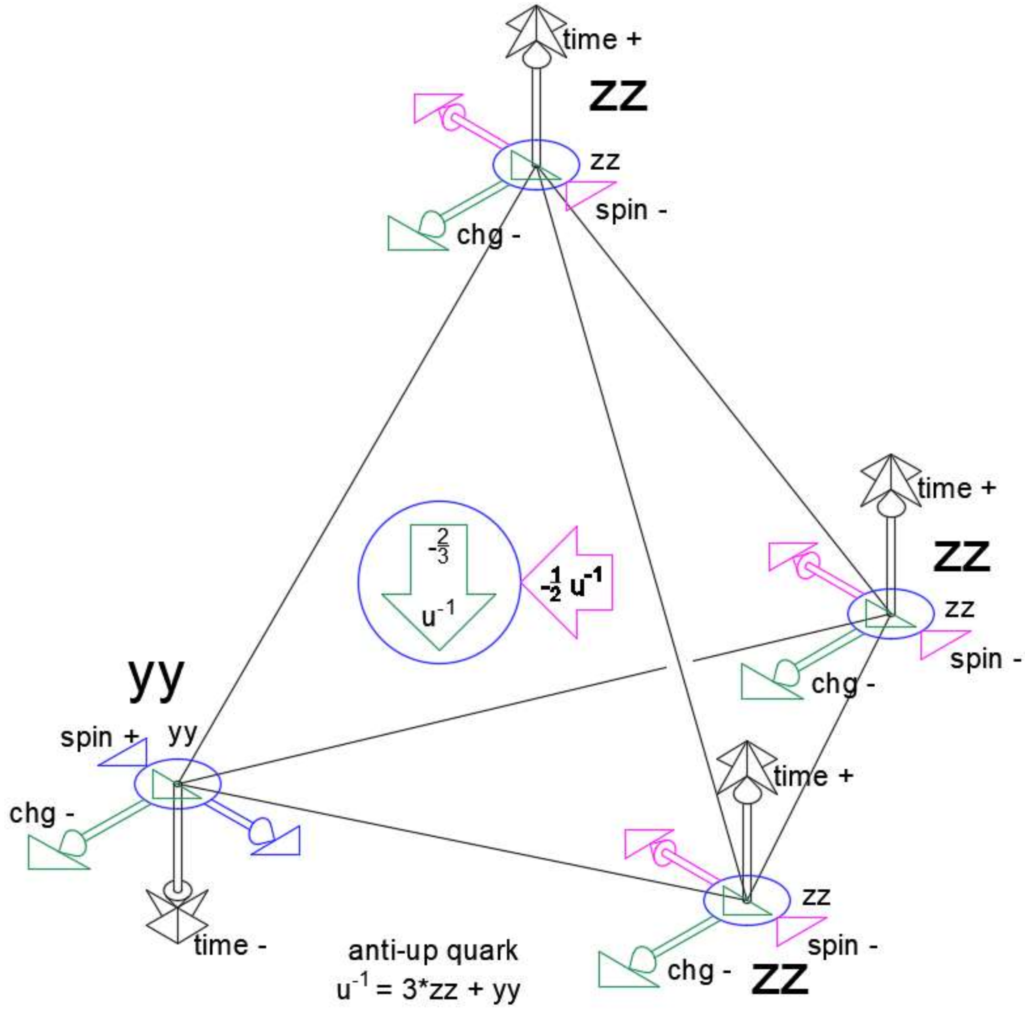

Figure 17 - Anti-Up Quark

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Up and Congruent Anti-Up Quark

It is postulated that an anti-particle exists congruently where every particle exists. In the below example, an up and an anti-up quark are postulated to exist congruently. Why? To complete Dirac's equation necessitating an antimatter particle where a matter particle exists. This tetron-level completion of Dirac's equation occurs below the matter-antimatter division. The existence of a yy tetron wherever an xx tetron exists (and zz wherever ww exists) ensures that matter and antimatter built from quarks follow suit.

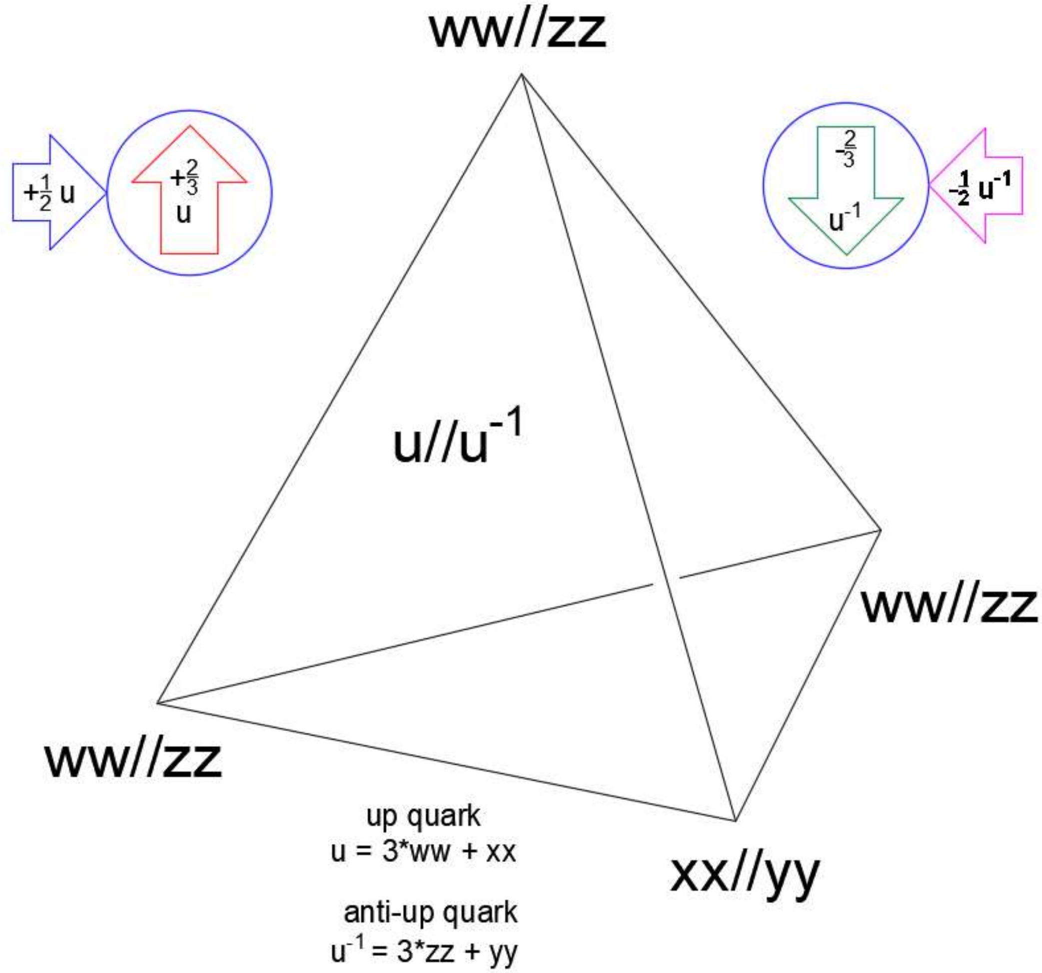

Figure 18 - Up and Congruent Anti-Up Quark

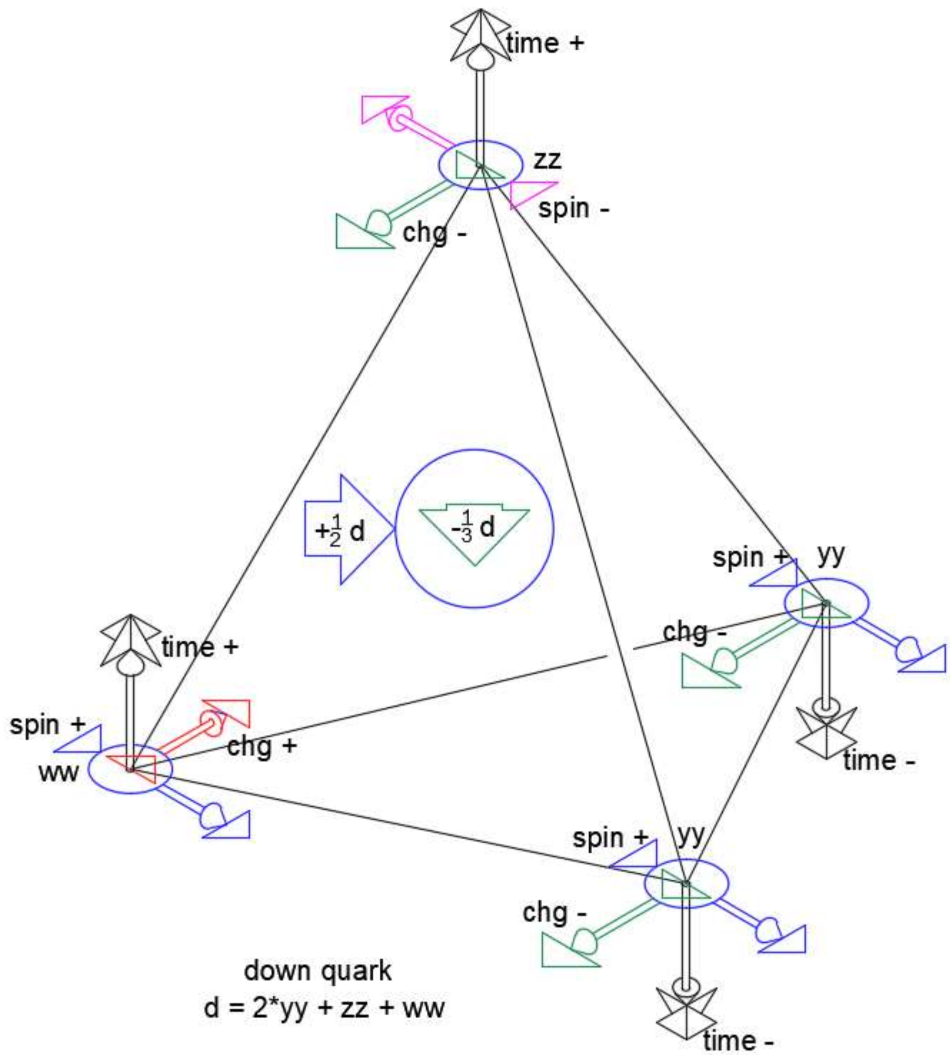

Figure 19 - Down Quark

Higher Mass Quarks

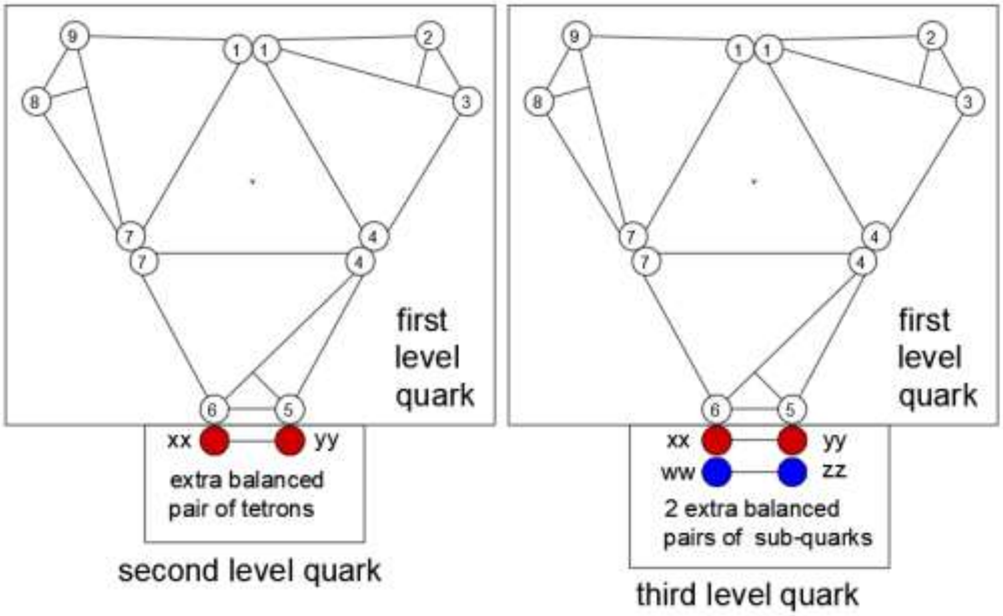

Figure 20 – First, Second and Third Level Quarks

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Higher Mass Quarks Have Extra xx//yy Tetron Pairs

Higher mass quarks are formed when extra xx//yy or yy//xx tetron pairs are added to the exterior (spine) vertices of a quark, which are ww//zz or zz//ww

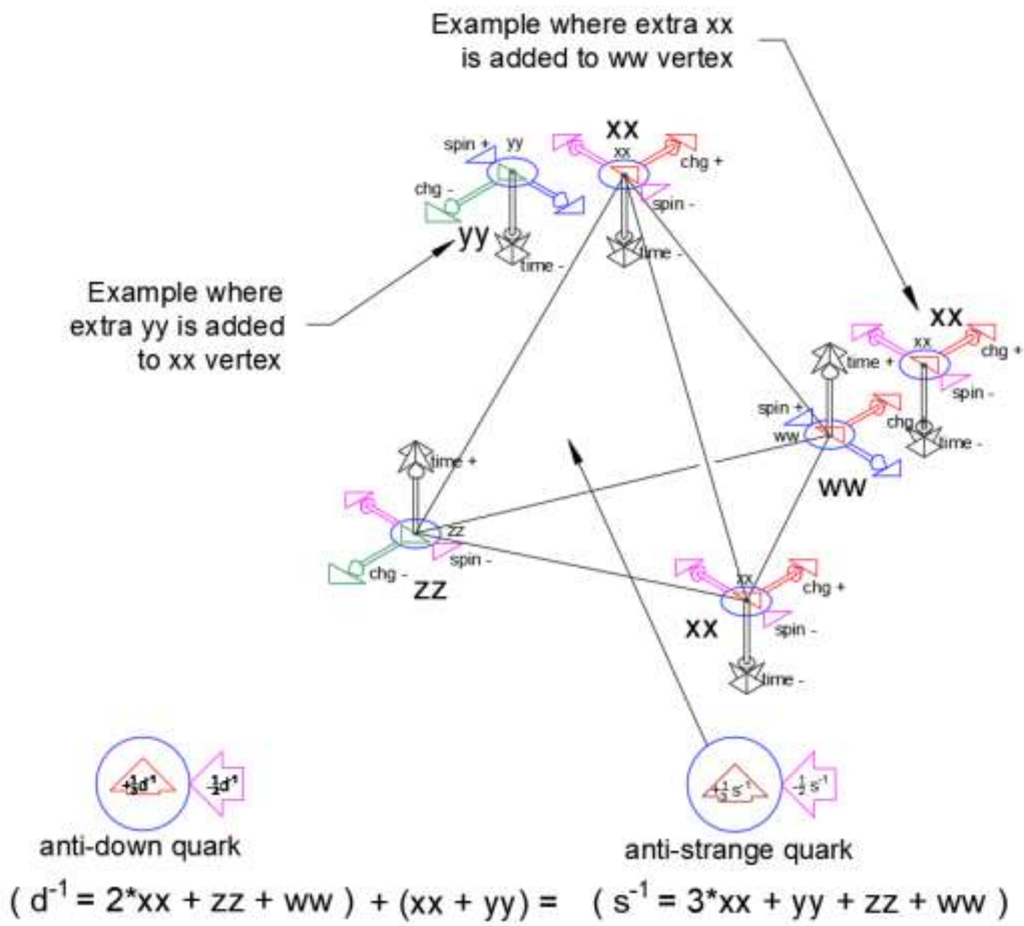

Figure 21 - Similarity of Anti-down and Anti-strange Quarks

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Gluons

Two tetron pairs can co-exist at a gluon where two quark vertices share a location. Two tetron pairs are at each of the three central triangle connections between formed by 3 quarks. In the three-quark particle, there are three gluons forming a triangle at the center.

When a gluon is formed, two pairs of tetrons become superimposed. The Pauli exclusion principle is obeyed because each of the 4 tetrons has a different set of charge, spin and time vectors. Two opposite charges are quenched, and two opposite spins are quenched.

The charges cause the gluon’s tetrons to become tightly bound by opposite charges. Concurrently, two opposite spins are placed in close proximity. Unlike the scalar opposite charges, the opposite spins are perpendicular to one another.

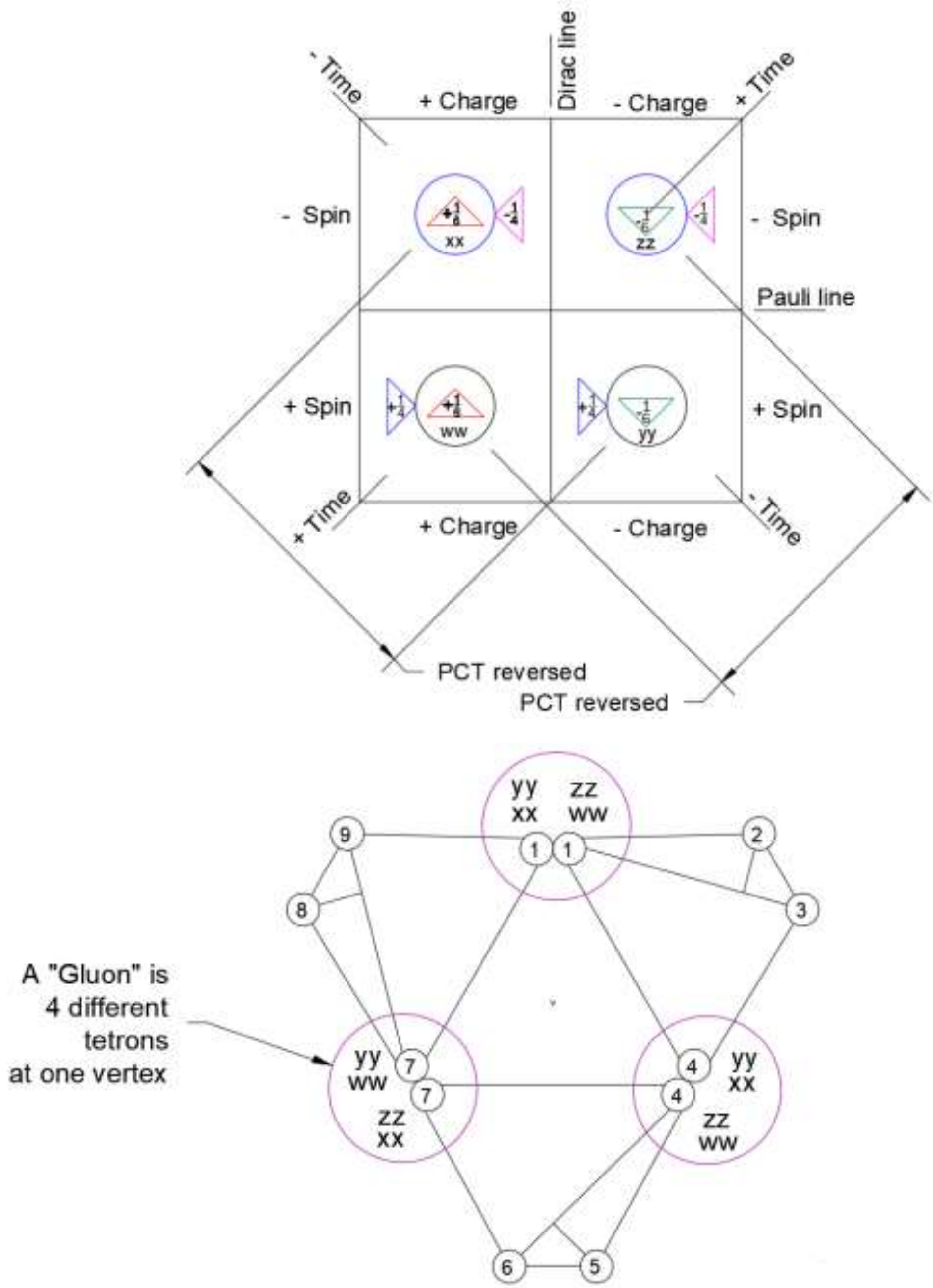

Figure 22 – One Particle Has Three Quarks and Three Gluons

One unit of plus spin (+1/2) forms a cross product with one unit of minus spin (-1/2), resulting in one unit of spin field. This unit of spin field is the result of having a plus unit spin and a minus unit spin acting in the same time direction.

One unit of spin field is the result of two tetrons. The below diagram shows the two instances of opposite spin and opposite charge of a pair of tetrons. The time vectors are aligned in each set because time flow must be the same for charge and spin to be interact.

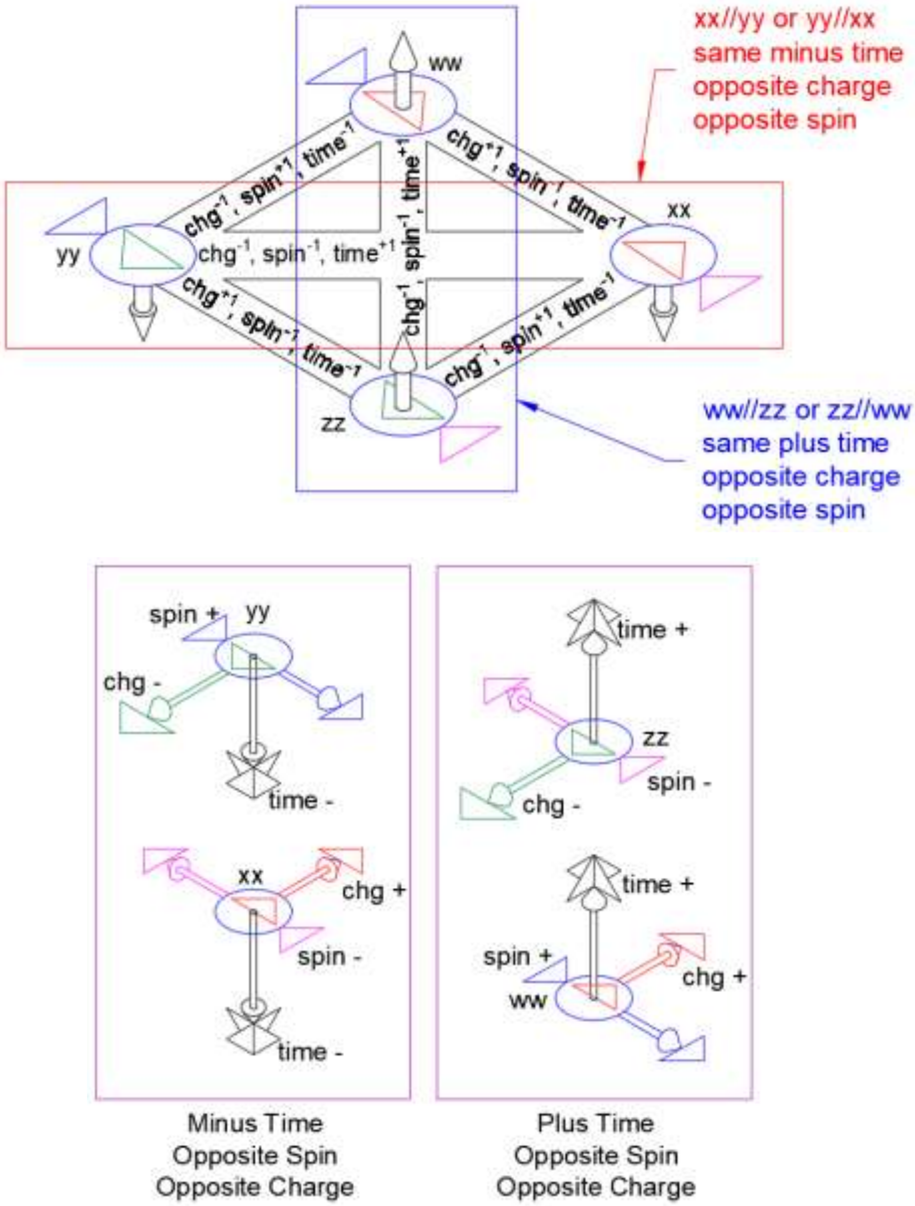

Figure 23 - Two Pairs of Tetrons in the Four Tetron Gluon

Creation of Fields

The gluon has been described as having opposite charge, spin and time that “quench”. Opposite rotations (spin and charge) cancel one another in the sense of no longer being available for being in another gluon. However, the process of cancellation is not annihilation by opposites in the same dimension.

Stalling of Right-Hand and Left-Hand Spins Stores Potential Energy

Plus-spin operates in a different dimension from minus-spin. Plus-spin and minus-spin form a cross product area. When discussing particle physics, it seems unusual to label “torsion” on a bar as one would do in solid mechanics where rotations act in opposite directions. Solid mechanics resolves opposite torsions into shear stress at the surface of the round bar.

The reason for the unusual diagram below is there is no rule for the cross product of a left-hand rule vector with a right-hand rule vector. The label below, "cannot have 3 pinions" means you can't use both the left-hand rule and the right-hand rule in the same diagram. However, we can use the "limit approaching zero" concept to illustrate how this stalling of rotation occurs. Postulate the rotations stall, converting their dynamic spin rotation energy to potential energy in a spin field. A good example of torsion stalling into stationary potential is an automatic transmission torque converter.

One unit of plus spin (+1/2) forms a cross product with one unit of minus spin (-1/2), resulting in one unit of spin field. This unit of spin field is the result of having a plus unit spin and a minus unit spin acting in the same time direction.

Combined with the electrostatic charge attraction in the four tetron gluon, this additional spin field adds up to the strong force.

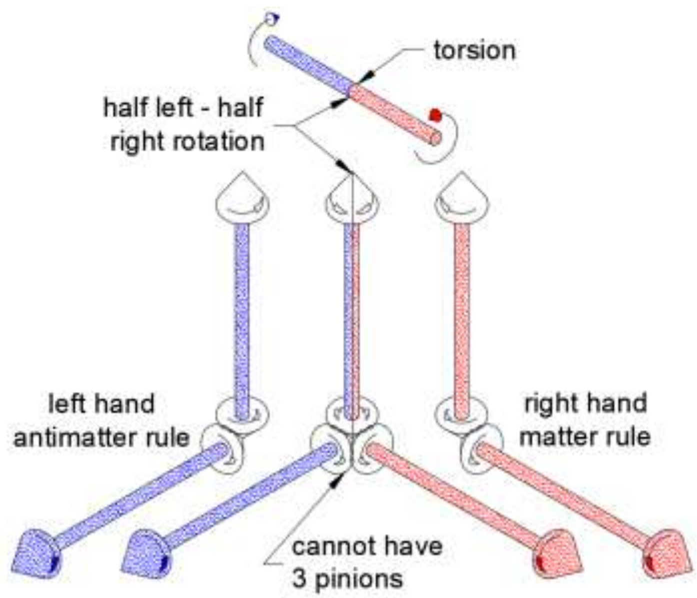

Figure 24 - Stalling of Right-Hand and Left-Hand Spins Stores Potential Energy

Spin Creation with Spin Reaction is Gravity

Cross product resultants are noncommutative and depend on the order written. This preserves the direction in different dimension.

Written in words:

- Plus spin matter is attracted to the plus spin field created by plus spin cross minus spin
- Plus spin matter is repelled by the minus spin field created by minus spin cross plus spin
- Minus spin antimatter is attracted by minus spin field created by minus spin cross plus spin

- Minus spin antimatter is repelled by plus spin field created by plus spin cross minus spin

Written in equations:

Where:
S is a tetron's spin, which can be + or -
+S X +S cannot occur
-S X -X cannot occur
SF is a spin field cross product, which can be + or –
Relative motion:
> = < is attract
< = > is repel
Field creation, where the left vector of the cross product is what the observer is made of:
+SF = +S X -S where +S is matter by naming convention
-SF = -S X +S where -S is antimatter by naming convention
Spin field generation
Like attracts like. The generating spin's gradient is the same slope as the receiving spin's gradient
+S > = < +SF
-S > = < -SF
Opposites repel. The generating spin's gradient is the opposite slope as the receiving spin's gradient
+S < = > -SF
-S < = > +SF
The following diagram shows how anti-gravity, because it is operating in reverse time from gravity, results in the same cause-effect direction of motion.

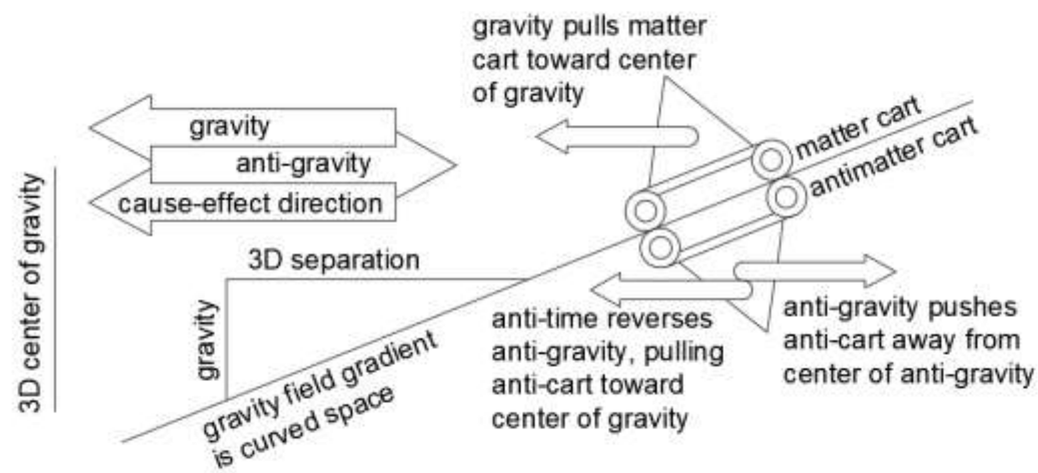

Figure 25 - Gravity and Anti-Gravity Work the Same Direction

Spin Creation at a Fixed Point

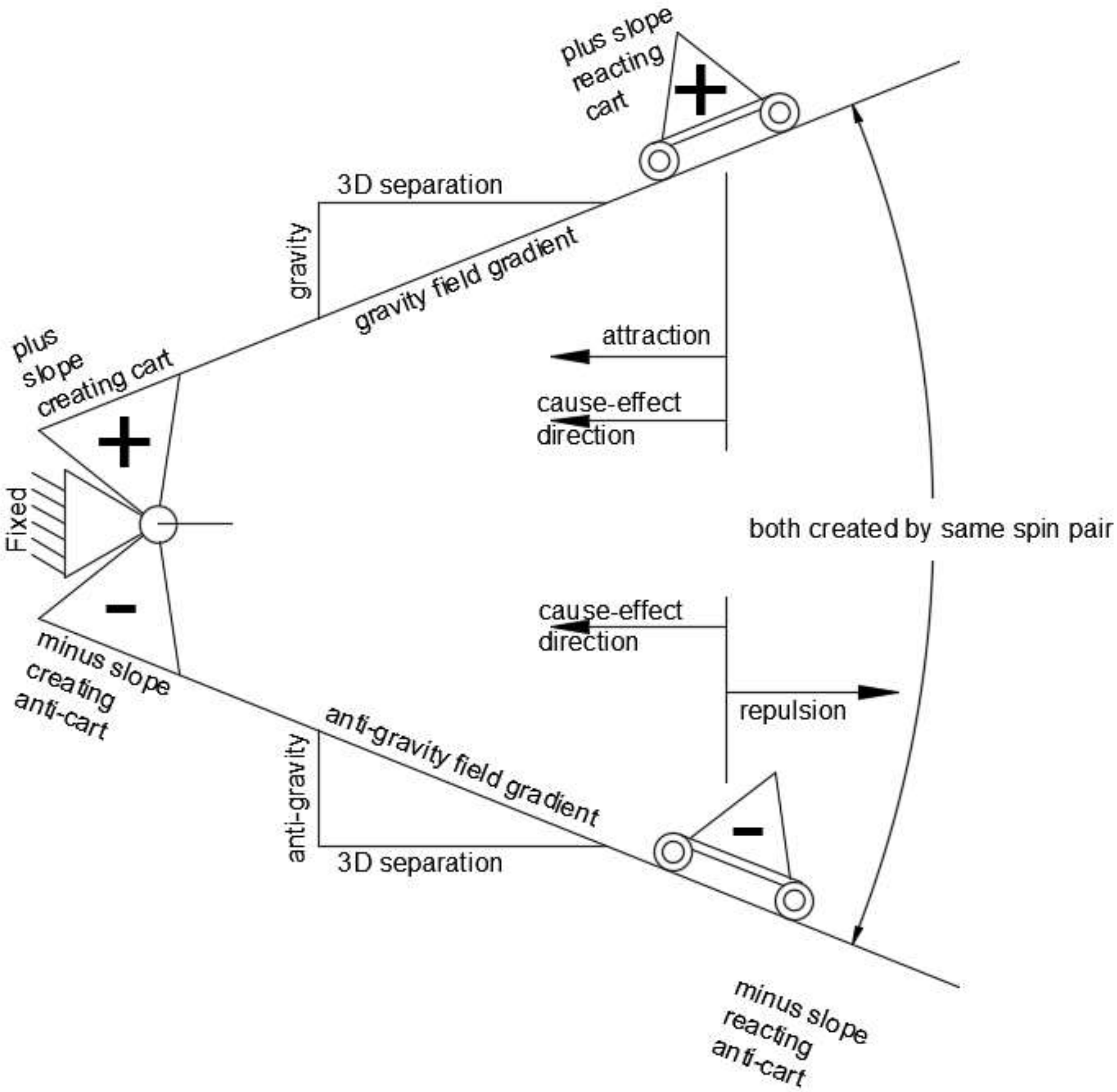

Figure 26 – Plus and Minus Spin Creates Plus and Minus Spin Fields

Chapter 4 Summary

This paper began with tetrons postulated as the building blocks of quarks. Next, four additional quarks were identified: wxy, wxy', yyz, yyz'. Quarks were then shown to be tetrahedral in shape, with a tetron at each vertex. Next, quarks were shown to be a composite with a congruent anti-quark.

Higher mass quarks were shown to be a lower-level quark and a pair of xx and yy spine quarks. Next, tetrons were shown to be the components of a gluon. The electrostatic charge and spin field were shown to be the strong force holding the particle together. Finally, the spin field was shown to be the source of gravity, and especially how a matter/antimatter pair both attract and repel another matter/antimatter pair.