The Quantum Chromodynamics Theory Of Pentaquarks And Mesobaryonic Particles

Based on a generalized particle diagram of baryons and anti-baryons which, in turn, is based on symmetry principles, this theory predicts the existence of: (a) strange pentaquarks and mesobaryonic particles containing one, two, three and four strange quarks, (b) strange pentaquarks and mesobaryonic particles with zero total strangeness, such as the $(\bar{u}\,\bar{u}\,\bar{u}\,\bar{s}\,s)$ *and* $(u\,u\,u\,s\,\bar{s})$ *particles, (c) a relatively large number of pentaquarks and mesobaryonic particles containing neither strange nor anti-strange quarks (also zero total strangeness) and (d) "bottom-top charmed" pentaquarks and mesobaryonic particles, such as the* $(t\,c\,u\,b\,\bar{b})$ *particle. The theory, of course, also predicts the anti-pentaquarks and anti-mesobaryonic particles corresponding to all predicted particles. More importantly, this theory predicts the existence of the* $(u\;u\;d\;c\;\bar{c})$ *pentaquark and the existence of the* $(u\;u\;d\;c\;\bar{c})$ *mesobaryonic particle. This prediction was confirmed on July 14th, 2015 by CERN researchers with the discovery of two charmonium-pentaquark states with a composition:* $(u\;u\;d\;c\;\bar{c})$ *with a significance of more than 9 standard deviations. This makes the discovery extremely solid. However, there are doubts on whether the discovered particles are a strongly bound state of five quarks (known as pentaquark) or a weakly bound state of a baryon,* $(u\;u\;d)$ *, and a meson,* $(c\;\bar{c})$ *(mesobaryonic particle or mesobaryonic molecule). Finally, a remarkable aspect of this theory is that it predicts the existence of all the pentaquarks and mesobaryonic particles there exist in nature.*

by R. A. Frino

Electronics Engineer - Degree from the University of Mar del Plata.

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Contents

1. Introduction

Quantum Chromodynamics (QCD) [1, 2, 3, 4] is a quantum mechanical description of the strong nuclear force. The strong force is mediated by gluons [4, 5] which are spin $1\hbar$ bosons (spin is quoted in units of reduced Plank's constant: $\hbar = h/2\pi$). Gluons act on quarks only (only quarks feel the strong force). Colour charge is a property of quarks (and gluons) which is a kind of electric charge (but of a totally different nature) associated with the strong nuclear interactions. There are three distinct types of colour charge: red, green and blue. It is very important to keep in mind that every quark carries a colour charge, while every antiquark carries an anticolour charge (antired, antigreen or antiblue). However colour charge has nothing to do with the real colour of things. The reason, this quark property, is called colour is because it behaves like colour: all known hadrons (baryons and mesons) are “colourless”, meaning they are colour neutral particles. Baryons, which are made of three quarks, are “colourless” because each quark has a different colour. Mesons, which are made of a quark and an antiquark, are “colourless” because antiquarks carry anticolour. Thus, a meson with a blue quark and a antiblue quark is a colour neutral particle.

An important point to observe is that the Pauli exclusion principle leads to the existence of colour. This principle may be expressed as follows

Pauli Exclusion Principle

In a system made of identical fermions, no two fermions can have the same set of quantum numbers.

The existence of colour was inferred from the omega-minus particle or Ω^- baryon because it seemed to challenge the above principle. This particle, which was discovered in 1964, is made up of three strange quarks (*s* quarks). Because quarks are fermions, they cannot exist with identical quantum numbers, or in other words, they cannot exist in identical quantum states. So that, the Ω^- particle needed a new quantum number to be able to satisfy the Pauli exclusion principle. Thus, physicists proposed the existence of a new quantum number which was called colour. Having a particle with a red strange quark, a green strange quark and a blue strange quark solved the problem: the Ω^- baryon had all its quarks in different quantum states. So that the property called colour was the one that distinguished each of the quarks of the Ω^- particle when all the other quantum numbers are identical.

Like the electric charge, colour charge is a conserved quantity. Thus, QCD introduced a new conservation law: the conservation of “colour charge”. Both quarks and gluons carry colour charge. In contrast, photons which are the mediators or carriers of the electromagnetic force, do not carry electric charge. This is a very important difference between Quantum Electrodynamics (QED) [6] and QCD. Another property of gluons is that they can interact with other gluons. In a certain way, the theory presented here is an extension of the QCD developed independently by Murray Gell-Mann and George Zweig in 1964. Gell-Mann read a James Joyce’s novel entitled Finnegan's Wake, which contains the sentence “three quarks for Muster Mark”, from where he took the word *quark* and introduced into physics. Gell-Mann predicted the existence of the omega-minus particle from a particle diagram known as the baryon decuplet. In 1969, he received the Nobel Prize in physics for this discovery. The baryon decuplet is shown in FIGURE 1 (see also page 25 of reference [2]). The baryon decuplet contains 10 baryons [4, 7, 8], (shown as blue spheres) which are arranged in a symmetric pattern forming an inverted equilateral triangle. This famous decuplet is also shown on the right hand side of FIGURE 2 through 9. However, in these figures, the baryon decuplet has a slightly different arrangement: baryons form a right-angled triangle. This will allow us to use a slightly longer horizontal axis representing the electric charge of the particles (from -2 to +2) rather than the isospin. This, in turn, will allow us to add an “antimaterial mirror image” of the 10 baryons so that we can extend the symmetry of the physical system to include not only baryons and antibaryons but also the elusive pentaquarks, mesobaryonic particles (MBPs) and their antiparticles: antipentaquarks and anti-mesobaryonic particles (anti-MBPs).

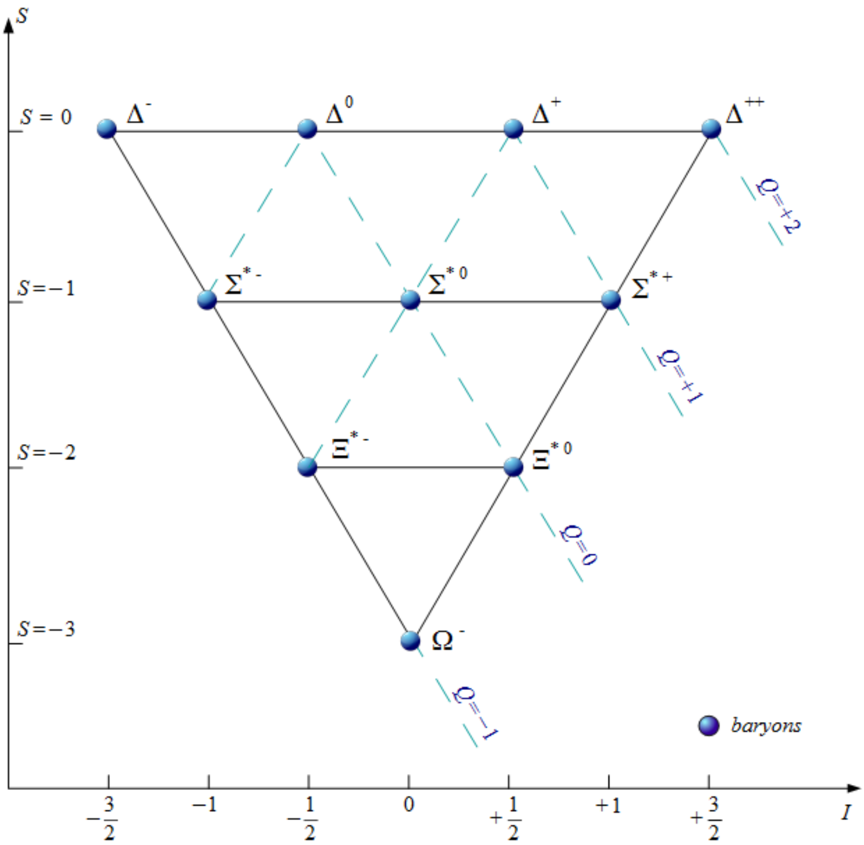

FIGURE 1: ***The Baryon decuplet***. *The diagram shows 10 baryons:* Δ^- , Δ^0 , Δ^+ , Δ^{++} , Σ^{*-} , Σ^{*0} , Σ^{*+} , Ξ^{*-} , Ξ^{*0} *and* Ω^- . *The vertical axis represents the strangeness, S, of the particles while the horizontal axis, I, the isospin. The diagonal lines shown in cyan are lines of equal electric charge. The particles whose names include an asterisk are exited states of the corresponding particles:* Σ^- , Σ^0 , Σ^+ , Ξ^- , Ξ^0 .

Although this theory is intended for experts, it is, from a mathematical point of view, very simple, so that, it is also suitable for those readers with basic knowledge of quarks and equations. Strictly speaking equations are not necessary either. In fact, a number of examples throughout the paper illustrate how to use fractions instead of equations to find the quark contents of exotic particles (pentaquarks and mesobaryonic particles). So that, if you know how to add and subtract fractions you should be able to follow the present analysis. Appendix 1 contains the nomenclature and acronyms used throughout this paper. The expert may skip section 2 as it contains the basic properties of quarks and antiquarks.

2. Summary of the Properties of Quarks and Antiquarks

The following two tables aim to provide a brief overview of the properties of quarks and anti-quarks for non-experts. TABLE 1 is a summary of the properties of quarks while TABLE 2 is a summary of the properties of anti-quarks. The elementary charge, *e*, is defined as a negative quantity: $e = -1.602\ 176\ 6208 \times 10^{-19}\, C$, approximately. Thus, the charge of the electron is e and that of the proton is $|\, e\,|$ (the absolute value of *e*).

QUARKS PROPERTIES (see note 1)							
QUARK NAME	SYMBOL	ELECTRIC CHARGE (times $\|e\|$)	SPIN	STRANGENESS	CHARMNESS	BOTTOMNESS	TOPNESS
up	u	$+\frac{2}{3}$	$\frac{1}{2}$	0	0	0	0
down	d	$-\frac{1}{3}$	$\frac{1}{2}$	0	0	0	0
strange	s	$-\frac{1}{3}$	$\frac{1}{2}$	-1	0	0	0
charm	c	$+\frac{2}{3}$	$\frac{1}{2}$	0	$+1$	0	0
bottom	b	$-\frac{1}{3}$	$\frac{1}{2}$	0	0	-1	0
top	t	$+\frac{2}{3}$	$\frac{1}{2}$	0	0	0	$+1$

TABLE 1: *Properties of quarks. The isospin and the isospin z-componet are not shown.*

ANTIQUARKS PROPERTIES (see note 1)							
QUARK NAME	SYMBOL	ELECTRIC CHARGE (times $\|e\|$)	SPIN	STRANGENESS	CHARMNESS	BOTTOMNESS	TOPNESS
Anti-up	$\bar{u}$	$-\frac{2}{3}$	$\frac{1}{2}$	0	0	0	0
Anti-down	$\bar{d}$	$+\frac{1}{3}$	$\frac{1}{2}$	0	0	0	0
Anti-strange	$\bar{s}$	$+\frac{1}{3}$	$\frac{1}{2}$	$+1$	0	0	0
Anti-charm	$\bar{c}$	$-\frac{2}{3}$	$\frac{1}{2}$	0	-1	0	0
Anti-bottom	$\bar{b}$	$+\frac{1}{3}$	$\frac{1}{2}$	0	0	$+1$	0
Anti-top	$\bar{t}$	$-\frac{2}{3}$	$\frac{1}{2}$	0	0	0	-1

TABLE 2: *Properties of antiquarks. The isospin and the isospin z-componet are not shown because are not used by this theory.*

3. The Incomplete Matter-Antimatter Way

The existence of pentaquarks was first postulated by three Russian physicists: Polyakov, Diakonov and Petrov in 1997. In this formulation and using a different approach, I have hypothesized the existence of a wide spectrum of pentaquarks and mesobaryonic particles. In fact, we shall see that this theory is so general that accounts for all these exotic particles in existence. My approach is based on a new diagram that I call **the matter-antimatter way** (MAW). We shall explore this diagram in detail starting with **the incomplete matter-antimatter way** (see FIGURE 2) which is, as the name suggests, an incomplete version of **the matter antimatter way** (see FIGURE 9). The first thing we notice is that the diagram of FIGURE 2 is symmetrical about the vertical axis, which is called: the symmetry axis (the symmetry axis has no arrows and is shown in red). We also observe that the diagram may be considered as made up of two different diagrams:

(a) the **particles side** or **material side** (on the right hand size of the symmetry axis), and
(b) the **antiparticles side** or **anti-material side** (on the left hand side of the symmetry axis).

On the particles side we have 10 baryons, known as the baryon decuplet. This is the original decuplet discovered by Murray Gell-Mann (See FIGURE 1). This decuplet is shown as blue circles. On the antiparticles side we have the anti-baryon decuplet containing the 10 corresponding anti-baryons. These anti-baryons are shown as red circles. The antiparticles side of the diagram can be obtained simply by placing a mirror along the symmetry axis (with the reflecting side facing the material side) and replacing the reflection of the particles by their corresponding antiparticles. Thus, our mirror is a kind of "magical mirror" because in addition to reflecting images (this is called parity or *P* symmetry) it has to do additional tasks that normal mirrors don't do. Firstly, it must also be able to replace the reflected particles by their corresponding antiparticles (this is called charge conjugation or *C* symmetry - see note 2). This means that the direction of the *Q* axis for antiparticles must point in the same direction to that of particles (according to the way axes are shown in FIGURE 2, the reflection of the *Q* axis in a normal reflected image will point in the opposite direction to that of the original or real *Q* axis). Secondly, it must reverse the direction of time so that if a particle moves forward in time, then its reflected image must be moving backward in time (this is called time reversal or *T* symmetry). Thirdly, it must change the strangeness of particles by the corresponding strangeness of antiparticles. This means that the direction of the *S* axis for antiparticles must point in the opposite direction to that of particles. This is **strangeness reversal**.

In summary, we have changed the direction of the reflected *Q* and *S* axes so that the *Q* axis for antiparticles will point in the same direction than that for particles, and the *S* axis for antiparticles will point in the opposite direction than that for particles. So, all in all, the operations our "magical mirror" must perform are:

(1) Parity operation (*P* symmetry).
(2) Charge conjugation (*C* symmetry),
(3) Time reversal (*T* symmetry),

These operations are called ***CPT* symmetry** (strangeness reversal is included into the *C* operation – see note 2). However, the name *CPT* symmetry is inappropriate because antiparticles have opposite properties to that of particles, and this includes opposite flow of time. In other words, antiparticles will always exhibit time reversal and charge conjugation simultaneously. Therefore, you cannot separate charge conjugation from time reversal because is conceptually wrong (see note 2). Thus, in order to solve this conceptual problem I shall use the acronym: ***PC*+ symmetry** instead of *CPT* symmetry. Where *P* indicates a parity operation (Operation 1) and *C*+ indicates all the reversal operations to be performed to convert particles into antiparticles. These include

C+ operation/ transformation (C plus symmetry)	Electrical charge reversal (*Q* symmetry) (Operation 2), Time reversal (*T* symmetry) (Operation 3), Strangeness reversal (Operation 4), Charmness reversal (Operation 5), Bottomness reversal (Operation 6), Topness reversal (Operation 7), Baryon number reversal (Operation 8), Lepton number reversal (Operation 9), etc.

Thus our “magical mirror” has to perform the following operations or transformations:

<table>
<tr><td rowspan="2">CPT
operation/
transformation
(CPT symmetry)</td><td>P operation</td><td>Parity (Operation 1),</td></tr>
<tr><td>C+ operation/
transformation
(C plus symmetry)</td><td>Electrical charge reversal (Q symmetry) (Operation 2),
Time reversal (T symmetry) (Operation 3),
Strangeness reversal (Operation 4),
Charmness reversal (Operation 5),
Bottomness reversal (Operation 6),
Topness reversal (Operation 7),
Baryon number reversal (Operation 8),
Lepton number reversal (Operation 9),
etc.</td></tr>
</table>

It is worthwhile to remark that the *Q* operation involves electrical charge reversal only. Let's now return to FIGURE 2. Because I have introduced two modifications to the “baryon decuplet”, this decuplet turns out to be a special case of the incomplete matter-antimatter way shown on FIGURE 2. The first modification is that (a) the isospin axis has been replaced by an axis representing the electric charge of particles. This modification changes the layout of the 10 baryons. Thus, instead of having 10 baryons arranged in an equilateral triangle, they are now arranged in a right-angled triangle (see the blue circles on the particles side of FIGURE 2). I must clarify that the electric charge axis, *Q*, may be drawn diagonally on the original baryon decuplet diagram. This is shown in FIGURE 1 and also in page 25 of reference [2]. The second modification is (b) the addition of the “magical mirror image” (*PC*+ symmetry) of the 10 baryons represented by the right-angled triangle on the left hand side of the symmetry axis (see the red circles on the antiparticles side of FIGURE 2). The figure also shows 5 pairs of empty circles drawn on the symmetry axis. Despite the fact that every pair of empty circles overlap, they are shown as partially overlapped so that one can distinguish each pair. Each pair contains two points or empty circles. The fully visible empty circle correspond to particles (on the matter side) while the circle behind it, corresponds to antiparticles (on the antimatter side). Later when I describe the general theory of pentaquarks and mesobaryonic particles, I shall show these circles side by side and I shall also change the colours of some circles (see FIGURE 9). The reason is that the general theory requires a more meticulous diagram than that shown on FIGURE 2. But as for now, figures 2 through 8 will be good enough. The 5 fully visible points or empty circles are denoted, from the lower vertex up the page of FIGURE 2, with the letters *V, W, X, Y, Z,* respectively; and the 5 partially visible points or empty circles are denoted, in the same order, with the primed letters *V', W', X', Y', Z',* respectively. These 10 points are located on the symmetry axis. The coordinates of these 10 points are shown on TABLE 3. We have to keep in mind that these coordinates (as the coordinates of all the points shown on FIGURE 8 and FIGURE 9) are fundamental to this theory.

QS COORDINATE SYSTEM	POINT	POINT COORDINATES	MEANING (The expert may leave out this column)
MATTER For particles. Right hand side coordinate system)	V (lower vertex)	$(-2,-4)$	$Q=-2$ and $S=-4$
	W (lower middle point)	$(-2,-3)$	$Q=-2$ and $S=-3$
	X (middle point)	$(-2,-2)$	$Q=-2$ and $S=-2$
	Y (upper middle point)	$(-2,-1)$	$Q=-2$ and $S=-1$
	Z (base point)	$(-2,\ 0)$	$Q=-2$ and $S=0$
ANTIMATTER (For antiparticles. Left hand side coordinate system)	V' (lower vertex)	$(+2,+4)$	$Q=+2$ and $S=+4$
	W' (lower middle point)	$(+2,+3)$	$Q=+2$ and $S=+3$
	X' (middle point)	$(+2,+2)$	$Q=+2$ and $S=+2$
	Y' (upper middle point)	$(+2,+1)$	$Q=+2$ and $S=+1$
	Z' (base point)	$(+2,\ 0)$	$Q=+2$ and $S=0$

TABLE 3: *Coordinates of the of points the triangle of FIGURE 2 (incomplete matter-antimatter way). These points are marked with empty circles.*

The main idea behind this formulation is that every pair of empty circles (every pair of non-primed and primed points) of FIGURE 2 (and all the labelled points of FIGURE 9) represents a set of particles and antiparticles. In fact, in the next sections, and based on the values of electric charge and strangeness for each point, I shall find: (a) the exact nature of the particles and antiparticles (pentaquarks and mesobaryonic particles and the corresponding antiparticles) of each pair of empty circles, and (b) the exact number of particles and antiparticles (pentaquarks and mesobaryonic particles and the corresponding antiparticles) contained in every pair of empty circles. But this is not the full story. The full story is that in every blue circle, red circle and empty circle of FIGURE 2 there exist pentaquarks and mesobaryonic particles. This is shown in FIGURE 9 of section 7. FIGURE 9 shows all the points in which pentaquarks and mesobaryonic particles exist. It is important to observe that I have changed the colour code of the particles/antiparticles to be able to easily differentiate baryons from pentaquarks and anti-baryons from antipentaquarks. But, as for now, let's turn our attention to the incomplete matter-antimatter way of FIGURE 2.

(see next page)

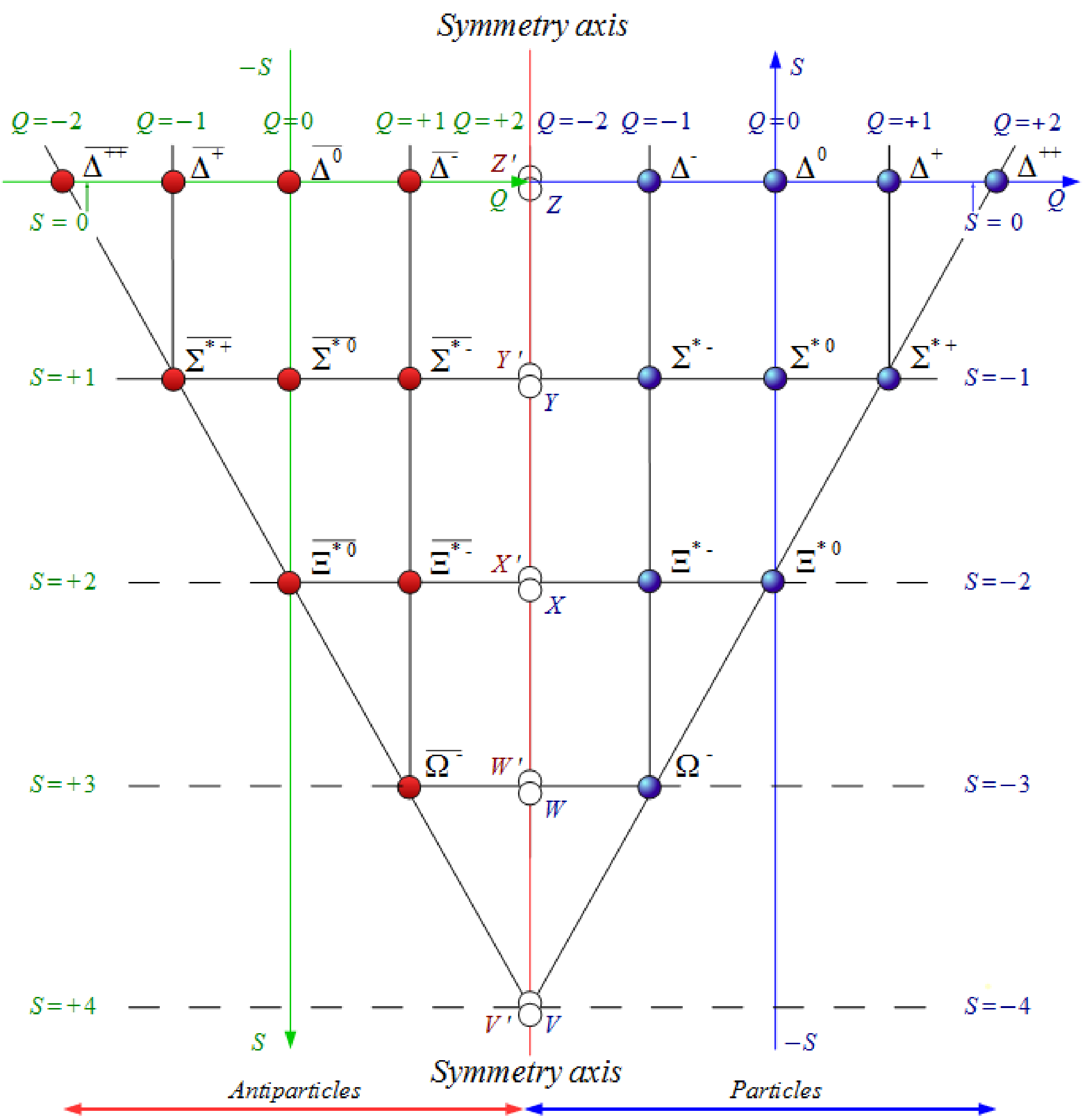

FIGURE 2: ***The Incomplete Matter-Antimatter Way:*** *a pattern of 10 baryons (blue circles), 10 anti-baryons (red circles) and 5 pairs of empty circles drawn on the symmetry axis. Despite the fact that every pair of empty circles overlap, they are shown as partially overlapped so that one can distinguish each pair. It is important to observe that two QS coordinate systems have been used. One QS coordinate system is for particles while the other one is for their antiparticles. Thus, one of the horizontal Q axes represents the electric charge of particles while the other one represents the electric charge of antiparticles. It is important to observe that Q=-2 belongs to the particles' Q axis while Q=+2 belongs to the antiparticles' Q axis (see TABLE 3 for the rest of the points). One of the vertical S axis represents the strangeness of particles while the other vertical S axis represents the strangeness of antiparticles. The isospin property of the particles and antiparticles is not used in this formulation, therefore is not shown. The composition of all the particles and antiparticles shown in this diagram are given in Appendix 1. The particles whose names include an asterisk:* Σ^{*-} , Σ^{*0} , Σ^{*+} , Ξ^{*-} , Ξ^{*0} *are exited states of the corresponding particles:* Σ^{-} , Σ^{0} , Σ^{+} , Ξ^{-} , Ξ^{0} .

In addition to the diagram of FIFURE 2 the main diagrams of this formulation are:

(1) **The matter-antimatter way along the symmetry axis.** This diagram includes all the pentaquarks and mesobaryonic particles (and all their corresponding antiparticles) there exist on the empty points along the symmetry axis. This diagram is shown in FIGURE 8.

(2) **The complete matter-antimatter way** or simply **the matter-antimatter way.** This diagram includes all the pentaquarks and mesobaryonic particles (and all their corresponding antiparticles) there exist in nature. This is the most complete diagram of this theory. This diagram is shown in FIGURE 9.

Before we get to the complete diagram, let's explore the diagram of FIGURE 2 in more detail. An innovative feature of this diagram is that contains two *QS* coordinate systems which act like Cartesian coordinate systems (*Q* instead of *x* and *S* instead of *y*). One *QS* coordinate system is for particles (shown in blue) while the other one is for their antiparticles (shown in red). Thus, one of the horizontal *Q* axes represents the electric charge of particles while the other one represents the electric charge of antiparticles. Similarly, one of the vertical *S* axis represents the strangeness of particles (+*S* points up the page) while the other vertical *S* axis represents the strangeness of antiparticles (+*S* points down the page).

It is important to observe that *Q* = -2 belongs to the particles' *Q* axis while *Q* = +2 belongs to the antiparticles' *Q* axis. Thus the points (-2, 0) and (+2,0) overlap. In this theory, I postulate that that there exist pentaquarks and mesobaryonic particles on the non-primed points: *V*, *W*, *X*, *Y* and *Z*; and antipentaquarks and anti-mesobaryonic particles on the primed points: *V'*, *W'*, *X',* *Y'* and *Z'* of the diagram. Later I shall generalize the theory to include all the labelled points of the complete matter-antimatter way shown on FIGURE 9.

If pentaquarks and nd mesobaryonic particles were not real, no particles would occupy the empty circles. This would contradict the belief that the universe is based on symmetry. By the way, the Standard Model has been built around symmetry principles as well. Symmetries are very powerful principles that dictate the form of the laws of physics and impose the micro structures of the universe.

4. Analysis Along the Straight Lines $Q = -2$ and $Q' = +2$ (Symmetry Axis)

4.1 Analysis of Quadruply Strange Pentaquarks: Point $V(-2,-4)$ and $V'(+2,+4)$

Despite the fact that I predicted the existence of quadruply strange pentaquarks in another article [9], I decided to include a similar analysis here because of three reasons. The first reason is completeness. The general theory must be complete without making reference to any other external analysis. The second reason is that the explanations of this section are more detailed. The third reason is graphical. The figure included in this section (FIGURE 2) is an improved version of the corresponding figure that appears in the previous article.

4.1.1 Point $V(-2,-4)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue on the right hand side of FIGURE 2. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -2 ($Q=-2$) (meaning $-2e$, where *e* is the absolute value of the elementary charge).

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -4 ($S=-4$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), the only way a particle can have a strangeness of -4 is if 4 of the constituents of this particle were 4 strange quarks.

Taking into account these two conditions and the fact that each strange quark carries an electric charge of $-1/3$, the **electric charge equation** for this particle will be

$$Q = 4\,q_s + q \tag{4.1.1}$$

Where

$Q =$ total electric charge of the unknown particle (-2)
$q_s =$ electric charge of the strange quark ($-1/3$)
$q =$ electric charge of another quark (different from an *s* quark) so that the total charge of the unknown particle is -2 . This quark will be called the fifth quark.

We solve equation (4.1.1) for *q*. This gives

$$q = Q - 4\,q_s \tag{4.1.2}$$

Then, the value of the electric charge, *q,* of the fifth quark should be

$$q = -2 - \left(-\frac{4}{3}\right) = -2 + \frac{4}{3} = -\frac{2}{3} \tag{4.1.3}$$

Looking at TABLE 2 of section 2 (antiquark properties) we see that there are only three antiquarks that have an electric charge equal to $-2/3$. These antiquarks are:

(i) the antiup quark, $\bar{u}$,
(ii) the anticharm quark, $\bar{c}$, and
(iii) the antitop quark, $\bar{t}$,

Because equation (4.1.2) is satisfied by three antiquarks, equation (4.1.1) must be written as three different equations

$$Q = 4\,q_s + q_{\bar{u}} \tag{4.1.4}$$
$$Q = 4\,q_s + q_{\bar{c}} \tag{4.1.5}$$
$$Q = 4\,q_s + q_{\bar{t}} \tag{4.1.6}$$

Where

$q_{\bar{u}} =$ electric charge of the antiup quark = $-2/3$
$q_{\bar{c}} =$ electric charge of the anticharm quark = $-2/3$

$q_{\bar{t}} =$ electric charge of the antitop quark = $-2/3$

But having three different electric charge equations means that we must also have three different particles of each type: 3 pentaquarks and 3 mesobaryonic particles. Thus, in total, there must be 6 exotic particles. Thus based on the allowed electric charge and strangeness we have found the nature of the unknown particles. The following table summarizes the properties of the quadruply strange pentaquarks and quadruply strange mesobaryonic particles (or mesobaryonic molecules)

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
PARTICLES WITH 4 STRANGE QUARKS	$P_{4s\bar{u}}$ and $M_{4s\bar{u}}$	$(s\,s\,s\,s\,\bar{u})$	-2	-4
	$P_{4s\bar{c}}$ and $M_{4s\bar{c}}$	$(s\,s\,s\,s\,\bar{c})$	-2	-4
	$P_{4s\bar{t}}$ and $M_{4s\bar{t}}$	$(s\,s\,s\,s\,\bar{t})$	-2	-4

TABLE 4: *Some of the properties of the quadruply strange pentaquarks and quadruply strange mesobaryonic molecules. P stands for pentaquark and M stands for mesobaryonic particle (or mesobaryonic molecule). All tables relating to matter must be interpreted as follows: there is a pentaquark with the composition given in the table, and additionally, there is a mesobaryonic particle with the composition given in the table (the same composition).*

4.1.2 Point $V'(+2, +4)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for antiparticles which is shown in green colour on the left hand side of FIGURE 2. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (antipentaquark and $\overline{MBP}$) must satisfy is that its electric charge should be equal to +2 (Q = +2) (meaning +2*e*, where *e* is the absolute value of the elementary charge).

(b) The second condition the unknown particle (antipentaquark and $\overline{MBP}$) must satisfy is that its strangeness should be equal to +4 (S = +4). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property for anti-strange quarks is +1 (see TABLE 2 of section 2), the only way a particle can have a strangeness of +4 is if 4 of the constituents of this particle were 4 anti-strange quarks.
Taking into consideration these two conditions and the fact that each anti-strange quark carries an electric charge of $+1/3$, the electric charge equation for these particles should be

$$Q = 4\,q_{\bar{s}} + q_5 \qquad (4.1.10)$$

Where

$Q =$ total electric charge of the unknown particle ($+2$)

$q_{\bar{s}} =$ electric charge of the anti-strange quark ($+1/3$)
$q_5 =$ electric charge of another quark (different from a anti-strange quark) so that the total charge of the unknown particle is $+2$. This quark will be called the fifth quark.

We solve equation (4.1.11) for *q*. This gives

$$q_5 = Q - 4 q_{\bar{s}} \tag{4.1.11}$$

Then, the value of the electric charge, *q,* of the fifth quark should be

$$q_5 = +2 - \left(+\frac{4}{3}\right) = +2 - \frac{4}{3} = +\frac{2}{3} \tag{4.1.12}$$

If we look at TABLE 1 of section 2 (quark properties) we shall see that there are only three quarks that have an electric charge equal to $+2/3$. These quarks are

(i) the up quark, u ,
(ii) the charm quark, c , and
(iii) the top quark, t

Because equation (4.1.11) is satisfied by three antiquarks, equation (4.1.10) must be written as three different equations

$$Q = 4 q_{\bar{s}} + q_u \tag{4.1.13}$$
$$Q = 4 q_{\bar{s}} + q_c \tag{4.1.14}$$
$$Q = 4 q_{\bar{s}} + q_t \tag{4.1.15}$$

Where
$q_u =$ electric charge of the up quark = $+2/3$
$q_c =$ electric charge of the charm quark = $+2/3$
$q_t =$ electric charge of the top quark = $+2/3$

But having three different electric charge equations means that we must also have three different antiparticles of each type: 3 antipentaquarks and 3 antimesobaryonic particles. Thus, in total, there must be 6 exotic antiparticles. Thus, based on the allowed electric charge and strangeness we have found the nature of the unknown particles. The following table summarizes the properties of the quadruply strange antipentaquarks and quadruply strange anti-mesobaryonic particles.

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
ANTI-PARTICLES WITH 4 STRANGE QUARKS	$\bar{P}_{4\bar{s}u}$ and $\bar{M}_{4\bar{s}u}$	$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,u)$	$+2$	$+4$
	$\bar{P}_{4\bar{s}c}$ and $\bar{M}_{4\bar{s}c}$	$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,c)$	$+2$	$+4$
	$\bar{P}_{4\bar{s}t}$ and $\bar{M}_{4\bar{s}t}$	$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,t)$	$+2$	$+4$

TABLE 5: *Some of the properties of the quadruply strange antipentaquarks and quadruply strange anti-mesobaryonic molecules.* $\bar{P}$ *stands for anti-pentaquark and* $\bar{M}$ *stands for anti-mesobaryonic particle (or mesobaryonic antiparticle, or anti-mesobaryonic molecule, or mesobaryonic anti-molecule). All tables relating to antimatter must be interpreted as follows: there is a antipentaquark with the composition given in the table, and additionally, there is a mesobaryonic antiparticle with the composition given in the table (the same composition).*

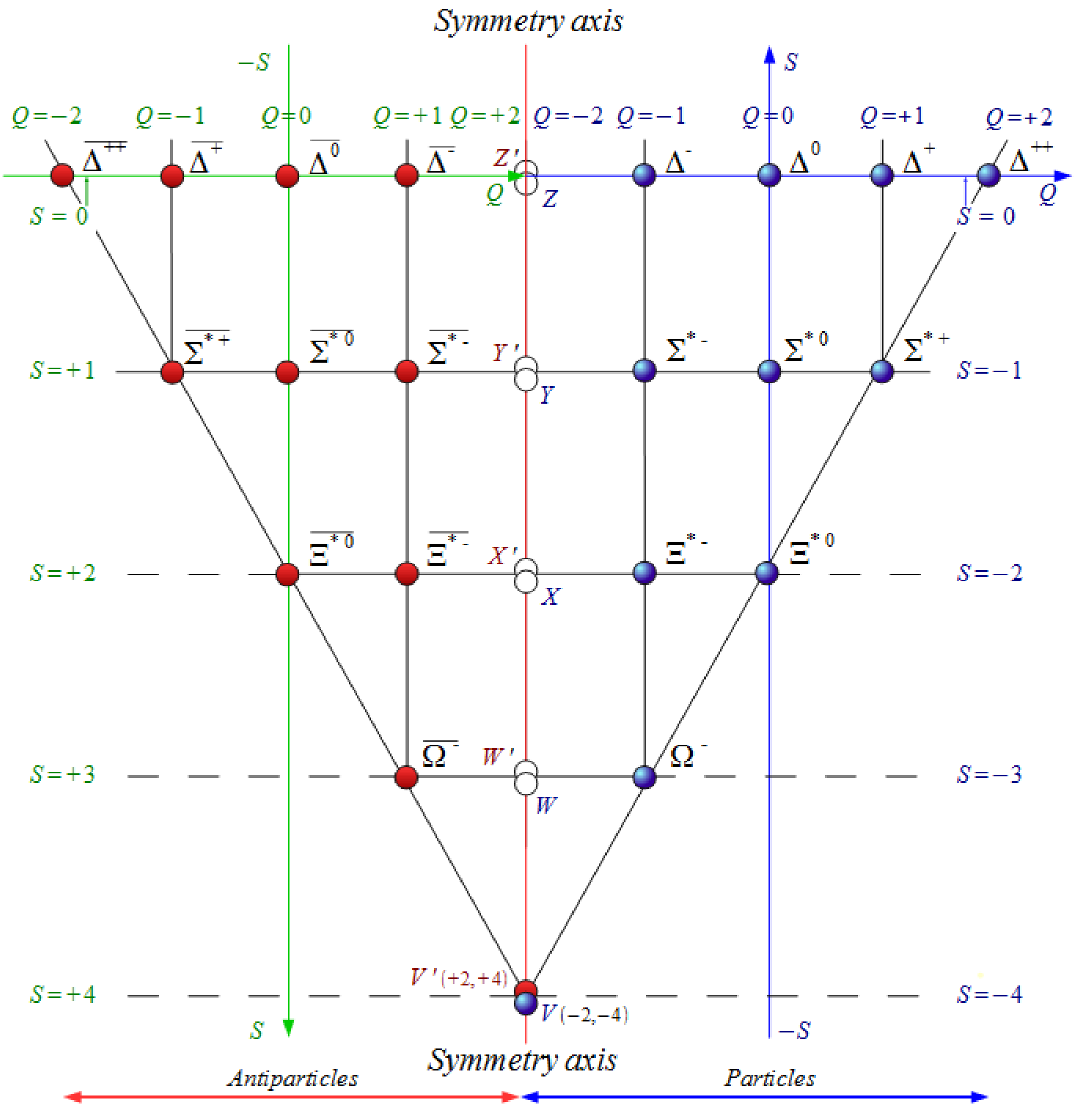

FIGURE 3: *The Incomplete Matter-Antimatter Way (including particle level |4|): a pattern of 10 baryons (blue circles), 10 anti-baryons (red circles), 3 pentaquanks (blue circle at point V), 3 mesobaryonic particles, 3 antipentaquarks and 3 anti-mesobaryonic particles (or mesobaryonic anti-particles) (red circle at point V').*

4.2 Analysis of Triply Strange Pentaquarks: Points $W(-2,-3)$ and $W'(+2,+3)$

4.2.1 Point $W(-2,-3)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 2. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -2 ($Q=-2$)

(b) The second condition the unknown particle (pentaquark) must satisfy is that its strangeness should be equal to -3 ($S=-3$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), the only way a particle can have a strangeness of -3 is if 3 of the constituents of this particle were 3 strange quarks.

Taking into account these two conditions and the fact that each strange quark carries an electric charge of $-1/3$, the electric charge equation for this particle should be

$$Q=3q_s+q_4+q_5 \tag{5.1.1}$$

Where

$Q =$ total electric charge of the unknown particle (-2)
$q_s =$ electric charge of the strange quark ($-1/3$)
$q_5 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the fifth quark.
$q_4 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the forth quark.

We solve equation (5.1.1) for q_4+q_5 . This gives

$$q_4+q_5=Q-3q_s \tag{5.1.2}$$

Then, the value of the combined electric charge, q_4+q_5 , of the forth and fifth quarks should be

$$q_4+q_5=-2-3\times\left(-\frac{1}{3}\right)=-2+1=-1 \tag{5.1.3}$$

Therefore, the pentaquark must have the forth and the fifth quarks so that the addition of their electrical charges to be equal to -1 and, because of condition (b), none of these two quarks must be *s* quarks.

Looking at TABLE 2 of section 2 (antiquark properties) we see that

(i) the forth quark must be a *d* quark or a *b* quark, and
(ii) the fifth quark must be a $\bar{u}$ quark, a $\bar{c}$ quark or a $\bar{t}$ quark

These constrains will give us 6 pentaquarks and 6 mesobaryonic particles.

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\vert e \vert$)	STRANGENESS
PARTICLES WITH 3 STRANGE QUARKS	$P_{3sd\bar{u}}$ and $M_{3sd\bar{u}}$	$(sssd\bar{u})$	-2	-3
	$P_{3sd\bar{c}}$ and $M_{3sd\bar{c}}$	$(sssd\bar{c})$	-2	-3
	$P_{3sd\bar{t}}$ and $M_{3sd\bar{t}}$	$(sssd\bar{t})$	-2	-3
	$P_{3sb\bar{u}}$ and $M_{3sb\bar{u}}$	$(sssb\bar{u})$	-2	-3
	$P_{3sb\bar{c}}$ and $M_{3sb\bar{c}}$	$(sssb\bar{c})$	-2	-3
	$P_{3sb\bar{t}}$ and $M_{3sb\bar{t}}$	$(sssb\bar{t})$	-2	-3

TABLE 6: *Some of the properties of the triply strange particles (triply strange pentaquarks and triply strange mesobaryonic particles).*

4.2.2 Point $W'(+2,+3)$: Analysis of the Electric Charge and Strangeness

A similar analysis shows that point W' should contain 6 antipentaquarks and also 6 anti-mesobaryonic particles.

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\vert e \vert$)	STRANGENESS
ANTI-PARTICLES WITH 3 ANTI-STRANGE QUARKS	$P_{3\bar{s}\bar{d}u}$ and $M_{3\bar{s}\bar{d}u}$	$(\bar{s}\bar{s}\bar{s}\bar{d}u)$	$+2$	$+3$
	$\bar{P}_{3\bar{s}\bar{d}c}$ and $\bar{M}_{3\bar{s}\bar{d}c}$	$(\bar{s}\bar{s}\bar{s}\bar{d}c)$	$+2$	$+3$
	$P_{3\bar{s}\bar{d}t}$ and $M_{3\bar{s}\bar{d}t}$	$(\bar{s}\bar{s}\bar{s}\bar{d}t)$	$+2$	$+3$
	$\bar{P}_{3\bar{s}\bar{b}u}$ and $\bar{M}_{3\bar{s}\bar{b}u}$	$(\bar{s}\bar{s}\bar{s}\bar{b}u)$	$+2$	$+3$
	$\bar{P}_{3\bar{s}\bar{b}c}$ and $\bar{M}_{3\bar{s}\bar{b}c}$	$(\bar{s}\bar{s}\bar{s}\bar{b}c)$	$+2$	$+3$
	$\bar{P}_{3\bar{s}\bar{b}t}$ and $\bar{M}_{3\bar{s}\bar{b}t}$	$(\bar{s}\bar{s}\bar{s}\bar{b}t)$	$+2$	$+3$

TABLE 7: *Some of the properties of the triply strange anti-pentaquarks and anti-mesobaryonic molecules.*

Because this theory predicts that point W should contain 6 pentaquarks and 6 MBPs and that point W' should contain 6 antipentaquarks and 6 anti-MBPs (remember that W and W' overlap), we may replace the visible empty circle of point W of FIGURE 2 by a blue circle representing the new 12 particles; and the partially visible empty circle of point W', by and a red circle representing the new 12 antiparticles. This is done in FIGURE 4. TABLE 5 summarizes the properties of the triply strange pentaquarks and triply strange MBPs.

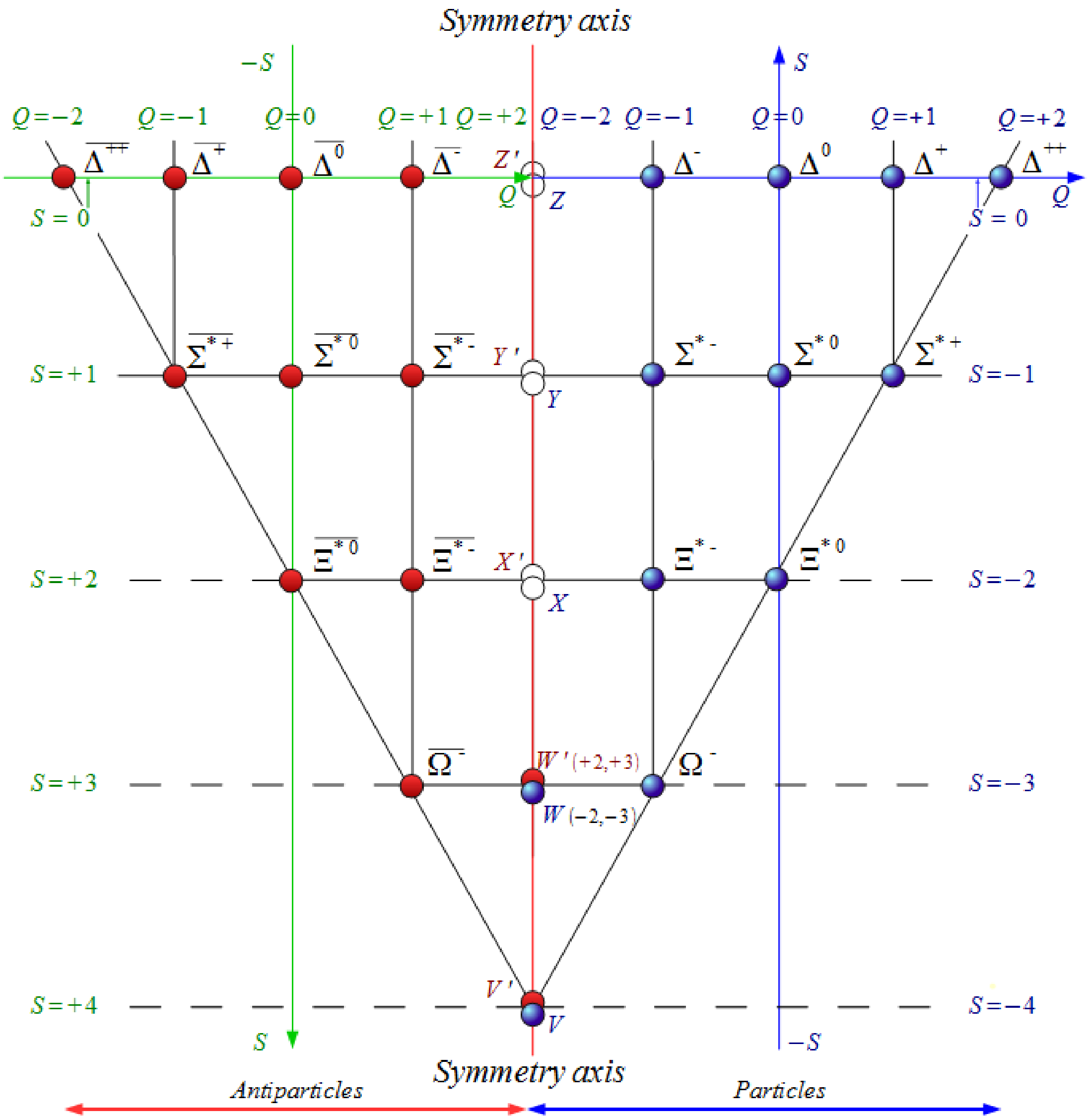

FIGURE 4: *The Incomplete Matter-Antimatter Way (including pentaquark levels |3| and |4|): a pattern of 10 baryons (blue circles), 10 anti-baryons (red circles), 3 pentaquanks and 3 MBPs (blue circle at point V), 3 antipentaquarks and 3 anti-MBPs (red circle at point V'), 6 pentaquanks and 6 MBPs (represented by a blue circle drawn at point W), 6 antipentaquarks and 6 anti-MBPs (represented by a red circle drawn at point W').*

4.3 Analysis of Doubly Strange Pentaquarks: Points $X(-2,-2)$ and $X'(+2,+2)$

4.3.1 Point $X(-2,-2)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 2. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -2 ($Q=-2$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -2 ($S=-2$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), the only way a particle can have a strangeness of -2 is if 2 of the constituents of this particle were 2 strange quarks.

Taking into account these two conditions and the fact that each strange quark carries an electric charge of $-1/3$, the electric charge equation for this particle should be

$$Q= 2q_s+q_3+q_4+q_5 \tag{6.1.1}$$

Where

$Q =$ total electric charge of the unknown particle (-2)
$q_s =$ electric charge of the strange quark ($-1/3$)
$q_5 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the fifth quark.
$q_4 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the forth quark.
$q_3 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the third quark.

We solve equation (5.1.1) for $q_3+q_4+q_5$. This gives

$$q_3+q_4+q_5 = Q-2q_s \tag{6.1.2}$$

Then, the value of the combined electric charge, $q_3+q_4+q_5$ of the third, forth and fifth quarks should be

$$q_3+q_4+q_5 = -2-2\times\left(-\frac{1}{3}\right) = -2+\frac{2}{3}=-\frac{4}{3} \tag{6.1.3}$$

Therefore, the addition of the electrical charge of the third, forth and the fifth quarks must be to be equal to $-4/3$ and, because of condition (b), none of these two quarks must be *s* quarks. Looking at TABLE 1 (quark properties) and TABLE 2 (antiquark properties) of section 2 we see that the only way that 3 quarks can yield an electrical charge of $-4/3$

is if two of the 3 quarks have an electric charge of $-1/3$, and the other quark an electric charge of $-2/3$ so that the total charge of these 3 quarks is $-1/3-1/3-2/3=-4/3$

These constrains will give us the following 9 pentaquarks and 9 MBPs

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
PARTICLES WITH 2 STRANGE QUARKS	$P_{2s2d\bar{u}}$ and $M_{2s2d\bar{u}}$	$(s\,s\,d\,d\,\bar{u})$	-2	-2
	$P_{2s2d\bar{c}}$ and $M_{2s2d\bar{c}}$	$(s\,s\,d\,d\,\bar{c})$	-2	-2
	$P_{2s2d\bar{t}}$ and $M_{2s2d\bar{t}}$	$(s\,s\,d\,d\,\bar{t})$	-2	-2
	$P_{2sdb\bar{u}}$ and $M_{2sdb\bar{u}}$	$(s\,s\,d\,b\,\bar{u})$	-2	-2
	$P_{2sdb\bar{c}}$ and $M_{2sdb\bar{c}}$	$(s\,s\,d\,b\,\bar{c})$	-2	-2
	$P_{2sdb\bar{t}}$ and $M_{2sdb\bar{t}}$	$(s\,s\,d\,b\,\bar{t})$	-2	-2
	$P_{2s2b\bar{u}}$ and $M_{2s2b\bar{u}}$	$(s\,s\,b\,b\,\bar{u})$	-2	-2
	$P_{2s2b\bar{c}}$ and $M_{2s2b\bar{c}}$	$(s\,s\,b\,b\,\bar{c})$	-2	-2
	$P_{2s2b\bar{t}}$ and $M_{2s2b\bar{t}}$	$(s\,s\,b\,b\,\bar{t})$	-2	-2

TABLE 8: *Some of the properties of the doubly strange pentaquarks and MBPs. It should be observed that there are 3 doubly strange-doubly down pentaquarks (and the corresponding doubly strange-doubly down mesobaryonic particles) and 3 doubly strange-doubly bottom pentaquarks (and the corresponding doubly strange-doubly bottom mesobaryonic particles).*

4.3.2 Point $X'(+2,+2)$: Analysis of the Electric Charge and Strangeness

A similar analysis shows that point *W′* should contain the following 9 antipentaquarks and 9 anti-MBPs.

(see next page)

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
ANTI-PARTICLES WITH 2 ANTI-STRANGE QUARKS	$\bar{P}_{2\bar{s}2\bar{d}u}$ and $\bar{M}_{2\bar{s}2\bar{d}u}$	$(\bar{s}\bar{s}\bar{d}\bar{d}u)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}2\bar{d}c}$ and $\bar{M}_{2\bar{s}2\bar{d}c}$	$(\bar{s}\bar{s}\bar{d}\bar{d}c)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}2\bar{d}t}$ and $\bar{M}_{2\bar{s}2\bar{d}t}$	$(\bar{s}\bar{s}\bar{d}\bar{d}t)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}\bar{d}\bar{b}u}$ and $\bar{M}_{2\bar{s}\bar{d}\bar{b}u}$	$(\bar{s}\bar{s}\bar{d}\bar{b}u)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}\bar{d}\bar{b}c}$ and $\bar{M}_{2\bar{s}\bar{d}\bar{b}c}$	$(\bar{s}\bar{s}\bar{d}\bar{b}c)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}\bar{d}\bar{b}t}$ and $\bar{M}_{2\bar{s}\bar{d}\bar{b}t}$	$(\bar{s}\bar{s}\bar{d}\bar{b}t)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}2\bar{b}u}$ and $\bar{M}_{2\bar{s}2\bar{b}u}$	$(\bar{s}\bar{s}\bar{b}\bar{b}u)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}2\bar{b}c}$ and $\bar{M}_{2\bar{s}2\bar{b}c}$	$(\bar{s}\bar{s}\bar{b}\bar{b}c)$	$+2$	$+2$
	$\bar{P}_{2\bar{s}2\bar{b}t}$ and $\bar{M}_{2\bar{s}2\bar{b}t}$	$(\bar{s}\bar{s}\bar{b}\bar{b}t)$	$+2$	$+2$

TABLE 9: *Some of the properties of the doubly strange antipentaquarks and anti-mesobaryonic particles. It should be observed that that there are 3 doubly strange-doubly down antipentaquarks (and the corresponding doubly strange-doubly down anti-mesobaryonic particles) and 3 doubly strange-doubly bottom antipentaquarks (and the corresponding doubly strange-doubly bottom anti-mesobaryonic particles).*

Because this theory predicts that point X should contain 9 pentaquarks and 9 MBPs and that point X' should also contain 9 anti-pentaquarks and 9 anti-MBPs (remember that X and X' overlap), we may replace the visible empty circle of point X of FIGURE 2 by a blue circle representing the 9 new pentaquarks and the 9 new MBPs; and the partially visible empty circle of point X', by and a red circle representing 9 the new antipentaquarks and the 9 new anti-MBPs. This is done in FIGURE 5. The following table summarizes the properties of the doubly strange pentaquarks and doubly strange mesobaryonic particles.

(see next page)

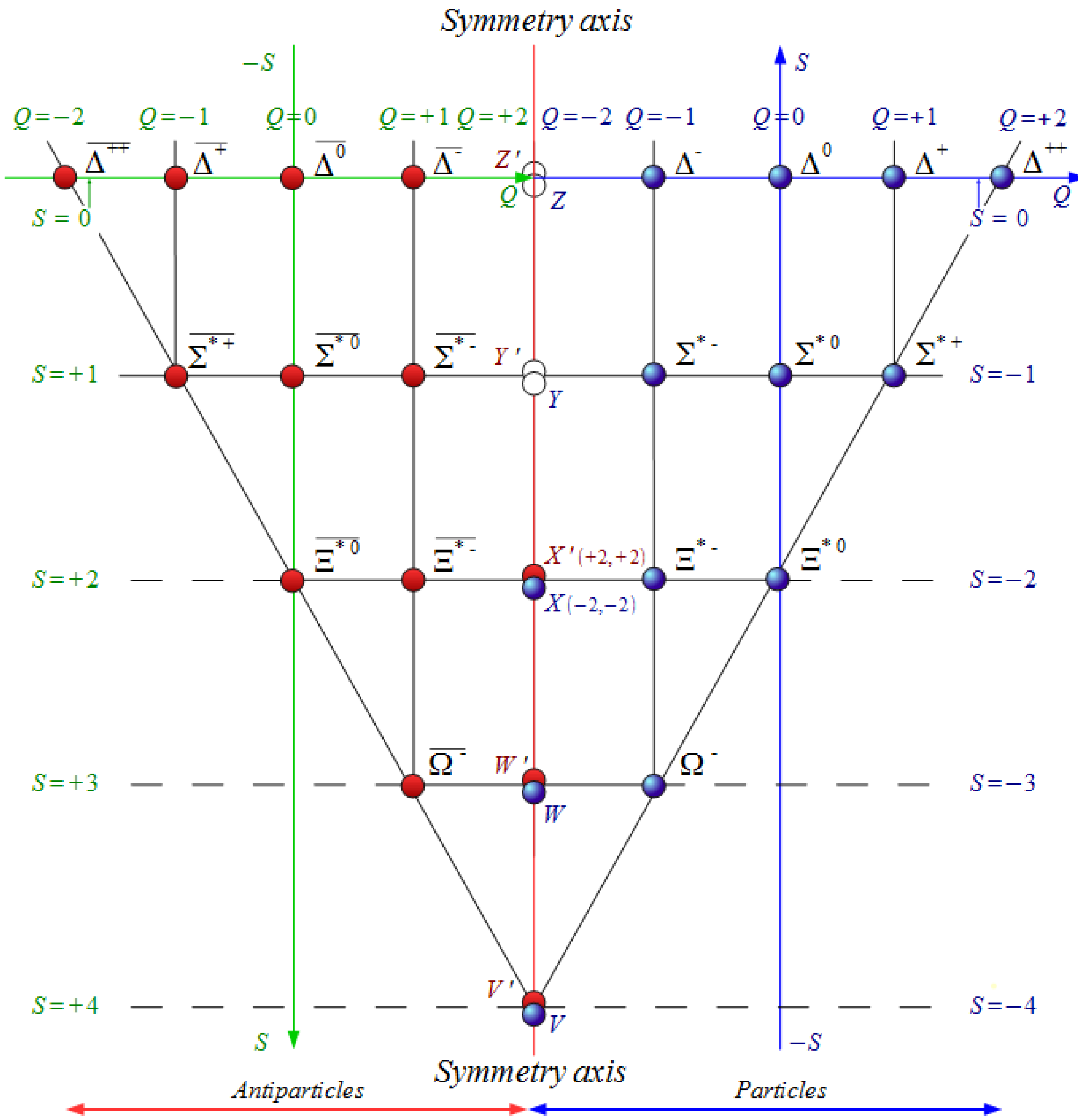

FIGURE 5: *The Incomplete Matter-Antimatter Way (including pentaquark levels* |2|, |3| and |4|)*: a pattern of 10 baryons (blue circles), 10 anti-baryons (red circles), 3 pentaquanks and 3 mesobaryonic particles (blue circle at point V), 3 antipentaquarks and 3 anti-mesobaryonic particles (red circle at point V'), 6 pentaquanks and 6 mesobaryonic particles (represented by a blue circle drawn at point W), 6 antipentaquarks and 6 anti-mesobaryonic particles (represented by a red circle drawn at point W'), 9 pentaquanks and 9 mesobaryonic particles (represented by a blue circle drawn at point X) and 9 antipentaquarks and 9 anti-mesobaryonic particles (represented by a red circle drawn at point X').*

4.4 Analysis of Singly Strange Pentaquarks: Points $Y(-2,-1)$ and $Y'(+2,+1)$

4.4.1 Point $Y(-2,-1)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 1. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -2 ($Q=-2$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -1 ($S=-1$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), the only way a particle can have a strangeness of -1 is if one of the constituents of this particle is a strange quark.

Taking into account these two conditions and the fact that each strange quark carries an electric charge of $-1/3$, the electric charge equation for these particles should be

$$Q=q_s+q_2+q_3+q_4+q_5 \tag{7.1.1}$$

Where

$Q =$ total electric charge of the unknown particle (-2)
$q_s =$ electric charge of the strange quark ($-1/3$)
$q_5 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the fifth quark.
$q_4 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the forth quark.
$q_3 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the third quark.
$q_2 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the second quark.

We solve equation (7.1.1) for $q_2+q_3+q_4+q_5$. This gives

$$q_2+q_3+q_4+q_5=Q-q_s \tag{7.1.2}$$

Then, the value of the combined electric charge, $q_2+q_3+q_4+q_5$, of the second, third, forth and fifth quarks should be

$$q_2+q_3+q_4+q_5=-2-\left(-\frac{1}{3}\right)=-2+\frac{1}{3}=-\frac{5}{3} \tag{7.1.3}$$

Therefore, the addition of the electrical charge of the second, third, forth and the fifth quarks must be to be equal to $-5/3$ and, because of condition (b), none of these four quarks must be *s* quarks. Looking at TABLE 1 (quark properties) and TABLE 2 (antiquark properties) of section 2 we see that the only way that 4 quarks (an additional *s* quark will complete the pentaquark) can yield an electrical charge of $-5/3$ is if one of the 4 quarks has an electric charge of $-2/3$ (which is the charge of either an $\bar{u}$ quark, or a $\bar{c}$ quark or a $\bar{t}$ quark) and the other 3 quarks have a charge of $-1/3$ each (which is the charge of either a *d* quark or a *b* quark). Thus, a combinations of these types of 4 quarks will produce an electric charge of

$$q_2+q_3+q_4+q_5=-\frac{2}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}=-\frac{5}{3} \tag{7.1.4}$$

Thus, these conditions yield the following 12 pentaquarks and 12 mesobaryonic particles

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
PARTICLES WITH 1 STRANGE QUARK	$P_{s3d\bar{u}}$ and $M_{s3d\bar{u}}$	$(s\,d\,d\,d\,\bar{u})$	-2	-1
	$P_{s2db\bar{u}}$ and $M_{s2db\bar{u}}$	$(s\,d\,d\,b\,\bar{u})$	-2	-1
	$P_{sd2b\bar{u}}$ and $M_{sd2b\bar{u}}$	$(s\,d\,b\,b\,\bar{u})$	-2	-1
	$P_{s3b\bar{u}}$ and $M_{s3b\bar{u}}$	$(s\,b\,b\,b\,\bar{u})$	-2	-1
	$P_{s3d\bar{c}}$ and $M_{s3d\bar{c}}$	$(s\,d\,d\,d\,\bar{c})$	-2	-1
	$P_{s2db\bar{c}}$ and $M_{s2db\bar{c}}$	$(s\,d\,d\,b\,\bar{c})$	-2	-1
	$P_{sd2b\bar{c}}$ and $M_{sd2b\bar{c}}$	$(s\,d\,b\,b\,\bar{c})$	-2	-1
	$P_{s3b\bar{c}}$ and $M_{s3b\bar{c}}$	$(s\,b\,b\,b\,\bar{c})$	-2	-1
	$P_{s3d\bar{t}}$ and $M_{s3d\bar{t}}$	$(s\,d\,d\,d\,\bar{t})$	-2	-1
	$P_{s2db\bar{t}}$ and $M_{s2db\bar{t}}$	$(s\,d\,d\,b\,\bar{t})$	-2	-1
	$P_{sd2b\bar{t}}$ and $M_{sd2b\bar{t}}$	$(s\,d\,b\,b\,\bar{t})$	-2	-1
	$P_{s3b\bar{t}}$ and $M_{s3b\bar{t}}$	$(s\,b\,b\,b\,\bar{t})$	-2	-1

TABLE 10: *Some of the properties of the singly strange pentaquarks and singly strange mesobaryonic molecules.*

4.4.2 Point $Y'(+2,+1)$: Analysis of the Electric Charge and Strangeness

A similar analysis shows that point Y' should contain 12 antipentaquarks and 12 anti-MBPs which are shown on the following table

(see next page)

	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times |*e*|)	STRANGENESS
ANTI-PARTICLES WITH 1 ANTI-STRANGE QUARK	$\bar{P}_{\bar{s}3\bar{d}u}$ and $\bar{M}_{\bar{s}3\bar{d}u}$	$(\bar{s}\,\bar{d}\,\bar{d}\,\bar{d}\,u)$	$+2$	$+1$
	$\bar{P}_{\bar{s}2\bar{d}\bar{b}u}$ and $\bar{M}_{\bar{s}2\bar{d}\bar{b}u}$	$(\bar{s}\,\bar{d}\,\bar{d}\,\bar{b}\,u)$	$+2$	$+1$
	$\bar{P}_{\bar{s}\bar{d}2\bar{b}u}$ and $\bar{M}_{\bar{s}\bar{d}2\bar{b}u}$	$(\bar{s}\,\bar{d}\,\bar{b}\,\bar{b}\,u)$	$+2$	$+1$
	$\bar{P}_{\bar{s}3\bar{b}u}$ and $\bar{M}_{\bar{s}3\bar{b}u}$	$(\bar{s}\,\bar{b}\,\bar{b}\,\bar{b}\,u)$	$+2$	$+1$
	$\bar{P}_{\bar{s}3\bar{d}c}$ and $\bar{M}_{\bar{s}3\bar{d}c}$	$(\bar{s}\,\bar{d}\,\bar{d}\,\bar{d}\,c)$	$+2$	$+1$
	$\bar{P}_{\bar{s}2\bar{d}\bar{b}c}$ and $\bar{M}_{\bar{s}2\bar{d}\bar{b}c}$	$(\bar{s}\,\bar{d}\,\bar{d}\,\bar{b}\,c)$	$+2$	$+1$
	$\bar{P}_{\bar{s}\bar{d}2\bar{b}c}$ and $\bar{M}_{\bar{s}\bar{d}2\bar{b}c}$	$(\bar{s}\,\bar{d}\,\bar{b}\,\bar{b}\,c)$	$+2$	$+1$
	$\bar{P}_{\bar{s}3\bar{b}c}$ and $\bar{M}_{\bar{s}3\bar{b}c}$	$(\bar{s}\,\bar{b}\,\bar{b}\,\bar{b}\,c)$	$+2$	$+1$
	$\bar{P}_{\bar{s}3\bar{d}t}$ and $\bar{M}_{\bar{s}3\bar{d}t}$	$(\bar{s}\,\bar{d}\,\bar{d}\,\bar{d}\,t)$	$+2$	$+1$
	$\bar{P}_{\bar{s}2\bar{d}\bar{b}t}$ and $\bar{M}_{\bar{s}2\bar{d}\bar{b}t}$	$(\bar{s}\,\bar{d}\,\bar{d}\,\bar{b}\,t)$	$+2$	$+1$
	$\bar{P}_{\bar{s}\bar{d}2\bar{b}t}$ and $\bar{M}_{\bar{s}\bar{d}2\bar{b}t}$	$(\bar{s}\,\bar{d}\,\bar{b}\,\bar{b}\,t)$	$+2$	$+1$
	$\bar{P}_{\bar{s}3\bar{b}t}$ and $\bar{M}_{\bar{s}3\bar{b}t}$	$(\bar{s}\,\bar{b}\,\bar{b}\,\bar{b}\,t)$	$+2$	$+1$

TABLE 11: *Some of the properties of the singly strange antipentaquarks and singly strange anti-mesobaryonic particles. In total there are 24 particles with the shown composition. The table does not include the exited states.*

Because this theory predicts that point *Y* should contain 12 pentaquarks and 12 MBPs and that point *Y′* should also contain 12 antipentaquarks and 12 anti-MBPs (remember that *Y* and *Y′* overlap), we may replace the visible empty circle of point *Y* of FIGURE 2 by a blue circle representing the 12 new pentaquarks and the 12 new MBPs; and the partially visible empty circle of point *Y′*, by and a red circle representing the 12 new antipentaquarks and the 12 new MBPs. This is done in FIGURE 6.

(see next page)

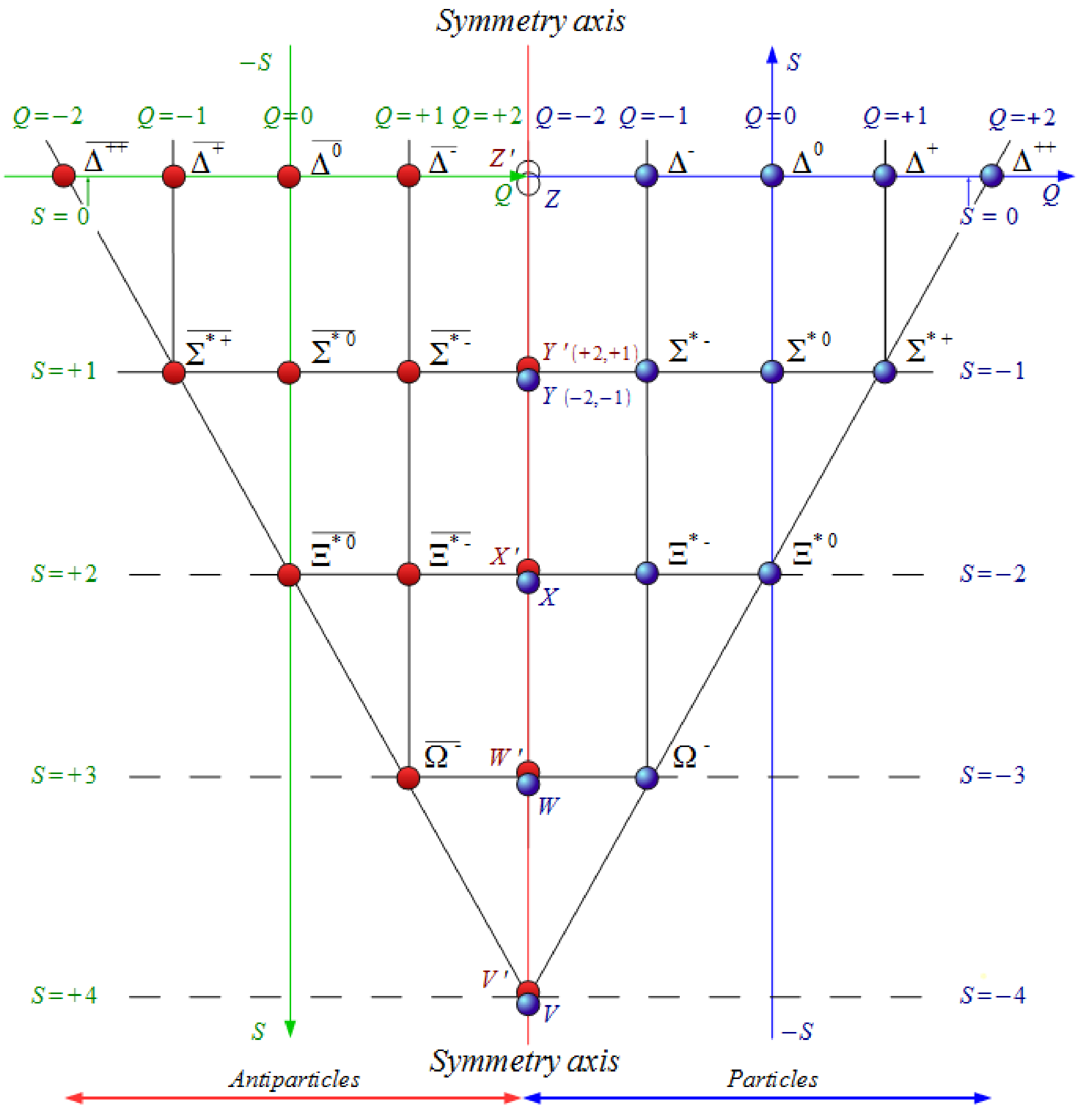

FIGURE 6: *The Incomplete Matter-Antimatter Way (including pentaquark levels |1|, |2|, |3| and |4|): a pattern of 10 baryons (blue circles that are not over the symmetry axis), 10 anti-baryons (red circles that are not over the symmetry axis), 3 quadruply strange pentaquanks and 3 quadruply strange MBPs (represented by a blue circle at point V over the symmetry axis), 3 quadruply strange antipentaquarks and 3 quadruply strange anti-MBPs (represented by a red circle at point V' over the symmetry axis), 6 triply strange pentaquanks and 6 triply strange MBPs (represented by a blue circle drawn at point W over the symmetry axis), 6 triply strange antipentaquarks and 6 triply strange anti-MBPs (represented by a red circle drawn at point W' over the symmetry axis), 9 doubly strange pentaquanks and 9 doubly strange MBPs (represented by a blue circle drawn at point X over the symmetry axis), 9 doubly strange antipentaquarks and 9 doubly strange anti-MBPs (represented by a red circle drawn at point X' over the symmetry axis), 12 singly strange pentaquanks and 12 singly strange MBPs (represented by a blue circle drawn at point Y over the symmetry axis), 12 singly strange antipentaquarks and 12 singly strange anti-MBPs (represented by a red circle drawn at point Y' over the symmetry axis).*

4.5 Analysis of Non-Strange Pentaquarks: Points $Z(-2,\ 0)$ and $Z'(+2,\ 0)$

4.5.1 Point $Z(-2,\ 0)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles and for antiparticles. The *QS* coordinate system for particles is shown in blue colour on the right hand side of FIGURE 2. The *QS* coordinate system for antiparticles is shown in green colour on the left hand side of FIGURE 2. Note that the point $Z(-2,0)$ is on the symmetry axis while the point $Z_{-2}'(-2,0)$ is one of the vertices of the diagram. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -2 ($Q=-2$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to 0 ($S=0$). In other words, this condition means that the unknown particle (pentaquark) can not contain any strange quarks.

Taking into account these two conditions and the fact that each strange quark carries an electric charge of $-1/3$, the electric charge equation for this particle should be

$$Q=q_1+q_2+q_3+q_4+q_5 \tag{8.1.1}$$

Where

$Q=$ total electric charge of the unknown particle (-2)
$q_5=$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the fifth quark.
$q_4=$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the forth quark.
$q_3=$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the third quark.
$q_2=$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the second quark.
$q_1=$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark) (cannot be an *s* quark). This quark will be called the first quark.

The electric charge equation is

$$Q=q_1+q_2+q_3+q_4+q_5=-2 \tag{8.1.1}$$

Because this the addition of the electrical charge of the 5 quarks must be -2 , we shall consider the following three cases

Case 1: particles
The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}=-\frac{6}{3}=-2$$

Because of the quark composition we predict that this case will generate pentaquarks.

Case 1

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}$
Quarks that satisfy the electric charge condition (the s quark has been left out because the total strangeness of the pentaquark must be 0)	d d d d $\bar{u}$ b b b b $\bar{c}$ $\bar{t}$

Combining these quarks we get the following 15 pentaquarks

Z CASE 1 **pentaquarks/mesobaryonic particles**				
ROW number	PREDICTED PARTICLE (symbol)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$P_{4d\bar{u}}$ or $M_{4d\bar{u}}$	$(d\,d\,d\,d\,\bar{u})$	-2	0
2	$P_{3db\bar{u}}$ and $M_{3db\bar{u}}$	$(d\,d\,d\,b\,\bar{u})$	-2	0
3	$P_{2d2b\bar{u}}$ and $M_{2d2b\bar{u}}$	$(d\,d\,b\,b\,\bar{u})$	-2	0
4	$P_{d3b\bar{u}}$ and $M_{d3b\bar{u}}$	$(d\,b\,b\,b\,\bar{u})$	-2	0
5	$P_{4b\bar{u}}$ and $M_{4b\bar{u}}$	$(b\,b\,b\,b\,\bar{u})$	-2	0
6	$P_{4d\bar{c}}$ and $M_{4d\bar{c}}$	$(d\,d\,d\,d\,\bar{c})$	-2	0
7	$P_{3db\bar{c}}$ and $M_{3db\bar{c}}$	$(d\,d\,d\,b\,\bar{c})$	-2	0
8	$P_{2d2b\bar{c}}$ and $M_{2d2b\bar{c}}$	$(d\,d\,b\,b\,\bar{c})$	-2	0
9	$P_{d3b\bar{c}}$ and $M_{d3b\bar{c}}$	$(d\,b\,b\,b\,\bar{c})$	-2	0
10	$P_{4b\bar{c}}$ and $M_{4b\bar{c}}$	$(b\,b\,b\,b\,\bar{c})$	-2	0
11	$P_{4d\bar{t}}$ and $M_{4d\bar{t}}$	$(d\,d\,d\,d\,\bar{t})$	-2	0
12	$P_{3db\bar{t}}$ and $M_{3db\bar{t}}$	$(d\,d\,d\,b\,\bar{t})$	-2	0
13	$P_{2d2b\bar{t}}$ and $M_{2d2b\bar{t}}$	$(d\,d\,b\,b\,\bar{t})$	-2	0
14	$P_{d3b\bar{t}}$ and $M_{d3b\bar{t}}$	$(d\,b\,b\,b\,\bar{t})$	-2	0
15	$P_{4b\bar{t}}$ and $M_{4b\bar{t}}$	$(b\,b\,b\,b\,\bar{t})$	-2	0

TABLE 12: *Non-strange particles at point* Z *according to case 1. The table does not include the exited states.*

4.5.2 Point $Z'(+2,\ 0)$: Analysis of the Electric Charge and Strangeness

Case 1: antiparticles
The electric charge in this case is

Case 1

Electric charge condition	$+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}+\frac{2}{3}$
Quarks that satisfy the electric charge condition	$\bar{d}$ $\bar{d}$ $\bar{d}$ $\bar{d}$ u $\bar{b}$ $\bar{b}$ $\bar{b}$ $\bar{b}$ c t

Z' CASE 1 **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{d}\bar{d}\bar{d}\bar{d}u)$	$+2$	0
$(\bar{d}\bar{d}\bar{d}\bar{d}c)$	$+2$	0
$(\bar{d}\bar{d}\bar{d}\bar{d}t)$	$+2$	0
$(\bar{d}\bar{d}\bar{d}\bar{b}u)$	$+2$	0
$(\bar{d}\bar{d}\bar{d}\bar{b}c)$	$+2$	0
$(\bar{d}\bar{d}\bar{d}\bar{b}t)$	$+2$	0
$(\bar{d}\bar{d}\bar{b}\bar{b}u)$	$+2$	0
$(\bar{d}\bar{d}\bar{b}\bar{b}c)$	$+2$	0
$(\bar{d}\bar{d}\bar{b}\bar{b}t)$	$+2$	0
$(\bar{d}\bar{b}\bar{b}\bar{b}u)$	$+2$	0
$(\bar{d}\bar{b}\bar{b}\bar{b}c)$	$+2$	0
$(\bar{d}\bar{b}\bar{b}\bar{b}t)$	$+2$	0
$(\bar{b}\bar{b}\bar{b}\bar{b}u)$	$+2$	0
$(\bar{b}\bar{b}\bar{b}\bar{b}c)$	$+2$	0
$(\bar{b}\bar{b}\bar{b}\bar{b}t)$	$+2$	0

TABLE 13: *Some of the properties of the particles predicted by this theory at point* Z' *according to case 1.*

(see next page)

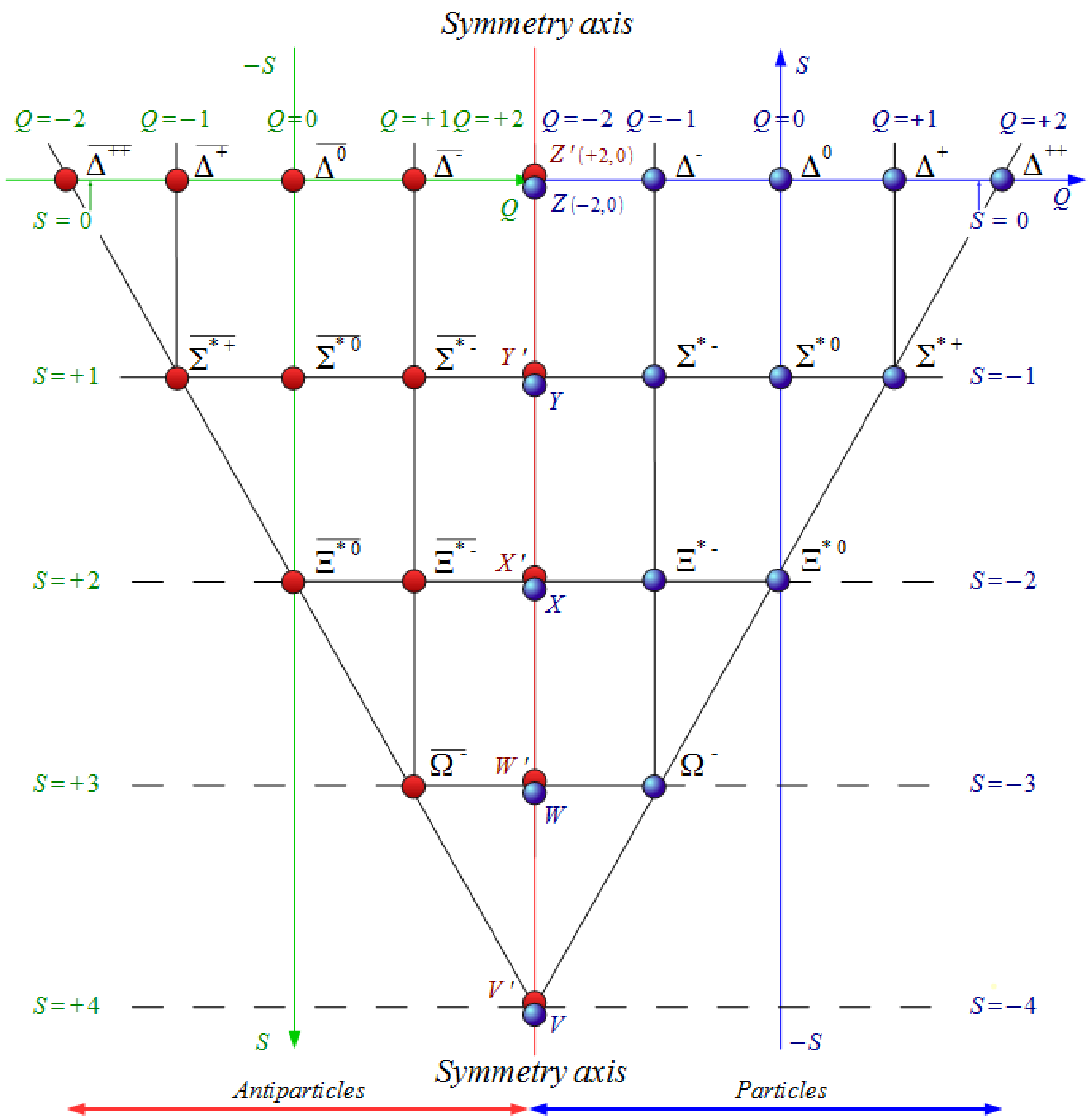

FIGURE 7: *The Matter-Antimatter Way showing pentaquarks and mesobaryonic particles (blue circles) and anti-pentaquarks and anti-mesobaryonic particles (red circles) on the symmetry axis.*

5. The Matter-Antimatter Way Along the Symmetry Axis

The diagram shown on FIGURE 8 is the complete matter-antimatter way along the symmetry axis. It is worthwhile to remark that

(a) strange exotic particles (pentaquarks and MBPs) are not allowed on point Z on the "material Q axis" (particles side) and

(b) strange exotic antiparticles (antipentaquarks and anti-MBPs) are not allowed on point Z' on the "antimaterial Q axis" (antiparticles side).

The reason is that particles containing either one $s\bar{s}$ pair or two $s\bar{s}$ pairs on these axis would satisfy the strangeness requirements but would not satisfy the charge requirements. See the caption of FIGURE 8 for more details.

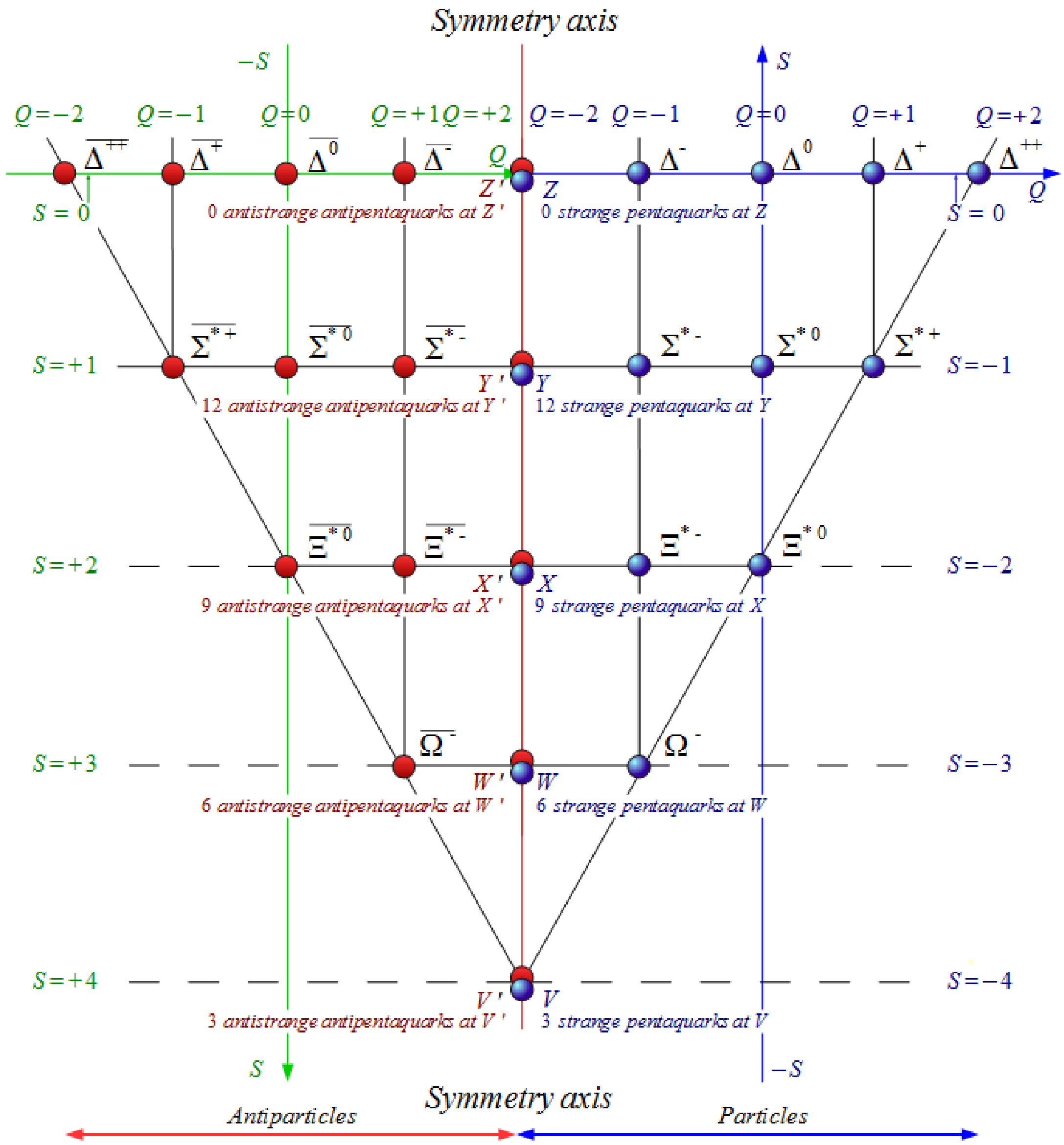

FIGURE 8: ***The Complete Matter-Antimatter Way along the symmetry axis***. *It is important to observe that (a) pentaquarks and MBPs on the Q axis for particles cannot contain a strange quark/anti-strange quark pair,* $s\bar{s}$ *, because this composition will give at total electric charge of +2 which is not allowed at this point (Q should be -2). Similarly, antipentaquarks and anti-MBPs the Q axis for antiparticles cannot contain a strange quark/anti-strange quark pair,* $s\bar{s}$ *, either because this composition will give at total electric charge of -2 which is not allowed at this point (Q should be +2). (b) Pentaquarks and MBPs on the Q axis for particles cannot contain two* $s\bar{s}$ *pairs either because the total electric charge of the particle would not be an integer number. A similar analysis applies to antipentaquarks and anti-MBPs. In other words, strange exotic particles are not allowed on points Z and Z' on the Q axes.*

This diagram is complete along the symmetry axis because there are no empty circles on this axis. However this diagram does not represents the full story. The full story is the general case represented by the diagram of FIGURE 9. The general case includes the points of intersection of all electric charge levels with all the strangeness levels on both the matter and the anti-matter side. This means that, so far, we have only found pentaquarks/MBPs and their antiparticles in each and every labelled point on the symmetry axis of FIGURE 2 (these are the 10 points specified in TABLE 3, section 3). In the next sections we shall analyse the rest of the straight lines parallel to the symmetry axis. This will give us all the pentaquarks and all the MBPs particle there exist in nature.

6. Analysis Along the Straight Lines $Q = -1$ and $Q' = +1$

6.1 Analysis of Points $W_{-1}(-1, -3)$ and $W_1'(+1, +3)$

6.1.1 Point $W_{-1}(-1, -3)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -1 ($Q = -1$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -3 ($S = -3$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), there are two ways of satisfying this condition

b1) Three of the constituents of this particle are strange quarks and the other two constituents are not strange quarks.

b2) Four of the constituents of this particle are strange quarks and the other constituent is an anti-strange quark. Thus we have the following case

Case 1: particles
The electric charge in this case is

$$\left(-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}\right)-\frac{1}{3}+\frac{1}{3}=-\frac{3}{3}=-1$$

Case 1

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. We shall consider the pair $s\,\bar{s}$ separately (there is only one particle).	$s \quad s \quad s \quad d \quad \bar{d}$ $d \quad \bar{b}$ $s \quad \bar{s}$

(see next page)

W_{-1} CASE 1 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(s\,s\,s\,d\,\bar{d})$	-1	-3
$(s\,s\,s\,d\,\bar{b})$	-1	-3
$(s\,s\,s\,b\,\bar{d})$	-1	-3
$(s\,s\,s\,b\,\bar{b})$	-1	-3
$(s\,s\,s\,s\,\bar{s})$	-1	$-4+1=-3$

TABLE 14: *Some of the properties of the particles predicted at point* W_{-1} *according to case 1.*

6.1.2 Point $W_1'(+1,+3)$: Analysis of the Electric Charge and Strangeness

Similarly we found the following antiparticles

W_1' CASE 1 **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{d}\,d)$	$+1$	$+3$
$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{d}\,b)$	$+1$	$+3$
$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{b}\,d)$	$+1$	$+3$
$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{b}\,b)$	$+1$	$+3$
$(\bar{s}\,\bar{s}\,\bar{s}\,\bar{s}\,s)$	$+1$	$+4-1=+3$

TABLE 15: *Some of the properties of the antiparticles predicted at point* W_1' *according to case 1.*

6.2 Analysis of Points $X_{-1}(-1,-2)$ and $X_1'(+1,+2)$

6.2.1 Point $X_{-1}(-1,-2)$: Analysis of the Electric Charge and

Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -1 ($Q=-1$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -2 ($S=-2$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), there are two ways of satisfying this condition:

Case 1: particles

The electric charge in this case is

$$\left(-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}\right)-\frac{1}{3}+\frac{1}{3}=-\frac{3}{3}=-1$$

There are two possibilities

Case 1a
The pentaquark must contain 2 strange quarks. The third, fourth and fifth quarks can be neither strange nor anti-strange quarks.

Case 1b
The pentaquark must contain 3 strange quarks and one anti-strange quark. The fifth quark can be neither a strange nor an anti-strange quark.

Case 1a

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad d \quad \bar{d}$ $s \quad s \quad s \quad s \quad \bar{s}$ $b \quad b \quad b \quad b \quad \bar{b}$
Because two of the quarks must be *s* quarks, we don't have to consider, for example, neither the *d* and *b* quarks of the 3rd and 4th columns nor the s quark of columns 1 and 2. Finally we don't consider the anti-strange quark of column 3.	$d \quad d \quad \quad \quad \bar{d}$ $\quad \quad s \quad s$ $b \quad b \quad \quad \quad \bar{b}$

(see next page)

X_{-1} CASE 1a **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,d\,s\,s\,\bar{d})$	-1	-2
$(d\,d\,s\,s\,\bar{d})$	-1	-2
$(d\,b\,s\,s\,\bar{d})$	-1	-2
$(d\,b\,s\,s\,\bar{b})$	-1	-2
$(b\,b\,s\,s\,\bar{d})$	-1	-2
$(b\,b\,s\,s\,\bar{b})$	-1	-2

TABLE 16: *Some of the properties of the particles predicted at point* X_{-1} *according to case 1a.*

Case 1b

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad d \quad \bar{d}$ $s \quad s \quad s \quad s \quad \bar{s}$ $b \quad b \quad b \quad b \quad \bar{b}$
Because the pentaquark must contain 3 strange quarks and one anti-strange quark, the possibilities are reduced to the following	d $\quad s \quad s \quad s \quad \bar{s}$ b

X_{-1} CASE 1b **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,s\,s\,s\,\bar{s})$	-1	$-3+1=-2$
$(b\,s\,s\,s\,\bar{s})$	-1	$-3+1=-2$

TABLE 17: *Some of the properties of the particles predicted at point* X_{-1} *according to case 1b.*

6.2.2 Point $X_1'(+1,+2)$: Analysis of the Electric Charge and Strangeness

Similarly we found the following antiparticles

X_1' CASE 1a **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{s}\,d)$	$+1$	$+2$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{s}\,d)$	$+1$	$+2$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{s}\,d)$	$+1$	$+2$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{s}\,b)$	$+1$	$+2$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{s}\,d)$	$+1$	$+2$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{s}\,b)$	$+1$	$+2$

TABLE 18: *Some of the properties of the antiparticles predicted at point* X_1' *according to case 1a.*

X_1' CASE 1b **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{d}\,\bar{s}\,\bar{s}\,\bar{s}\,s)$	-1	$+3-1=+2$
$(\bar{b}\,\bar{s}\,\bar{s}\,\bar{s}\,s)$	$+1$	$+3-1=+2$

TABLE 19: *Some of the properties of the antiparticles predicted at point* X_1' *according to case 1b.*

6.3 Analysis of Points $Y_{-1}(-1,-1)$ and $Y_1'(+1,+1)$

6.3.1 Point $Y_{-1}(-1,-1)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -1 ($Q=-1$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -1 ($S=-1$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), there are two ways of satisfying this condition:

Case 1: particles

The electric charge in this case is

$$\left(-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}\right)-\frac{1}{3}+\frac{1}{3}=-\frac{3}{3}=-1$$

There are two possibilities

Case 1a
The pentaquark must contain only one strange quark and no anti-strange quarks.

Case 1b
The pentaquark must contain 2 strange quarks and 1 anti-strange quark only.

Case 2: particles

The electric charge in this case is

$$\left(-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3}=-\frac{3}{3}=-1$$

Case 1a

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad d \quad \bar{d}$ $s \quad s \quad s \quad s \quad \bar{s}$ $b \quad b \quad b \quad b \quad \bar{b}$
The possibilities reduce to	$d \quad d \quad d \quad \quad \bar{d}$ s $b \quad b \quad b \quad \quad \bar{b}$

(see next page)

Y_{-1} CASE 1a **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,d\,d\,s\,\bar{d})$	-1	-1
$(d\,d\,d\,s\,\bar{b})$	-1	-1
$(d\,d\,b\,s\,\bar{d})$	-1	-1
$(d\,d\,b\,s\,\bar{b})$	-1	-1
$(d\,b\,b\,s\,\bar{d})$	-1	-1
$(d\,b\,b\,s\,\bar{b})$	-1	-1
$(b\,b\,b\,s\,\bar{d})$	-1	-1
$(b\,b\,b\,s\,\bar{b})$	-1	-1

TABLE 20: *Some of the properties of the particles predicted at point* Y_{-1} *according to case 1a.*

Case 1b

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad d \quad \bar{d}$ $s \quad s \quad s \quad s \quad \bar{s}$ $b \quad b \quad b \quad b \quad \bar{b}$
The possibilities reduce to the following	$d \quad d$ $s \quad s \quad \bar{s}$ $b \quad b$

(see next page)

Y_{-1} CASE 1b **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\, d\, s\, s\, \bar{s})$	-1	$-2+1=-1$
$(d\, b\, s\, s\, \bar{s})$	-1	$-2+1=-1$
$(b\, b\, s\, s\, \bar{s})$	-1	$-2+1=-1$

TABLE 21: *Some of the properties of the particles predicted at point* Y_{-1} *according to case 1b.*

Case 2

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}-\frac{2}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad u \quad \bar{u}$ $s \quad s \quad s \quad c \quad \bar{c}$ $b \quad b \quad b \quad t \quad \bar{t}$
The possibilities reduce to the following	$d \quad d \quad \quad u \quad \bar{u}$ $\quad \quad s \quad c \quad \bar{c}$

(see next page)

Y_{-1} CASE 2 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,d\,s\,u\,\bar{u})$	-1	-1
$(d\,d\,s\,u\,\bar{c})$	-1	-1
$(d\,d\,s\,u\,\bar{t})$	-1	-1
$(d\,d\,s\,c\,\bar{u})$	-1	-1
$(d\,d\,s\,c\,\bar{c})$	-1	-1
$(d\,d\,s\,c\,\bar{t})$	-1	-1
$(d\,d\,s\,t\,\bar{u})$	-1	-1
$(d\,d\,s\,t\,\bar{c})$	-1	-1
$(d\,d\,s\,t\,\bar{t})$	-1	-1
$(d\,b\,s\,u\,\bar{u})$	-1	-1
$(d\,d\,s\,u\,\bar{c})$	-1	-1
$(d\,b\,s\,u\,\bar{t})$	-1	-1
$(d\,b\,s\,c\,\bar{u})$	-1	-1
$(d\,b\,s\,c\,\bar{c})$	-1	-1
$(d\,b\,s\,c\,\bar{t})$	-1	-1
$(d\,b\,s\,t\,\bar{u})$	-1	-1
$(d\,b\,s\,t\,\bar{c})$	-1	-1
$(d\,b\,s\,t\,\bar{t})$	-1	-1
$(b\,b\,s\,u\,\bar{u})$	-1	-1
$(b\,b\,s\,u\,\bar{c})$	-1	-1
$(b\,b\,s\,u\,\bar{t})$	-1	-1
$(d\,b\,s\,c\,\bar{u})$	-1	-1
$(b\,b\,s\,c\,\bar{c})$	-1	-1
$(b\,b\,s\,c\,\bar{t})$	-1	-1
$(b\,b\,s\,t\,\bar{u})$	-1	-1
$(b\,b\,s\,t\,\bar{c})$	-1	-1
$(b\,b\,s\,t\,\bar{t})$	-1	-1

TABLE 22: *Some of the properties of the particles predicted at point* Y_{-1} *according to case 2.*

6.3.2 Point $Y_1'(+1,+1)$: Analysis of the Electric Charge and Strangeness

Similarly we found the following antiparticles

Y_1' CASE 1a **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{s}\,d)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{s}\,b)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{b}\,\bar{s}\,d)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{b}\,\bar{s}\,b)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{b}\,\bar{s}\,d)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{b}\,\bar{s}\,b)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{b}\,\bar{s}\,d)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{b}\,\bar{s}\,b)$	$+1$	$+1$

TABLE 23: *Some of the properties of the antiparticles predicted at point* Y_1' *according to case 1a.*

Y_1' CASE 1b **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{s}\,s)$	$+1$	$+2-1=+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{s}\,s)$	$+1$	$+2-1=+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{s}\,s)$	$+1$	$+2-1=+1$

TABLE 24: *Some of the properties of the antiparticles predicted at point* Y_1' *according to case 1b.*

$Y_1{}'$ CASE 2 **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{u}\,u)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{u}\,c)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{u}\,t)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{c}\,u)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{c}\,c)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{c}\,t)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{t}\,u)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{t}\,c)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{t}\,t)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{u}\,u)$	$+1$	$+1$
$(\bar{d}\,\bar{d}\,\bar{s}\,\bar{u}\,c)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{u}\,t)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{c}\,u)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{c}\,c)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{c}\,t)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{t}\,u)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{t}\,c)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{t}\,t)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{u}\,u)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{u}\,c)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{u}\,t)$	$+1$	$+1$
$(\bar{d}\,\bar{b}\,\bar{s}\,\bar{c}\,u)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{c}\,c)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{c}\,t)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{t}\,u)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{t}\,c)$	$+1$	$+1$
$(\bar{b}\,\bar{b}\,\bar{s}\,\bar{t}\,t)$	$+1$	$+1$

TABLE 25: *Some of the properties of the antiparticles predicted at point* Y_1' *according to case 2.*

6.4 Analysis of Points $Z_{-1}(-1, 0)$ and $Z_1'(+1, 0)$

6.4.1 Point $Z_1'(+1, 0)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to -1 ($Q=-1$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to 0 ($S=0$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2), there are two ways of satisfying this condition:

Case 1: particles

The electric charge in this case is

$$\left(-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}\right)-\frac{1}{3}+\frac{1}{3}=-\frac{3}{3}=-1$$

There are two possibilities

Case 1a
The pentaquark must contain no strange quark and no anti-strange quarks.

Case 1b
The pentaquark must contain a quark pair made of a strange quark and an anti-strange quark $(s\,\bar{s})$. The rest three quarks must be neither strange nor anti-strange quarks.

Case 2: particles

The electric charge in this case is

$$\left(-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3}=-\frac{3}{3}=-1$$

Case 1a

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. In this case The pentaquark cannot contain neither strange nor no anti-strange quarks.	$d \quad d \quad d \quad d \quad \bar{d}$ $b \quad b \quad b \quad b \quad \bar{b}$

Z_{-1} CASE 1a **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,d\,d\,d\,\bar{d})$	-1	0
$(d\,d\,d\,d\,\bar{b})$	-1	0
$(d\,d\,d\,d\,\bar{d})$	-1	0
$(d\,d\,d\,b\,\bar{b})$	-1	0
$(d\,d\,b\,b\,\bar{d})$	-1	0
$(d\,d\,b\,b\,\bar{b})$	-1	0
$(d\,b\,b\,b\,\bar{d})$	-1	0
$(d\,b\,b\,b\,\bar{b})$	-1	0
$(b\,b\,b\,b\,\bar{d})$	-1	0
$(b\,b\,b\,b\,\bar{b})$	-1	0

TABLE 26: *Some of the properties of the particles predicted at point* Z_{-1} *according to case 1a.*

Case 1b

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad s \quad \bar{s}$ $b \quad b \quad b \quad s \quad \bar{s}$

(see next page)

Z_{-1} CASE 1b **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,d\,d\,s\,\bar{s})$	-1	$-1+1=0$
$(d\,d\,b\,s\,\bar{s})$	-1	$-1+1=0$
$(d\,b\,b\,s\,\bar{s})$	-1	$-1+1=0$
$(b\,b\,b\,s\,\bar{s})$	-1	$-1+1=0$

TABLE 27: *Some of the properties of the particles predicted at point* Z_{-1} *according to case 1b. It should be remarked that the total strangeness for each pentaquark/MPP of this table (shown in pink) is also zero. This is so because the strange quark has a strangeness of -1 while the anti-strange quark has a strangeness of + 1, so the total strangeness of the particle is* $-1+1=0$.

Case 2

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}-\frac{2}{3}$
Quarks that satisfy the electric charge condition.	$d \quad d \quad d \quad u \quad \bar{u}$ $b \quad b \quad b \quad c \quad \bar{c}$ $t \quad \bar{t}$

(see next page)

Z_{-1} CASE 2 **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(d\,d\,d\,u\,\bar{u})$	$(d\,d\,d\,u\,\bar{c})$	$(d\,d\,d\,u\,\bar{t})$	-1	0
$(d\,d\,d\,c\,\bar{u})$	$(d\,d\,d\,c\,\bar{c})$	$(d\,d\,d\,c\,\bar{t})$	-1	0
$(d\,d\,d\,t\,\bar{u})$	$(d\,d\,d\,t\,\bar{c})$	$(d\,d\,d\,t\,\bar{t})$	-1	0
$(d\,d\,b\,u\,\bar{u})$	$(d\,d\,b\,u\,\bar{c})$	$(d\,d\,b\,u\,\bar{t})$	-1	0
$(d\,d\,b\,c\,\bar{u})$	$(d\,d\,b\,c\,\bar{c})$	$(d\,d\,b\,c\,\bar{t})$	-1	0
$(d\,d\,b\,t\,\bar{u})$	$(d\,d\,b\,t\,\bar{c})$	$(d\,d\,b\,t\,\bar{t})$	-1	0
$(d\,b\,b\,u\,\bar{u})$	$(d\,b\,b\,u\,\bar{c})$	$(d\,b\,b\,u\,\bar{t})$	-1	0
$(d\,b\,b\,c\,\bar{u})$	$(d\,b\,b\,c\,\bar{c})$	$(d\,b\,b\,c\,\bar{t})$	-1	0
$(d\,b\,b\,t\,\bar{u})$	$(d\,b\,b\,t\,\bar{c})$	$(d\,b\,b\,t\,\bar{t})$	-1	0
$(b\,b\,b\,u\,\bar{u})$	$(b\,b\,b\,u\,\bar{c})$	$(b\,b\,b\,u\,\bar{t})$	-1	0
$(b\,b\,b\,c\,\bar{u})$	$(b\,b\,b\,c\,\bar{c})$	$(b\,b\,b\,c\,\bar{t})$	-1	0
$(b\,b\,b\,t\,\bar{u})$	$(b\,b\,b\,t\,\bar{c})$	$(b\,b\,b\,t\,\bar{t})$	-1	0

TABLE 28: *Some of the properties of the particles predicted at point* Z_{-1} *according to case 2.*

6.4.2 Point $Z_1'(+1, 0)$: Analysis of the Electric Charge and Strangeness

So far we have used the above pentaquarks to obtain the corresponding antipentaquarks by replacing the quarks by the corresponding anti-quarks and the anti-quark by the corresponding quark. However, we may also carry out a direct analysis for antiparticles without using the pentaquark composition obtained in the previous subsection. The direct analysis is illustrated here.

Case 1: antiparticles
The electric charge in this case is

$$\left(+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}\right)-\frac{1}{3}+\frac{1}{3} = +\frac{3}{3}+0 = +1$$

Note that in this case we have included the corresponding cases: *case 1a* and *case 1b* of the previous subsection.

Case 2: antiparticles
The electric charge in this case is

$$\left(+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3} = +\frac{3}{3}+0 = +1$$

Case 1

$$\left(+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}\right)-\frac{1}{3}+\frac{1}{3} = +\frac{3}{3}+0 = +1$$

Z'_1 CASE 1 **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{d}\,d)$	$+1$	0
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{b}\,d)$	$+1$	0
$(\bar{d}\,\bar{d}\,\bar{b}\,\bar{b}\,d)$	$+1$	0
$(\bar{d}\,\bar{b}\,\bar{b}\,\bar{b}\,d)$	$+1$	0
$(\bar{b}\,\bar{b}\,\bar{b}\,\bar{b}\,d)$	$+1$	0
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{d}\,b)$	$+1$	0
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{b}\,b)$	$+1$	0
$(\bar{d}\,\bar{d}\,\bar{b}\,\bar{b}\,b)$	$+1$	0
$(\bar{d}\,\bar{b}\,\bar{b}\,\bar{b}\,b)$	$+1$	0
$(\bar{b}\,\bar{b}\,\bar{b}\,\bar{b}\,b)$	$+1$	0
$(\bar{d}\,\bar{d}\,\bar{d}\,\bar{s}\,s)$	$+1$	$+1-1=0$
$(\bar{d}\,\bar{d}\,\bar{b}\,\bar{s}\,s)$	$+1$	$+1-1=0$
$(\bar{d}\,\bar{b}\,\bar{b}\,\bar{s}\,s)$	$+1$	$+1-1=0$
$(\bar{b}\,\bar{b}\,\bar{b}\,\bar{s}\,s)$	$+1$	$+1-1=0$

TABLE 29: *Some of the properties of the particles predicted by this theory at point* Z'_1 *according to case 1. It should be remarked that the total strangeness for each of the last 4 pentaquarks/mesobaryonic particles of this table (shown in pink) is also zero. This is so because the strange quark has a strangeness of -1 while the anti-strange quark has a strangeness of + 1, so the total strangeness of the particle is* $-1+1=0$.

Case 2

$$\left(+\frac{1}{3}+\frac{1}{3}+\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3}=+\frac{3}{3}+0=+1$$

Z'_1 CASE 2 **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(u\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{u})$	$(c\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{u})$	$(t\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{u})$	$+1$	0
$(u\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{c})$	$(c\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{c})$	$(t\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{c})$	$+1$	0
$(u\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{t})$	$(c\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{t})$	$(t\,\bar{d}\,\bar{d}\,\bar{d}\,\bar{t})$	$+1$	0
$(u\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{u})$	$(c\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{u})$	$(t\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{u})$	$+1$	0
$(u\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{c})$	$(c\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{c})$	$(t\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{c})$	$+1$	0
$(u\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{t})$	$(c\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{t})$	$(t\,\bar{d}\,\bar{d}\,\bar{b}\,\bar{t})$	$+1$	0
$(u\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{u})$	$(c\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{u})$	$(t\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{u})$	$+1$	0
$(u\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{c})$	$(c\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{c})$	$(t\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{c})$	$+1$	0
$(u\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{t})$	$(c\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{t})$	$(t\,\bar{d}\,\bar{b}\,\bar{b}\,\bar{t})$	$+1$	0
$(u\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{u})$	$(c\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{u})$	$(t\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{u})$	$+1$	0
$(u\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{c})$	$(c\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{c})$	$(t\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{c})$	$+1$	0
$(u\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{t})$	$(c\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{t})$	$(t\,\bar{b}\,\bar{b}\,\bar{b}\,\bar{t})$	$+1$	0

TABLE 30: *Some of the properties of the antiparticles predicted at point* Z'_1 *according to case 2.*

7. Analysis Along the Straight Lines $Q=0$ and $Q'=0$

7.1 Analysis of Points $X_0(0,-2)$ and $X'_0(0,-2)$

7.1.1 Point $X_0(0,-2)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the QS coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to 0 ($Q=0$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -2 ($S = -2$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is -1 (see TABLE 1 of section 2). There are three ways of satisfying these conditions:

Case 1: particles

The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}+\frac{2}{3}=-\frac{3}{3}+\frac{3}{3}=0$$

There are two possibilities

Case 1a
The pentaquark or MBP must contain two strange quarks and no anti-strange quarks.

Case 1b
The pentaquark or MBP must contain 3 strange quarks and one an anti-strange quark. The "fifth" quark must be neither a strange nor an anti-strange quark.

Case 2: particles

The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=0$$

Case 1a

Rearranged Electric charge condition	$-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. In this case the pentaquark or MBP contains two strange quarks.	$s \quad s \quad u \quad d \quad \bar{d}$ c $t \quad b \quad \bar{b}$

(see next page)

X_0 CASE 1a **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(s s u d \bar{d})$	0	-2
$(s s u d \bar{b})$	0	-2
$(s s u b \bar{d})$	0	-2
$(s s u b \bar{b})$	0	-2
$(s s c d \bar{d})$	0	-2
$(s s c d \bar{b})$	0	-2
$(s s c b \bar{d})$	0	-2
$(s s c b \bar{b})$	0	-2
$(s s t d \bar{d})$	0	-2
$(s s t d \bar{b})$	0	-2
$(s s t b \bar{d})$	0	-2
$(s s t b \bar{b})$	0	-2

TABLE 31: *Some of the properties of the particles predicted by this theory at point* X_0 *according to case 1a.*

Case 1b

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. In this case the pentaquark or MBP contains three strange quarks and one anti-strange quark.	$s \quad s \quad s \quad \begin{matrix} u \\ c \\ t \end{matrix} \quad \bar{s}$
Rearranging	$\begin{matrix} u \\ c \\ t \end{matrix} \quad s \quad s \quad s \quad \bar{s}$

(see next page)

X_0 CASE 1b **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(u\,s\,s\,s\,\bar{s})$	0	$-3+1=-2$
$(c\,s\,s\,s\,\bar{s})$	0	$-3+1=-2$
$(t\,s\,s\,s\,\bar{s})$	0	$-3+1=-2$

TABLE 32: *Some of the properties of the particles predicted by this theory at point* X_0 *according to case 1b.*

Case 2

Rearranged Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}+\frac{2}{3}+\frac{2}{3}$
Quarks that satisfy the electric charge condition. In this case the pentaquark or MBP contains two strange quarks.	$\begin{matrix} & & \bar{u} & u & u \\ s & s & \bar{c} & c & c \\ & & \bar{t} & t & t \end{matrix}$
Rearranging	$\begin{matrix} & & u & u & \bar{u} \\ s & s & c & c & \bar{c} \\ & & t & t & \bar{t} \end{matrix}$

(see next page)

X_0 CASE 2 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(s\,s\,u\,u\,\bar{u})$	0	-2
$(s\,s\,u\,u\,\bar{c})$	0	-2
$(s\,s\,u\,u\,\bar{t})$	0	-2
$(s\,s\,u\,c\,\bar{u})$	0	-2
$(s\,s\,u\,c\,\bar{c})$	0	-2
$(s\,s\,u\,c\,\bar{t})$	0	-2
$(s\,s\,u\,t\,\bar{u})$	0	-2
$(s\,s\,u\,t\,\bar{c})$	0	-2
$(s\,s\,u\,t\,\bar{t})$	0	-2
$(s\,s\,c\,u\,\bar{u})$	0	-2
$(s\,s\,c\,u\,\bar{c})$	0	-2
$(s\,s\,c\,u\,\bar{t})$	0	-2
$(s\,s\,c\,c\,\bar{u})$	0	-2
$(s\,s\,c\,c\,\bar{c})$	0	-2
$(s\,s\,c\,c\,\bar{t})$	0	-2
$(s\,s\,c\,t\,\bar{u})$	0	-2
$(s\,s\,c\,t\,\bar{c})$	0	-2
$(s\,s\,c\,t\,\bar{t})$	0	-2
$(s\,s\,u\,u\,\bar{u})$	0	-2
$(s\,s\,t\,u\,\bar{c})$	0	-2
$(s\,s\,t\,u\,\bar{t})$	0	-2
$(s\,s\,t\,c\,\bar{u})$	0	-2
$(s\,s\,t\,c\,\bar{c})$	0	-2
$(s\,s\,t\,c\,\bar{t})$	0	-2
$(s\,s\,t\,t\,\bar{u})$	0	-2
$(s\,s\,t\,t\,\bar{c})$	0	-2
$(s\,s\,t\,t\,\bar{t})$	0	-2

TABLE 33: *Some of the properties of the particles predicted by this theory at point X_0 according to case 2.*

7.1.2 Point $X'_0(0,+2)$: Analysis of the Electric Charge and Strangeness

7.2 Analysis of Points $Y_0(0,-1)$ and $Y'_0(0,+1)$

7.2.1 Point $Y_0(0,-1)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to 0 ($Q=0$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -1 ($S=-1$).

There are three ways of satisfying these conditions:

Case 1: particles

The pentaquark or MBP has only one strange quark and no anti-strange quarks.
The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}+\frac{2}{3}=-\frac{3}{3}+\frac{3}{3}=0$$

Case 2: particles
The pentaquark or MBP, as in case 1, has only one strange quark and no anti-strange quarks. However the electric charge of its constituents is different. The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=-\frac{4}{3}+\frac{4}{3}=0$$

Case 3: particles
The pentaquark or MBP has two strange quarks and one anti-strange quarks. Therefore, the electric charge in this case is the same as in case 1, but the quark contents is different. We keep these particles as a separate case for convenience:

$$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}+\frac{1}{3}=-\frac{3}{3}+\frac{3}{3}=0$$

Case 1

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}+\frac{2}{3}$
Quarks that satisfy the electric charge condition. In this case the possibilities reduce to the following	$\begin{array}{ccccc} & d & d & \bar{d} & u \\ s & & & & c \\ & b & b & \bar{b} & t \end{array}$
Rearranging	$\begin{array}{ccccc} & d & d & \bar{d} & u \\ s & c & & & \\ & t & b & b & \bar{b} \end{array}$

Y_0 CASE 1 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\vert e \vert$)	STRANGENESS
$(s u d d \bar{d})$	0	-1
$(s u d d \bar{b})$	0	-1
$(s u d b \bar{d})$	0	-1
$(s u d b \bar{b})$	0	-1
$(s u b b \bar{d})$	0	-1
$(s u b b \bar{b})$	0	-1
$(s c d d \bar{d})$	0	-1
$(s c d d \bar{b})$	0	-1
$(s c d b \bar{d})$	0	-1
$(s c d b \bar{b})$	0	-1
$(s c b b \bar{d})$	0	-1
$(s c b b \bar{b})$	0	-1
$(s t d d \bar{d})$	0	-1
$(s t d d \bar{b})$	0	-1
$(s t d b \bar{d})$	0	-1
$(s t d b \bar{b})$	0	-1
$(s t b b \bar{d})$	0	-1
$(s t b b \bar{b})$	0	-1

\ **TABLE 34**: *Some of the properties of the particles predicted by this theory at point* Y_0 *according to case 1.*

Case 2

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}+\frac{2}{3}+\frac{2}{3}$
Quarks that satisfy the electric charge condition. In this case the possibilities reduce to the following	$\begin{array}{ccccc} & d & \bar{u} & u & u \\ s & & \bar{c} & c & c \\ & b & \bar{t} & t & t \end{array}$
Rearranging	$\begin{array}{ccccc} & u & u & d & \bar{u} \\ s & c & c & & \bar{c} \\ & t & t & b & \bar{t} \end{array}$

Y_0 CASE 2 **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(s u u d \bar{u})$	$(s c u d \bar{u})$	$(s t u d \bar{u})$	0	-1
$(s u u d \bar{c})$	$(s c u d \bar{c})$	$(s t u d \bar{c})$	0	-1
$(s u u d \bar{t})$	$(s c u d \bar{t})$	$(s t u d \bar{t})$	0	-1
$(s u u b \bar{u})$	$(s c u b \bar{u})$	$(s t u b \bar{u})$	0	-1
$(s u u b \bar{c})$	$(s c u b \bar{c})$	$(s t u b \bar{c})$	0	-1
$(s u u b \bar{t})$	$(s c u b \bar{t})$	$(s t u b \bar{t})$	0	-1
$(s u c d \bar{u})$	$(s c u d \bar{u})$	$(s t u d \bar{u})$	0	-1
$(s u c d \bar{c})$	$(s c c d \bar{c})$	$(s t c d \bar{c})$	0	-1
$(s u c d \bar{t})$	$(s c c d \bar{t})$	$(s t c d \bar{t})$	0	-1
$(s u c b \bar{u})$	$(s c c b \bar{u})$	$(s t c b \bar{u})$	0	-1
$(s u c b \bar{c})$	$(s c c b \bar{c})$	$(s t c b \bar{c})$	0	-1
$(s u c b \bar{t})$	$(s c c b \bar{t})$	$(s t c b \bar{t})$	0	-1
$(s u t d \bar{u})$	$(s c t d \bar{u})$	$(s t t d \bar{u})$	0	-1
$(s u t d \bar{c})$	$(s c u d \bar{c})$	$(s t u d \bar{c})$	0	-1
$(s u t d \bar{t})$	$(s c t d \bar{t})$	$(s t t d \bar{t})$	0	-1
$(s u t b \bar{u})$	$(s c t b \bar{u})$	$(s t t b \bar{u})$	0	-1
$(s u t b \bar{c})$	$(s c t b \bar{c})$	$(s t t b \bar{c})$	0	-1
$(s u t b \bar{t})$	$(s c t b \bar{t})$	$(s t t b \bar{t})$	0	-1

TABLE 35: *Some of the properties of the particles predicted by this theory at point* Y_0 *according to case 2.*

Case 3

Electric charge condition	$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. In this case the possibilities reduce to the following	$s \quad s \quad \begin{matrix} d \\ \\ b \end{matrix} \quad \begin{matrix} u \\ c \\ t \end{matrix} \quad \overline{s}$
Rearranging	$\begin{matrix} u \\ c \\ t \end{matrix} \quad \begin{matrix} d \\ \\ b \end{matrix} \quad s \quad s \quad \overline{s}$

Y_0 CASE 3 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u\,d\,s\,s\,\overline{s})$	0	-1
$(u\,b\,s\,s\,\overline{s})$	0	-1
$(c\,d\,s\,s\,\overline{s})$	0	-1
$(c\,b\,s\,s\,\overline{s})$	0	-1
$(t\,d\,s\,s\,\overline{s})$	0	-1
$(t\,b\,s\,s\,\overline{s})$	0	-1

TABLE 36: *Some of the properties of the particles predicted by this theory at point* Y_0 *according to case 3.*

7.2.2 Point $Y'_0(0,+1)$: Analysis of the Electric Charge and Strangeness

7.3 Analysis of Points $Z_0(0,\ 0)$ and $Z'_0(0,\ 0)$

7.3.1 Point $Z_0(0,\ 0)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the QS coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to 0 ($Q=0$)

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its **strangeness** should be equal to 0 ($S=0$).

There are three ways of satisfying these conditions:

Case 1: particles
The pentaquark or MBP has no strange quarks and no anti-strange quarks.
The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}+\frac{2}{3}=-\frac{3}{3}+\frac{3}{3}=0$$

Case 2: particles
The pentaquark or MBP, as in case 1, has no strange quarks and no anti-strange quarks. However the electric charge of its constituents is different. The electric charge in this case is

$$-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=-\frac{4}{3}+\frac{4}{3}=0$$

Case 3: particles
The pentaquark or MBP has one strange quark and one anti-strange quark. Therefore, the electric charge in this case is the same as in case 1, but the quark contents is different. We keep these particles as a separate case for convenience:

$$-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{2}{3}+\frac{1}{3}=-\frac{3}{3}+\frac{3}{3}=0$$

Case 1

Rearranged electric charge condition	$+\frac{2}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. In this case the possibilities reduce to the following	$u \quad d \quad d \quad d \quad \bar{d}$ c $t \quad b \quad b \quad b \quad \bar{b}$

(see next page)

Z_0 CASE 1 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u\,d\,d\,d\,\bar{d})$	0	0
$(u\,d\,d\,d\,\bar{b})$	0	0
$(u\,d\,d\,b\,\bar{d})$	0	0
$(u\,d\,d\,b\,\bar{b})$	0	0
$(u\,d\,b\,b\,\bar{d})$	0	0
$(u\,d\,b\,b\,\bar{b})$	0	0
$(u\,b\,b\,b\,\bar{d})$	0	0
$(u\,b\,b\,b\,\bar{b})$	0	0
$(c\,d\,d\,d\,\bar{d})$	0	0
$(c\,d\,d\,d\,\bar{b})$	0	0
$(c\,d\,d\,b\,\bar{d})$	0	0
$(c\,d\,d\,b\,\bar{b})$	0	0
$(c\,d\,b\,b\,\bar{d})$	0	0
$(c\,d\,b\,b\,\bar{b})$	0	0
$(c\,b\,b\,b\,\bar{d})$	0	0
$(c\,b\,b\,b\,\bar{b})$	0	0
$(t\,d\,d\,d\,\bar{d})$	0	0
$(t\,d\,d\,d\,\bar{b})$	0	0
$(t\,d\,d\,b\,\bar{d})$	0	0
$(t\,d\,d\,b\,\bar{b})$	0	0
$(t\,d\,b\,b\,\bar{d})$	0	0
$(t\,d\,b\,b\,\bar{b})$	0	0
$(t\,b\,b\,b\,\bar{d})$	0	0
$(t\,b\,b\,b\,\bar{b})$	0	0

TABLE 37: *Some of the properties of the particles predicted by this theory at point* Z_0 *according to case 1.*

Case 2

Rearranged electric charge condition	$+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}-\frac{1}{3}-\frac{2}{3}$
Quarks that satisfy the electric charge condition. In this case the possibilities reduce to the following	$u \quad u \quad d \quad d \quad \bar{u}$ $c \quad c \quad \quad \quad \quad \bar{c}$ $t \quad t \quad b \quad b \quad \bar{t}$

Z_0 CASE 2 (PART I) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u u d d \bar{u})$	$(c u d d \bar{u})$	$(t u d d \bar{u})$	0	0
$(u u d d \bar{c})$	$(c u d d \bar{c})$	$(t u d d \bar{c})$	0	0
$(u u d d \bar{t})$	$(c u d d \bar{t})$	$(t u d d \bar{t})$	0	0
$(u u d b \bar{u})$	$(c u d b \bar{u})$	$(t u d b \bar{u})$	0	0
$(u u d b \bar{c})$	$(c u d b \bar{c})$	$(t u d b \bar{c})$	0	0
$(u u d b \bar{t})$	$(c u d b \bar{t})$	$(t u d b \bar{t})$	0	0
$(u u b b \bar{u})$	$(c u b b \bar{u})$	$(t u b b \bar{u})$	0	0
$(u u b b \bar{c})$	$(c u b b \bar{c})$	$(t u b b \bar{c})$	0	0
$(u u b b \bar{t})$	$(c u b b \bar{t})$	$(t u b b \bar{t})$	0	0
$(u c d d \bar{u})$	$(c c d d \bar{u})$	$(t c d d \bar{u})$	0	0
$(u c d d \bar{c})$	$(c c d d \bar{c})$	$(t c d d \bar{c})$	0	0
$(u c d d \bar{t})$	$(c c d d \bar{t})$	$(t c d d \bar{t})$	0	0
$(u c d b \bar{u})$	$(c c d b \bar{u})$	$(t c d b \bar{u})$	0	0
$(u c d b \bar{c})$	$(c c d b \bar{c})$	$(t c d b \bar{c})$	0	0
$(u c d b \bar{t})$	$(c c d b \bar{t})$	$(t c d b \bar{t})$	0	0
$(u c b b \bar{u})$	$(c c b b \bar{u})$	$(t c b b \bar{u})$	0	0
$(u c b b \bar{c})$	$(c c b b \bar{c})$	$(t c b b \bar{c})$	0	0
$(u c b b \bar{t})$	$(c c b b \bar{t})$	$(t c b b \bar{t})$	0	0

(see next page)

Z_0 CASE 2 (PART II) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u t d d \bar{u})$	$(c t d d \bar{u})$	$(t t d d \bar{u})$	0	0
$(u t d d \bar{c})$	$(c t d d \bar{c})$	$(t t d d \bar{c})$	0	0
$(u t d d \bar{t})$	$(c t d d \bar{t})$	$(t t d d \bar{t})$	0	0
$(u t d b \bar{u})$	$(c t d b \bar{u})$	$(t t d b \bar{u})$	0	0
$(u t d b \bar{c})$	$(c t d b \bar{c})$	$(t t d b \bar{c})$	0	0
$(u t d b \bar{t})$	$(c t d b \bar{t})$	$(t t d b \bar{t})$	0	0
$(u t b b \bar{u})$	$(c t b b \bar{u})$	$(t t b b \bar{u})$	0	0
$(u t b b \bar{c})$	$(c t b b \bar{c})$	$(t t b b \bar{c})$	0	0
$(u t b b \bar{t})$	$(c t b b \bar{t})$	$(t t b b \bar{t})$	0	0

TABLE 38: *Some of the properties of the particles predicted by this theory at point* Z_0 *according to case 2.*

Case 3

Rearranged electric charge condition	$+\frac{2}{3}-\frac{1}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. In this case the possibilities reduce to the following	$u \quad d \quad d$ $c \qquad\qquad s \quad \bar{s}$ $t \quad b \quad b$

(see next page)

Z_0 CASE 3 **pentaquarks/mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u\,d\,d\,s\,\overline{s})$	0	$-1+1=0$
$(u\,d\,b\,s\,\overline{s})$	0	$-1+1=0$
$(u\,b\,b\,s\,\overline{s})$	0	$-1+1=0$
$(c\,d\,d\,s\,\overline{s})$	0	$-1+1=0$
$(c\,d\,b\,s\,\overline{s})$	0	$-1+1=0$
$(c\,b\,b\,s\,\overline{s})$	0	$-1+1=0$
$(t\,d\,d\,s\,\overline{s})$	0	$-1+1=0$
$(t\,d\,b\,s\,\overline{s})$	0	$-1+1=0$
$(t\,b\,b\,s\,\overline{s})$	0	$-1+1=0$

TABLE 39: *Some of the properties of the pentaquarks predicted by his theory at point* Z_0 *according \to case 3.*

7.3.2 Point $Z'_0(0,\,0)$: Analysis of the Electric Charge and Strangeness

A similar analysis shows that point $Z'_0(0,\,0)$ contains the following antipentaquarks and anti-mesobaryonic particles

(see next page)

$Z'_0(0,\ 0)$ CASE 1 **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{d}\,\bar{d}\,\bar{d}\,d)$	0	0
$(\bar{u}\,\bar{d}\,\bar{d}\,\bar{d}\,b)$	0	0
$(\bar{u}\,\bar{d}\,\bar{d}\,\bar{b}\,d)$	0	0
$(\bar{u}\,\bar{d}\,\bar{d}\,\bar{b}\,b)$	0	0
$(\bar{u}\,\bar{d}\,\bar{b}\,\bar{b}\,d)$	0	0
$(\bar{u}\,\bar{d}\,\bar{b}\,\bar{b}\,b)$	0	0
$(\bar{u}\,\bar{b}\,\bar{b}\,\bar{b}\,d)$	0	0
$(\bar{u}\,\bar{b}\,\bar{b}\,\bar{b}\,b)$	0	0
$(\bar{c}\,\bar{d}\,\bar{d}\,\bar{d}\,d)$	0	0
$(\bar{c}\,\bar{d}\,\bar{d}\,\bar{d}\,b)$	0	0
$(\bar{c}\,\bar{d}\,\bar{d}\,\bar{b}\,d)$	0	0
$(\bar{c}\,\bar{d}\,\bar{d}\,\bar{b}\,b)$	0	0
$(\bar{c}\,\bar{d}\,\bar{b}\,\bar{b}\,d)$	0	0
$(\bar{c}\,\bar{d}\,\bar{b}\,\bar{b}\,b)$	0	0
$(\bar{c}\,\bar{b}\,\bar{b}\,\bar{b}\,d)$	0	0
$(\bar{c}\,\bar{b}\,\bar{b}\,\bar{b}\,b)$	0	0
$(\bar{t}\,\bar{d}\,\bar{d}\,\bar{d}\,d)$	0	0
$(\bar{t}\,\bar{d}\,\bar{d}\,\bar{d}\,b)$	0	0
$(\bar{t}\,\bar{d}\,\bar{d}\,\bar{b}\,d)$	0	0
$(\bar{t}\,\bar{d}\,\bar{d}\,\bar{b}\,b)$	0	0
$(\bar{t}\,\bar{d}\,\bar{b}\,\bar{b}\,d)$	0	0
$(\bar{t}\,\bar{d}\,\bar{b}\,\bar{b}\,b)$	0	0
$(\bar{t}\,\bar{b}\,\bar{b}\,\bar{b}\,d)$	0	0
$(\bar{t}\,\bar{b}\,\bar{b}\,\bar{b}\,b)$	0	0

TABLE 40: *Some of the properties of the particles predicted by this theory at point* $Z'_0(0,\ 0)$ *according to case 1.*

$Z'_0(0,\ 0)$ CASE 2 (PART I) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,u)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,u)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,u)$	0	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,c)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,c)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,c)$	0	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,t)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,t)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,t)$	0	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,u)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,u)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,u)$	0	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,c)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,c)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,c)$	0	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,t)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,t)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,t)$	0	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,u)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,u)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,u)$	0	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,c)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,c)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,c)$	0	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,t)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,t)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,t)$	0	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,u)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,u)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,u)$	0	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,c)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,c)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,c)$	0	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,t)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,t)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,t)$	0	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,u)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,u)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,u)$	0	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,c)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,c)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,c)$	0	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,t)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,t)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,t)$	0	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,u)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,u)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,u)$	0	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,c)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,c)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,c)$	0	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,t)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,t)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,t)$	0	0

(see next page)

$Z'_0(0,\ 0)$ CASE 2 (PART II) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,u)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,u)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,u)$	0	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,c)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,c)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,c)$	0	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,t)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,t)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,t)$	0	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,u)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,u)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,u)$	0	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,c)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,c)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,c)$	0	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,t)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,t)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,t)$	0	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,u)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,u)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,u)$	0	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,c)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,c)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,c)$	0	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,t)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,t)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,t)$	0	0

TABLE 41: *Some of the properties of the particles predicted by this theory at point* Z_0' *according to case 2.*

Z_0' CASE 3 **antipentaquarks/anti-mesobaryonic particles**		
PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{d}\,\bar{d}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{u}\,\bar{d}\,\bar{b}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{u}\,\bar{b}\,\bar{b}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{c}\,\bar{d}\,\bar{d}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{c}\,\bar{d}\,\bar{b}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{c}\,\bar{b}\,\bar{b}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{t}\,\bar{d}\,\bar{d}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{t}\,\bar{d}\,\bar{b}\,\bar{s}\,s)$	0	$+1-1=0$
$(\bar{t}\,\bar{b}\,\bar{b}\,\bar{s}\,s)$	0	$+1-1=0$

TABLE 42: *Some of the properties of the antiparticles predicted by this theory at point* Z_0' *according to case 3.*

8. Analysis Along the Straight Lines $Q = +1$ and $Q' = -1$

8.1 Analysis of Points $Y_1(+1, -1)$ and $Y_{-1}'(-1, +1)$

8.1.1 Point $Y_1(+1, -1)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9 (the analysis of the Y_{-1}' will be included in future versions of this theory). The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to $+1$ ($Q = +1$).

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to -1 ($S = -1$).

We shall consider 2 cases

case 1: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{1}{3}\right)+\frac{2}{3}-\frac{1}{3}-\frac{1}{3} = +\frac{3}{3}+0 = +1$$

There are two possibilities

case 1a
The pentaquark or MBP contains only one strange quark. Therefore, its total strangeness is -1

case 1b
The pentaquark or MBP contains two strange quark and one anti-strange quark. Therefore, its total strangeness is also -1.

case 2: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3} = +\frac{3}{3}+0 = +1$$

Case 1a

Rearranged electric charge condition	$+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition. We don't consider one of the *s* quarks (e.g. the one in the 3th column) and additionally, we don't	$u \quad u \quad d \quad d \quad \bar{d}$ $c \quad c \quad s \quad s \quad \bar{b}$ $t \quad t \quad b \quad b \quad \bar{s}$

consider the anti-strange quark $\bar{s}$ in the 5th column.	
Furthermore, because one of the quarks has to be an *s* quark, we don't have to consider the *d* and *b* quarks of the 4th column. Therefore, the number of pentaquarks is reduced to $3\times3\times2\times1\times2=36$	$u \quad u \quad d \quad \quad \bar{d}$ $c \quad c \quad \quad s \quad \bar{b}$ $t \quad t \quad b$

Y_1 CASE 1a **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(uud\,s\bar{d})$	$(cud\,s\bar{d})$	$(tud\,s\bar{d})$	$+1$	-1
$(uud\,s\bar{b})$	$(cud\,s\bar{b})$	$(tud\,s\bar{b})$	$+1$	-1
$(uub\,s\bar{d})$	$(cub\,s\bar{d})$	$(tub\,s\bar{d})$	$+1$	-1
$(uub\,s\bar{b})$	$(cub\,s\bar{b})$	$(tub\,s\bar{b})$	$+1$	-1
$(ucd\,s\bar{d})$	$(ccd\,s\bar{d})$	$(ucd\,s\bar{d})$	$+1$	-1
$(ucd\,s\bar{b})$	$(ccd\,s\bar{b})$	$(tcd\,s\bar{b})$	$+1$	-1
$(ucb\,s\bar{d})$	$(ccb\,s\bar{d})$	$(tcb\,s\bar{d})$	$+1$	-1
$(ucb\,s\bar{b})$	$(ccb\,s\bar{b})$	$(tcb\,s\bar{b})$	$+1$	-1
$(utd\,s\bar{d})$	$(ctd\,s\bar{d})$	$(ttd\,s\bar{d})$	$+1$	-1
$(utd\,s\bar{b})$	$(ctd\,s\bar{b})$	$(ttd\,s\bar{b})$	$+1$	-1
$(utb\,s\bar{d})$	$(ctb\,s\bar{d})$	$(ttb\,s\bar{d})$	$+1$	-1
$(utb\,s\bar{b})$	$(ctb\,s\bar{b})$	$(ttb\,s\bar{b})$	$+1$	-1

TABLE 43: *Some of the properties of the particles predicted by this theory at point* Y_1 *according to case 1a.*

Case 1b

Rearranged electric charge condition	$+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition.	$u \quad u \quad d \quad d \quad \bar{d}$ $c \quad c \quad s \quad s \quad \bar{b}$ $t \quad t \quad b \quad b \quad \bar{s}$
The condition is satisfied if the 3th,4th and 5th quarks are *s*, *s* and $\bar{s}$, respectively. Therefore, the number of pentaquarks is reduced to $3\times3\times1\times1\times1=9$	$u \quad u$ $c \quad c \quad s \quad s$ $t \quad t \quad \quad \quad \bar{s}$

Y_1 CASE 1b **pentaquarks/mesobaryonic particles**			
ROW number	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(u\,u\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
2	$(u\,c\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
3	$(u\,t\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
4	$(c\,u\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
5	$(c\,c\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
6	$(c\,t\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
7	$(t\,u\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
8	$(t\,c\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$
9	$(t\,t\,s\,s\,\bar{s})$	$+1$	$-2+1=-1$

TABLE 44: *Some of the properties of the particles predicted by this theory at point* Y_1 *according to case 1b.*

Case 2

Rearranged electric charge condition	$\left(+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3}$
Quarks that satisfy the electric charge condition. The number of pentaquarks is reduced to $3\times3\times3\times1\times3=81$ (also the number of MBPs is reduced to 81).	$u \quad u \quad u \quad s \quad \bar{u}$ $c \quad c \quad c \quad \quad \bar{c}$ $t \quad t \quad t \quad \quad \bar{t}$

(see next page)

Y_1 CASE 2 **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u u u s \bar{u})$	$(c u u s \bar{u})$	$(t u u s \bar{u})$	$+1$	-1
$(u u u s \bar{c})$	$(c u u s \bar{c})$	$(t u u s \bar{c})$	$+1$	-1
$(u u u s \bar{t})$	$(c u u s \bar{t})$	$(t u u s \bar{t})$	$+1$	-1
$(u u c s \bar{u})$	$(c u c s \bar{u})$	$(t u c s \bar{u})$	$+1$	-1
$(u u c s \bar{c})$	$(c u c s \bar{c})$	$(t u c s \bar{c})$	$+1$	-1
$(u u c s \bar{t})$	$(c u c s \bar{t})$	$(t u c s \bar{t})$	$+1$	-1
$(u u t s \bar{u})$	$(c u t s \bar{u})$	$(t u t s \bar{u})$	$+1$	-1
$(u u t s \bar{c})$	$(c u t s \bar{c})$	$(t u t s \bar{c})$	$+1$	-1
$(u u t s \bar{t})$	$(c u t s \bar{t})$	$(t u t s \bar{t})$	$+1$	-1
$(u c u s \bar{u})$	$(c c u s \bar{u})$	$(t c u s \bar{u})$	$+1$	-1
$(u c u s \bar{c})$	$(c c u s \bar{c})$	$(t c u s \bar{c})$	$+1$	-1
$(u c u s \bar{t})$	$(c c u s \bar{t})$	$(t c u s \bar{t})$	$+1$	-1
$(u c c s \bar{u})$	$(c c c s \bar{u})$	$(t c c s \bar{u})$	$+1$	-1
$(u c c s \bar{c})$	$(c c c s \bar{c})$	$(t c c s \bar{c})$	$+1$	-1
$(u c c s \bar{t})$	$(c c c s \bar{t})$	$(t c c s \bar{t})$	$+1$	-1
$(u c t s \bar{u})$	$(c c t s \bar{u})$	$(t c t s \bar{u})$	$+1$	-1
$(u c t s \bar{c})$	$(c c t s \bar{c})$	$(t c t s \bar{c})$	$+1$	-1
$(u c t s \bar{t})$	$(c c t s \bar{t})$	$(t c t s \bar{t})$	$+1$	-1
$(u t u s \bar{u})$	$(c t u s \bar{u})$	$(t t u s \bar{u})$	$+1$	-1
$(u t u s \bar{c})$	$(c t u s \bar{c})$	$(t t u s \bar{c})$	$+1$	-1
$(u t u s \bar{t})$	$(c t u s \bar{t})$	$(t t u s \bar{t})$	$+1$	-1
$(u t c s \bar{u})$	$(c t c s \bar{u})$	$(t t c s \bar{u})$	$+1$	-1
$(u t c s \bar{c})$	$(c t c s \bar{c})$	$(t t c s \bar{c})$	$+1$	-1
$(u t c s \bar{t})$	$(c t c s \bar{t})$	$(t t c s \bar{t})$	$+1$	-1
$(u t t s \bar{u})$	$(c t t s \bar{u})$	$(t t t s \bar{u})$	$+1$	-1
$(u t t s \bar{c})$	$(c t t s \bar{c})$	$(t t t s \bar{c})$	$+1$	-1
$(u t t s \bar{t})$	$(c t t s \bar{t})$	$(t t t s \bar{t})$	$+1$	-1

TABLE 45: *Some of the properties of the particles predicted by this theory at point* Y_1 *according to case 2.*

8.1.2 Point $Y_{-1}'(-1, +1)$: Analysis of the Electric Charge and Strangeness

A similar analysis shows that point $Y_{-1}'(-1, +1)$ contains the following antipentaquarks and anti-mesobaryonic particles

Y_{-1}' CASE 1a **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{s}\,d)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{s}\,d)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{s}\,b)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{s}\,b)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{s}\,d)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{s}\,d)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{s}\,b)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{s}\,b)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{s}\,d)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{s}\,d)$	$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{s}\,b)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{s}\,b)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{s}\,d)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{s}\,d)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{s}\,b)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{s}\,b)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{s}\,d)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{s}\,d)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{s}\,b)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{s}\,b)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{s}\,d)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{s}\,d)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{s}\,b)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{s}\,b)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{s}\,d)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{s}\,d)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{s}\,b)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{s}\,b)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{s}\,b)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{s}\,d)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{s}\,d)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{s}\,d)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{s}\,b)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{s}\,b)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{s}\,b)$	-1	$+1$

TABLE 46: *Some of the properties of the particles predicted by this theory at point* Y_{-1}' *according to case 1a.*

Y_{-1}' CASE 1b **antipentaquarks/anti-mesobaryonic particles**			
ROW number	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(\bar{u}\,\bar{u}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
2	$(\bar{u}\,\bar{c}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
3	$(\bar{u}\,\bar{t}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
4	$(\bar{c}\,\bar{u}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
5	$(\bar{c}\,\bar{c}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
6	$(\bar{c}\,\bar{t}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
7	$(\bar{t}\,\bar{u}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
8	$(\bar{t}\,\bar{c}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$
9	$(\bar{t}\,\bar{t}\,\bar{s}\,\bar{s}\,s)$	-1	$+2-1=+1$

TABLE 47: *Some of the properties of the antiparticles predicted by this theory at point* Y_{-1}' *according to case 1b.*

(see next page)

$Y_{-1}{}'$ CASE 2

antipentaquarks/anti-mesobaryonic particles

PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{s}\,u)$	$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{s}\,u)$	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{s}\,c)$	$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{s}\,c)$	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{s}\,t)$	$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{s}\,t)$	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{s}\,u)$	$(\bar{c}\,\bar{u}\,\bar{c}\,\bar{s}\,u)$	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{s}\,c)$	$(\bar{c}\,\bar{u}\,\bar{c}\,\bar{s}\,c)$	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{s}\,t)$	$(\bar{c}\,\bar{u}\,\bar{c}\,\bar{s}\,t)$	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{s}\,u)$	$(\bar{c}\,\bar{u}\,\bar{t}\,\bar{s}\,u)$	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{s}\,c)$	$(\bar{c}\,\bar{u}\,\bar{t}\,\bar{s}\,c)$	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{s}\,t)$	$(\bar{c}\,\bar{u}\,\bar{t}\,\bar{s}\,t)$	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{s}\,u)$	$(\bar{c}\,\bar{c}\,\bar{u}\,\bar{s}\,u)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{s}\,c)$	$(\bar{c}\,\bar{c}\,\bar{u}\,\bar{s}\,c)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{s}\,t)$	$(\bar{c}\,\bar{c}\,\bar{u}\,\bar{s}\,t)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{s}\,u)$	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{s}\,u)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{s}\,c)$	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{s}\,c)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{s}\,t)$	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{s}\,t)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{s}\,u)$	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{s}\,u)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{s}\,c)$	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{s}\,c)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{s}\,t)$	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{s}\,t)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{s}\,u)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{s}\,u)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{s}\,c)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{s}\,c)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{s}\,t)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{s}\,t)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{s}\,u)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{s}\,u)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{s}\,c)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{s}\,c)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{s}\,t)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{s}\,t)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{s}\,t)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{s}\,u)$	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{s}\,u)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{s}\,u)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{s}\,c)$	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{s}\,c)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{s}\,c)$	-1	$+1$
$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{s}\,t)$	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{s}\,t)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{s}\,t)$	-1	$+1$

TABLE 48: *Some of the properties of the antiparticles predicted by this theory at point* $Y_{-1}{}'$ *according to case 2.*

8.2 Analysis of Points $Z_1(+1, 0)$ And $Z'_{-1}(-1, 0)$

8.2.1 Point $Z_1(+1, 0)$: Analysis of the Electric Charge and Strangeness

(Includes the discovered pentaquark/mesobaryonic particle – see Case 2 Part II)

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to $+1$ ($Q=+1$).

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to 0 ($S=0$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is 0 (see TABLE 1 of section 2), there are two possibilities:

(Possibility 1)
One way a particle can have a strangeness of 0 is if there are no strange quarks in the composition of this particle.

(Possibility 2)
Another way a particle can have a strangeness of 0 is if one of its quarks were a strange quark ($S=-1$), another one were an anti-strange quark ($S=+1$) and the rest of the quarks were neither non-strange quarks nor non-anti-strange quarks. Thus, the total strangeness of this particle would still be 0.

One may think that the particles on the *Q* axis for particles (and on the *Q* axis for antiparticles) should not contain any strange quarks (or any anti-strange quarks) because the delta baryons: Δ^- , Δ^0 , Δ^+ , Δ^{++} , which are also located on the *Q* axis, do not contain any strange quarks. The reason why baryons cannot contain an $(s\,\bar{s})$ pair is that a baryon such as $(u\,s\,\bar{s})$ would satisfy the second above condition ($S=0$) without problems but not the first one ($Q=+1$). Thus, the $(u\,s\,\bar{s})$ baryon is forbidden because it would have a fractional electric charge of $+2/3$ which is not allowed (The electric charge of a baryon must be an integer multiple of the elementary charge). A pentaquark, on the other hand, can contain a strange quark and an anti-strange quark and still satisfy the above conditions. For example, the $(\bar{d}\,\bar{d}\,\bar{d}\,\bar{s}\,s)$ pentaquark has a total electric charge of +1 and a total strangeness of 0. Therefore this pentaquark satisfies both conditions (a) and (b). Let's have a look at the cases that satisfy condition (a):

Case 1: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{1}{3}\right)+\frac{2}{3}-\frac{1}{3}-\frac{1}{3}=+\frac{3}{3}+0=+1$$

Case 2: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}\right)+\frac{2}{3}-\frac{2}{3} = +\frac{3}{3}+0 = +1$$

Case 3: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}\right)+\frac{1}{3}-\frac{1}{3} = +\frac{3}{3}+0 = +1$$

These cases give us the following pentaquarks

Case 1

Rearranged electric charge condition	$+\frac{2}{3}-\frac{1}{3}+\frac{2}{3}-\frac{1}{3}+\frac{1}{3}$
Quarks that satisfy the electric charge condition (*) (*) Because pentaquarks on the Q axes must have total strangeness of 0, the strange quark s and the anti-strange $\overline{s}$ must be included as a pair $s\,\overline{s}$ or unit. These pentaquarks are shown in a separate table.	$u \quad d \quad u \quad d \quad \overline{d}$ $c \quad b \quad c \quad b \quad \overline{b}$ $t \quad \quad t \quad s \quad \overline{s}$

(see next page)

Z_1 CASE 1 (PART I) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u u d d \bar{d})$	$(c u d d \bar{d})$	$(t u d d \bar{d})$	$+1$	0
$(u u d d \bar{b})$	$(c u d d \bar{b})$	$(t u d d \bar{b})$	$+1$	0
$(u u d b \bar{d})$	$(c u d b \bar{d})$	$(t u d b \bar{d})$	$+1$	0
$(u u d b \bar{b})$	$(c u d b \bar{b})$	$(t u d b \bar{b})$	$+1$	0
$(u u b b \bar{d})$	$(c u b b \bar{d})$	$(t u b b \bar{d})$	$+1$	0
$(u u b b \bar{b})$	$(c u b b \bar{b})$	$(t u b b \bar{b})$	$+1$	0
$(u c d d \bar{d})$	$(c c d d \bar{d})$	$(t c d d \bar{d})$	$+1$	0
$(u c d d \bar{b})$	$(c c d d \bar{b})$	$(t c d d \bar{b})$	$+1$	0
$(u c d b \bar{d})$	$(c c d b \bar{d})$	$(t c d b \bar{d})$	$+1$	0
$(u c d b \bar{b})$	$(c c d b \bar{b})$	$(t c d b \bar{b})$	$+1$	0
$(u c b b \bar{d})$	$(c c b b \bar{d})$	$(t c b b \bar{d})$	$+1$	0
$(u c b b \bar{b})$	$(c c b b \bar{b})$	$(t c b b \bar{b})$	$+1$	0
$(u t d d \bar{d})$	$(c t d d \bar{d})$	$(t t d d \bar{d})$	$+1$	0
$(u t d d \bar{b})$	$(c t d d \bar{b})$	$(t t d d \bar{b})$	$+1$	0
$(u t d b \bar{d})$	$(c t d b \bar{d})$	$(t t d b \bar{d})$	$+1$	0
$(u t d b \bar{b})$	$(c t d b \bar{b})$	$(t t d b \bar{b})$	$+1$	0
$(u t b b \bar{d})$	$(c t b b \bar{d})$	$(t t b b \bar{d})$	$+1$	0
$(u t b b \bar{b})$	$(c t b b \bar{b})$	$(t t b b \bar{b})$	$+1$	0

TABLE 49: *Some of the properties of the particles predicted by this theory at point* Z_1 *according to case 1 (Part I).*

Z_1 CASE 1 (PART II) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(u u d s \bar{s})$	$(c u d s \bar{s})$	$(t u d s \bar{s})$	$+1$	$-1+1=0$
$(u u b s \bar{s})$	$(c u b s \bar{s})$	$(t u b s \bar{s})$	$+1$	$-1+1=0$
$(u c d s \bar{s})$	$(c c d s \bar{s})$	$(t c d s \bar{s})$	$+1$	$-1+1=0$
$(u c b s \bar{s})$	$(c c b s \bar{s})$	$(t c b s \bar{s})$	$+1$	$-1+1=0$
$(u t d s \bar{s})$	$(c t d s \bar{s})$	$(t t d s \bar{s})$	$+1$	$-1+1=0$
$(u t b s \bar{s})$	$(c t b s \bar{s})$	$(t t b s \bar{s})$	$+1$	$-1+1=0$

TABLE 50: *Some of the properties of the particles predicted by this theory at point* Z_1 *according to case 1 (Part II). These particles contain one* $(s \bar{s})$ *quark/antiquark pair. However, the total strangeness of them is zero because the strangeness of the strange quark and that of the anti-strange quark cancel each other out:* $-1+1=0$.

Case 2

Rearranged electric charge condition	$+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}-\frac{2}{3}$
Quarks that satisfy the electric charge condition	$u \quad u \quad u \quad d \quad \bar{u}$ $c \quad c \quad c \quad b \quad \bar{c}$ $t \quad t \quad t \quad \quad \bar{t}$

(see next page)

Z_1 CASE 2 (PART I) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(u\,u\,u\,d\,\bar{u})$	$(u\,c\,u\,d\,\bar{u})$	$(u\,t\,u\,d\,\bar{u})$	$+1$	0
$(u\,u\,u\,d\,\bar{c})$	$(u\,c\,u\,d\,\bar{c})$	$(u\,t\,u\,d\,\bar{c})$	$+1$	0
$(u\,u\,u\,d\,\bar{t})$	$(u\,c\,u\,d\,\bar{t})$	$(u\,t\,u\,d\,\bar{t})$	$+1$	0
$(u\,u\,u\,b\,\bar{u})$	$(u\,c\,u\,b\,\bar{u})$	$(u\,t\,u\,b\,\bar{u})$	$+1$	0
$(u\,u\,u\,b\,\bar{c})$	$(u\,c\,u\,b\,\bar{c})$	$(u\,t\,u\,b\,\bar{c})$	$+1$	0
$(u\,u\,u\,b\,\bar{t})$	$(u\,c\,u\,b\,\bar{t})$	$(u\,t\,u\,b\,\bar{t})$	$+1$	0
$(u\,u\,c\,d\,\bar{u})$	$(u\,c\,c\,d\,\bar{u})$	$(u\,t\,c\,d\,\bar{u})$	$+1$	0
$(u\,u\,c\,d\,\bar{c})$	$(u\,c\,c\,d\,\bar{c})$	$(u\,t\,c\,d\,\bar{c})$	$+1$	0
$(u\,u\,c\,d\,\bar{t})$	$(u\,c\,c\,d\,\bar{t})$	$(u\,t\,c\,d\,\bar{t})$	$+1$	0
$(u\,u\,c\,b\,\bar{u})$	$(u\,c\,c\,b\,\bar{u})$	$(u\,t\,c\,b\,\bar{u})$	$+1$	0
$(u\,u\,c\,b\,\bar{c})$	$(u\,c\,c\,b\,\bar{c})$	$(u\,t\,c\,b\,\bar{c})$	$+1$	0
$(u\,u\,c\,b\,\bar{t})$	$(u\,c\,c\,b\,\bar{t})$	$(u\,t\,c\,b\,\bar{t})$	$+1$	0
$(u\,u\,t\,d\,\bar{u})$	$(u\,c\,t\,d\,\bar{u})$	$(u\,t\,t\,d\,\bar{u})$	$+1$	0
$(u\,u\,t\,d\,\bar{c})$	$(u\,c\,t\,d\,\bar{c})$	$(u\,t\,t\,d\,\bar{c})$	$+1$	0
$(u\,u\,t\,d\,\bar{t})$	$(u\,c\,t\,d\,\bar{t})$	$(u\,t\,t\,d\,\bar{t})$	$+1$	0
$(u\,u\,t\,b\,\bar{u})$	$(u\,c\,t\,b\,\bar{u})$	$(u\,t\,t\,b\,\bar{u})$	$+1$	0
$(u\,u\,t\,b\,\bar{c})$	$(u\,c\,t\,b\,\bar{c})$	$(u\,t\,t\,b\,\bar{c})$	$+1$	0
$(u\,u\,t\,b\,\bar{t})$	$(u\,c\,t\,b\,\bar{t})$	$(u\,t\,t\,b\,\bar{t})$	$+1$	0

TABLE 51: *Some of the properties of the particles predicted by this theory at point* Z_1 *according to case 2 (Part I).*

(see next page)

Z_1 CASE 2 (PART II) **pentaquarks/mesobaryonic particles** **Includes the Discovered Particle:** $P_{2udc\bar{c}}$ or $M_{2udc\bar{c}} = (uudc\bar{c})$				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(cuud\bar{u})$	$(ccud\bar{u})$	$(ctud\bar{u})$	$+1$	0
$(cuud\bar{c})$	$(ccud\bar{c})$	$(ctud\bar{c})$	$+1$	0
$(cuud\bar{t})$	$(ccud\bar{t})$	$(ctud\bar{t})$	$+1$	0
$(cuub\bar{u})$	$(ccub\bar{u})$	$(ctub\bar{u})$	$+1$	0
$(cuub\bar{c})$	$(ccub\bar{c})$	$(ctub\bar{c})$	$+1$	0
$(cuub\bar{t})$	$(ccub\bar{t})$	$(ctub\bar{t})$	$+1$	0
$(cucd\bar{u})$	$(cccd\bar{u})$	$(ctcd\bar{u})$	$+1$	0
$(cucd\bar{c})$	$(cccd\bar{c})$	$(ctcd\bar{c})$	$+1$	0
$(cucd\bar{t})$	$(cccd\bar{t})$	$(ctcd\bar{t})$	$+1$	0
$(cucb\bar{u})$	$(cccb\bar{u})$	$(ctcb\bar{u})$	$+1$	0
$(cucb\bar{c})$	$(cccb\bar{c})$	$(ctcb\bar{c})$	$+1$	0
$(cucb\bar{t})$	$(cccb\bar{t})$	$(ctcb\bar{t})$	$+1$	0
$(cutd\bar{u})$	$(cctd\bar{u})$	$(cttd\bar{u})$	$+1$	0
$(cutd\bar{c})$	$(cctd\bar{c})$	$(cttd\bar{c})$	$+1$	0
$(cutd\bar{t})$	$(cctd\bar{t})$	$(cttd\bar{t})$	$+1$	0
$(cutb\bar{u})$	$(cctb\bar{u})$	$(cttb\bar{u})$	$+1$	0
$(cutb\bar{c})$	$(cctb\bar{c})$	$(cttb\bar{c})$	$+1$	0
$(cutb\bar{t})$	$(cctb\bar{t})$	$(cttb\bar{t})$	$+1$	0

TABLE 52: *Some of the properties of the particles predicted by this theory at point* Z_1 *according to case 2 (Part II). The highlighted quark in the first column, second row, whose quark composition is:* $cuud\bar{c}$ *(or* $uudc\bar{c}$ *), has been discovered by CERN's Large Hadron Collider in 2015 which confirms the predictions of this formulation. The table only shows the quark composition of the particles regardless of their quantum states. Because both the* $P_c(4380)^+$ *and the* $P_c(4450)^+$ *states have the same composition (in terms of valence quarks), the table shows the common composition for all the states (sharing that composition).*

Z_1 CASE 2 (PART III) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(t u u d \bar{u})$	$(t c u d \bar{u})$	$(t t u d \bar{u})$	$+1$	0
$(t u u d \bar{c})$	$(t c u d \bar{c})$	$(t t u d \bar{c})$	$+1$	0
$(c u u d \bar{t})$	$(t c u d \bar{t})$	$(t t u d \bar{t})$	$+1$	0
$(t u u b \bar{u})$	$(t c u b \bar{u})$	$(t t u b \bar{u})$	$+1$	0
$(t u u b \bar{c})$	$(t c u b \bar{c})$	$(t t u b \bar{c})$	$+1$	0
$(t u u b \bar{t})$	$(t c u b \bar{t})$	$(t t u b \bar{t})$	$+1$	0
$(t u c d \bar{u})$	$(t c c d \bar{u})$	$(t t c d \bar{u})$	$+1$	0
$(t u c d \bar{c})$	$(t c c d \bar{c})$	$(t t c d \bar{c})$	$+1$	0
$(t u c d \bar{t})$	$(t c c d \bar{t})$	$(t t c d \bar{t})$	$+1$	0
$(t u c b \bar{u})$	$(t c c b \bar{u})$	$(t t c b \bar{u})$	$+1$	0
$(t u c b \bar{c})$	$(t c c b \bar{c})$	$(t t c b \bar{c})$	$+1$	0
$(t u c b \bar{t})$	$(t c c b \bar{t})$	$(t t c b \bar{t})$	$+1$	0
$(t u t d \bar{u})$	$(t c t d \bar{u})$	$(t t t d \bar{u})$	$+1$	0
$(t u t d \bar{c})$	$(t c t d \bar{c})$	$(t t t d \bar{c})$	$+1$	0
$(t u t d \bar{t})$	$(t c t d \bar{t})$	$(t t t d \bar{t})$	$+1$	0
$(t u t b \bar{u})$	$(t c t b \bar{u})$	$(t t t b \bar{u})$	$+1$	0
$(t u t b \bar{c})$	$(t c t b \bar{c})$	$(t t t b \bar{c})$	$+1$	0
$(t u t b \bar{t})$	$(t c t b \bar{t})$	$(t t t b \bar{t})$	$+1$	0

TABLE 53: *Some of the properties of the particles predicted by this theory at point* Z_1 *according to case 2 (Part III)*

(see next page)

Case 3

$$\left(+\frac{2}{3}+\frac{2}{3}-\frac{1}{3}\right)+\frac{1}{3}-\frac{1}{3}=+\frac{3}{3}+0=+1$$

Z_1 CASE 3 **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(u u d d \bar{d})$	$(c u d d \bar{d})$	$(t u d d \bar{d})$	+1	0
$(u u d d \bar{b})$	$(c u d d \bar{b})$	$(t u d d \bar{b})$	+1	0
$(u u d b \bar{d})$	$(c u d b \bar{d})$	$(t u d b \bar{d})$	+1	0
$(u u d b \bar{b})$	$(c u d b \bar{b})$	$(t u d b \bar{b})$	+1	0
$(u u b b \bar{d})$	$(c u b b \bar{d})$	$(t u b b \bar{d})$	+1	0
$(u u b b \bar{b})$	$(c u b b \bar{b})$	$(t u b b \bar{b})$	+1	0
$(u c d d \bar{d})$	$(c c d d \bar{d})$	$(t c d d \bar{d})$	+1	0
$(u c d d \bar{b})$	$(c c d d \bar{b})$	$(t c d d \bar{b})$	+1	0
$(u c d b \bar{d})$	$(c c d b \bar{d})$	$(t c d b \bar{d})$	+1	0
$(u c d b \bar{b})$	$(c c d b \bar{b})$	$(t c d b \bar{b})$	+1	0
$(u c b b \bar{d})$	$(c c b b \bar{d})$	$(t c b b \bar{d})$	+1	0
$(u c b b \bar{b})$	$(c c b b \bar{b})$	$(t c b b \bar{b})$	+1	0
$(u t d d \bar{d})$	$(c t d d \bar{d})$	$(t t d d \bar{d})$	+1	0
$(u t d d \bar{b})$	$(c t d d \bar{b})$	$(t t d d \bar{b})$	+1	0
$(u t d b \bar{d})$	$(c t d b \bar{d})$	$(t t d b \bar{d})$	+1	0
$(u t d b \bar{b})$	$(c t d b \bar{b})$	$(t t d b \bar{b})$	+1	0
$(u t b b \bar{d})$	$(c t b b \bar{d})$	$(t t b b \bar{d})$	+1	0
$(u t b b \bar{b})$	$(c t b b \bar{b})$	$(t t b b \bar{b})$	+1	0

TABLE 54: *Some of the properties of the particles predicted by this theory at point* Z_1 *according to case 3.*

8.2.2 Point $Z_{-1}'(-1, 0)$: Analysis of the Electric Charge and Strangeness

Case 1

Z_{-1}' CASE 1 (PART I) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,d)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,d)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,d)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,b)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,b)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,b)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,d)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,d)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,b)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,b)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,d)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,d)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,b)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,b)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,d)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,d)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,d)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,b)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,b)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,b)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,d)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,d)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,b)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,b)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,d)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,d)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,b)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,b)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,d)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,d)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,d)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,b)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,b)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,b)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,b)$	-1	0

TABLE 55: *Some of the properties of the antiparticles predicted by this theory at point* Z_{-1}' *according to case 1*

Z_{-1}' CASE 1 (PART II) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{s}\,s)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{s}\,s)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{s}\,s)$	-1	$+1-1=0$
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{s}\,s)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{s}\,s)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{s}\,s)$	-1	$+1-1=0$
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{s}\,s)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{s}\,s)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{s}\,s)$	-1	$+1-1=0$
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{s}\,s)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{s}\,s)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{s}\,s)$	-1	$+1-1=0$
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{s}\,s)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{s}\,s)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{s}\,s)$	-1	$+1-1=0$
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{s}\,s)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{s}\,s)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{s}\,s)$	-1	$+1-1=0$

TABLE 56: *Some of the properties of the antiparticles predicted by this theory at point* Z_{-1}' *according to case 1 (Part II). These particles contain one* $(\bar{s}\,s)$ *antiquark/quark pair. However, the total strangeness of them is zero because the strangeness of the strange quark and that of the anti-strange quark cancel each other out:* $+1-1=0$.

(see next page)

Case 2

Z_{-1}' CASE 2 (PART I) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{d}\,u)$	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{d}\,u)$	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{d}\,u)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{d}\,c)$	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{d}\,c)$	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{d}\,c)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{d}\,t)$	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{d}\,t)$	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{d}\,t)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{b}\,u)$	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{b}\,u)$	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{b}\,u)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{b}\,c)$	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{b}\,c)$	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{b}\,c)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{b}\,t)$	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{b}\,t)$	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{b}\,t)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{d}\,u)$	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{d}\,u)$	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{d}\,u)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{d}\,c)$	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{d}\,c)$	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{d}\,c)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{d}\,t)$	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{d}\,t)$	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{d}\,t)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{b}\,u)$	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{b}\,u)$	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{b}\,u)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{b}\,c)$	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{b}\,c)$	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{b}\,c)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{b}\,t)$	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{b}\,t)$	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{b}\,t)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{d}\,u)$	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{d}\,u)$	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{d}\,u)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{d}\,c)$	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{d}\,c)$	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{d}\,c)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{d}\,t)$	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{d}\,t)$	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{d}\,t)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{b}\,u)$	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{b}\,u)$	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{b}\,u)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{b}\,c)$	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{b}\,c)$	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{b}\,c)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{b}\,t)$	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{b}\,t)$	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{b}\,t)$	-1	0

TABLE 57: *Some of the properties of the antiparticles predicted by this theory at point* Z_{-1}' *according to case 2 (Part I).*

(see next page)

Z_{-1}' CASE 2 (Part II) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{c}\bar{u}\bar{u}\bar{d}u)$	$(\bar{c}\bar{c}\bar{u}\bar{d}u)$	$(\bar{c}\bar{t}\bar{u}\bar{d}u)$	-1	0
$(\bar{c}\bar{u}\bar{u}\bar{d}c)$	$(\bar{c}\bar{c}\bar{u}\bar{d}c)$	$(\bar{c}\bar{t}\bar{u}\bar{d}c)$	-1	0
$(\bar{c}\bar{u}\bar{u}\bar{d}t)$	$(\bar{c}\bar{c}\bar{u}\bar{d}t)$	$(\bar{c}\bar{t}\bar{u}\bar{d}t)$	-1	0
$(\bar{c}\bar{u}\bar{u}\bar{b}u)$	$(\bar{c}\bar{c}\bar{u}\bar{b}u)$	$(\bar{c}\bar{t}\bar{u}\bar{b}u)$	-1	0
$(\bar{c}\bar{u}\bar{u}\bar{b}c)$	$(\bar{c}\bar{c}\bar{u}\bar{b}c)$	$(\bar{c}\bar{t}\bar{u}\bar{b}c)$	-1	0
$(\bar{c}\bar{u}\bar{u}\bar{b}t)$	$(\bar{c}\bar{c}\bar{u}\bar{b}t)$	$(\bar{c}\bar{t}\bar{u}\bar{b}t)$	-1	0
$(\bar{c}\bar{u}\bar{c}\bar{d}u)$	$(\bar{c}\bar{c}\bar{c}\bar{d}u)$	$(\bar{c}\bar{t}\bar{c}\bar{d}u)$	-1	0
$(\bar{c}\bar{u}\bar{c}\bar{d}c)$	$(\bar{c}\bar{c}\bar{c}\bar{d}c)$	$(\bar{c}\bar{t}\bar{c}\bar{d}c)$	-1	0
$(\bar{c}\bar{u}\bar{c}\bar{d}t)$	$(\bar{c}\bar{c}\bar{c}\bar{d}t)$	$(\bar{c}\bar{t}\bar{c}\bar{d}t)$	-1	0
$(\bar{c}\bar{u}\bar{c}\bar{b}u)$	$(\bar{c}\bar{c}\bar{c}\bar{b}u)$	$(\bar{c}\bar{t}\bar{c}\bar{b}u)$	-1	0
$(\bar{c}\bar{u}\bar{c}\bar{b}c)$	$(\bar{c}\bar{c}\bar{c}\bar{b}c)$	$(\bar{c}\bar{t}\bar{c}\bar{b}c)$	-1	0
$(\bar{c}\bar{u}\bar{c}\bar{b}t)$	$(\bar{c}\bar{c}\bar{c}\bar{b}t)$	$(\bar{c}\bar{t}\bar{c}\bar{b}t)$	-1	0
$(\bar{c}\bar{u}\bar{t}\bar{d}u)$	$(\bar{c}\bar{c}\bar{t}\bar{d}u)$	$(\bar{c}\bar{t}\bar{t}\bar{d}u)$	-1	0
$(\bar{c}\bar{u}\bar{t}\bar{d}c)$	$(\bar{c}\bar{c}\bar{t}\bar{d}c)$	$(\bar{c}\bar{t}\bar{t}\bar{d}c)$	-1	0
$(\bar{c}\bar{u}\bar{t}\bar{d}t)$	$(\bar{c}\bar{c}\bar{t}\bar{d}t)$	$(\bar{c}\bar{t}\bar{t}\bar{d}t)$	-1	0
$(\bar{c}\bar{u}\bar{t}\bar{b}u)$	$(\bar{c}\bar{c}\bar{t}\bar{b}u)$	$(\bar{c}\bar{t}\bar{t}\bar{b}u)$	-1	0
$(\bar{c}\bar{u}\bar{t}\bar{b}c)$	$(\bar{c}\bar{c}\bar{t}\bar{b}c)$	$(\bar{c}\bar{t}\bar{t}\bar{b}c)$	-1	0
$(\bar{c}\bar{u}\bar{t}\bar{b}t)$	$(\bar{c}\bar{c}\bar{t}\bar{b}t)$	$(\bar{c}\bar{t}\bar{t}\bar{b}t)$	-1	0

TABLE 58: *Some of the properties of the antiparticles predicted by this theory at point* Z_{-1}' *according to case 2 (Part II).*

(see next page)

Z_{-1}' CASE 2 (PART III) **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{d}\,u)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{d}\,u)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{d}\,u)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{d}\,c)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{d}\,c)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{d}\,c)$	-1	0
$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{d}\,t)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{d}\,t)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{d}\,t)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{b}\,u)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{b}\,u)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{b}\,u)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{b}\,c)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{b}\,c)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{b}\,c)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{b}\,t)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{b}\,t)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{b}\,t)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{d}\,u)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{d}\,u)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{d}\,u)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{d}\,c)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{d}\,c)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{d}\,c)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{d}\,t)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{d}\,t)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{d}\,t)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{b}\,u)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{b}\,u)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{b}\,u)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{b}\,c)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{b}\,c)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{b}\,c)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{b}\,t)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{b}\,t)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{b}\,t)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{d}\,u)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{d}\,u)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{d}\,u)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{d}\,c)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{d}\,c)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{d}\,c)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{d}\,t)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{d}\,t)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{d}\,t)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{b}\,u)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{b}\,u)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{b}\,u)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{b}\,c)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{b}\,c)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{b}\,c)$	-1	0
$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{b}\,t)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{b}\,t)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{b}\,t)$	-1	0

TABLE 59: *Some of the properties of the antiparticles predicted by this theory at point* Z_{-1}' *according to case 2 (Part III)*

(see next page)

Case 3

$Z_{-1}{}'$ CASE 3 **antipentaquarks/anti-mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,d)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,d)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,d)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{d}\,b)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{d}\,b)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{d}\,b)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,d)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,d)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{d}\,\bar{b}\,b)$	$(\bar{c}\,\bar{u}\,\bar{d}\,\bar{b}\,b)$	$(\bar{t}\,\bar{u}\,\bar{d}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,d)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,d)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{u}\,\bar{b}\,\bar{b}\,b)$	$(\bar{c}\,\bar{u}\,\bar{b}\,\bar{b}\,b)$	$(\bar{t}\,\bar{u}\,\bar{b}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,d)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,d)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,d)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{d}\,b)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{d}\,b)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{d}\,b)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,d)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,d)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{d}\,\bar{b}\,b)$	$(\bar{c}\,\bar{c}\,\bar{d}\,\bar{b}\,b)$	$(\bar{t}\,\bar{c}\,\bar{d}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,d)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,d)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{c}\,\bar{b}\,\bar{b}\,b)$	$(\bar{c}\,\bar{c}\,\bar{b}\,\bar{b}\,b)$	$(\bar{t}\,\bar{c}\,\bar{b}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,d)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,d)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,d)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{d}\,b)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{d}\,b)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{d}\,b)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{d}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{d}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{d}\,\bar{b}\,b)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,d)$	-1	0
$(\bar{u}\,\bar{t}\,\bar{b}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{b}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{b}\,\bar{b}\,b)$	-1	0

TABLE 60: *Some of the properties of the particles predicted by this theory at point* $Z_{-1}{}'$ *according to case 3.*

9. Analysis Along the Straight Lines $Q = +2$ and $Q' = -2$

9.1 Analysis of Points $Z_2(+2, 0)$ and $Z_{-2}'(-2, 0)$

9.1.1 Point $Z_2(+2, 0)$: Analysis of the Electric Charge and Strangeness

In this analysis we only consider the *QS* coordinate system for particles which is shown in blue colour on the right hand side of FIGURE 9. The predicted particles must satisfy the following two conditions:

(a) the first condition the unknown particle (pentaquark and MBP) must satisfy is that its electric charge should be equal to $+2$ ($Q = +2$).

(b) The second condition the unknown particle (pentaquark and MBP) must satisfy is that its strangeness should be equal to 0 ($S = 0$). Because strange quarks are the only particles which possess the strangeness property, and because the value of this property is 0 (see TABLE 1 of section 2), there are two possibilities:

(Possibility 1)
One way a particle can have a strangeness of 0 is if there are no strange quarks in the composition of this particle.

(Possibility 2)
A second way a particle can have a strangeness of 0 is if there is strange quark and an anti-strange quark in the composition of this particle.

I shall consider the following cases

Case 1: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}\right)+\frac{2}{3}-\frac{2}{3} = +\frac{6}{3}+0 = +2$$

Case 2: particles
The electric charge in this case is

$$\left(+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}\right)+\frac{1}{3}-\frac{1}{3} = +\frac{6}{3}+0 = +2$$

(see next page)

Case 1

Electric charge condition $+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}-\frac{2}{3}$

Quarks that satisfy the electric charge condition

u	u	u	u	$\bar{u}$
c	c	c	c	$\bar{c}$
t	t	t	t	$\bar{t}$

Z_2 CASE 1 **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(u\,u\,u\,u\,\bar{u})$	$(u\,c\,u\,u\,\bar{u})$	$(u\,t\,u\,u\,\bar{u})$	+2	0
$(u\,u\,u\,u\,\bar{c})$	$(u\,c\,u\,u\,\bar{c})$	$(u\,t\,u\,u\,\bar{c})$	+2	0
$(u\,u\,u\,u\,\bar{t})$	$(u\,c\,u\,u\,\bar{t})$	$(u\,t\,u\,u\,\bar{t})$	+2	0
$(u\,u\,u\,c\,\bar{u})$	$(u\,c\,u\,c\,\bar{t})$	$(u\,t\,u\,c\,\bar{u})$	+2	0
$(u\,u\,u\,c\,\bar{c})$	$(u\,c\,u\,c\,\bar{c})$	$(u\,t\,u\,c\,\bar{c})$	+2	0
$(u\,u\,u\,c\,\bar{t})$	$(u\,c\,u\,c\,\bar{t})$	$(u\,t\,u\,c\,\bar{t})$	+2	0
$(u\,u\,u\,t\,\bar{u})$	$(u\,c\,u\,t\,\bar{u})$	$(u\,t\,u\,t\,\bar{u})$	+2	0
$(u\,u\,u\,t\,\bar{c})$	$(u\,c\,u\,t\,\bar{c})$	$(u\,t\,u\,t\,\bar{c})$	+2	0
$(u\,u\,u\,t\,\bar{t})$	$(u\,c\,u\,t\,\bar{t})$	$(u\,t\,u\,t\,\bar{t})$	+2	0
$(u\,u\,c\,u\,\bar{u})$	$(u\,c\,c\,u\,\bar{u})$	$(u\,t\,c\,u\,\bar{u})$	+2	0
$(u\,u\,c\,u\,\bar{c})$	$(u\,c\,c\,u\,\bar{c})$	$(u\,t\,c\,u\,\bar{c})$	+2	0
$(u\,u\,c\,u\,\bar{t})$	$(u\,c\,c\,u\,\bar{t})$	$(u\,t\,c\,u\,\bar{t})$	+2	0
$(u\,u\,c\,c\,\bar{u})$	$(u\,c\,c\,c\,\bar{u})$	$(u\,t\,c\,c\,\bar{u})$	+2	0
$(u\,u\,c\,c\,\bar{c})$	$(u\,c\,c\,c\,\bar{c})$	$(u\,t\,c\,c\,\bar{c})$	+2	0
$(u\,u\,c\,c\,\bar{t})$	$(u\,c\,c\,c\,\bar{t})$	$(u\,t\,c\,c\,\bar{t})$	+2	0
$(u\,u\,c\,t\,\bar{u})$	$(u\,c\,c\,t\,\bar{u})$	$(u\,t\,c\,t\,\bar{u})$	+2	0
$(u\,u\,c\,t\,\bar{c})$	$(u\,c\,c\,t\,\bar{c})$	$(u\,t\,c\,t\,\bar{c})$	+2	0
$(u\,u\,c\,t\,\bar{t})$	$(u\,c\,c\,t\,\bar{t})$	$(u\,t\,c\,t\,\bar{t})$	+2	0

TABLE 61: *Some of the properties of the particles predicted by this theory at point* Z_2 *according to case 1*

Case 2

Electric charge condition	$+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{1}{3}-\frac{1}{3}$
Quarks that satisfy the electric charge condition (*). (*) Because pentaquarks on the Q axes must have total strangeness of 0, the strange quark s and the anti-strange $\bar{s}$ must be included as a pair $s\,\bar{s}$ or unit. These pentaquarks are shown in a separate table.	$u \quad u \quad u \quad \bar{d} \quad d$ $c \quad c \quad c \quad \bar{b} \quad b$ $t \quad t \quad t \quad \bar{s} \quad s$

Z_2 CASE 2 (PART I) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\lvert e \rvert$)	STRANGENESS
$(uud\,d\,\bar{d})$	$(ucud\,\bar{d})$	$(utud\,\bar{d})$	$+2$	0
$(uud\,d\,\bar{b})$	$(ucud\,\bar{b})$	$(utud\,\bar{b})$	$+2$	0
$(uuub\,\bar{d})$	$(ucub\,\bar{d})$	$(utub\,\bar{d})$	$+2$	0
$(uuub\,\bar{b})$	$(ucub\,\bar{b})$	$(utub\,\bar{b})$	$+2$	0
$(uucd\,\bar{d})$	$(uccd\,\bar{d})$	$(utcd\,\bar{d})$	$+2$	0
$(uucd\,\bar{b})$	$(uucd\,\bar{b})$	$(utcd\,\bar{b})$	$+2$	0
$(uucb\,\bar{d})$	$(uccb\,\bar{d})$	$(utcb\,\bar{d})$	$+2$	0
$(uucb\,\bar{b})$	$(uccb\,\bar{b})$	$(utcb\,\bar{b})$	$+2$	0
$(uutd\,\bar{d})$	$(uctd\,\bar{d})$	$(uttd\,\bar{d})$	$+2$	0
$(uutd\,\bar{b})$	$(uctd\,\bar{b})$	$(uttd\,\bar{b})$	$+2$	0
$(uutb\,\bar{d})$	$(uctb\,\bar{d})$	$(uttb\,\bar{d})$	$+2$	0
$(uutb\,\bar{b})$	$(uctb\,\bar{b})$	$(uttb\,\bar{b})$	$+2$	0

TABLE 62: *Some of the properties of the particles predicted by this theory at point* Z_2 *according to case 2 (part I).*

(see next page)

Z_2 CASE 2 (PART II) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(c u u d \bar{d})$	$(c c u d \bar{d})$	$(c t u d \bar{d})$	$+2$	0
$(c u u d \bar{b})$	$(c c u d \bar{b})$	$(c t u d \bar{b})$	$+2$	0
$(c u u b \bar{d})$	$(c c u b \bar{d})$	$(c t u b \bar{d})$	$+2$	0
$(c u u b \bar{b})$	$(c c u b \bar{b})$	$(c t u b \bar{b})$	$+2$	0
$(c u c d \bar{d})$	$(c c c d \bar{d})$	$(c t c d \bar{d})$	$+2$	0
$(c u c d \bar{b})$	$(c u c d \bar{b})$	$(c t c d \bar{b})$	$+2$	0
$(c u c b \bar{d})$	$(c c c b \bar{d})$	$(c t c b \bar{d})$	$+2$	0
$(u u c b \bar{b})$	$(u c c b \bar{b})$	$(u t c b \bar{b})$	$+2$	0
$(c u t d \bar{d})$	$(c c t d \bar{d})$	$(c t t d \bar{d})$	$+2$	0
$(c u t d \bar{b})$	$(c c t d \bar{b})$	$(c t t d \bar{b})$	$+2$	0
$(c u t b \bar{d})$	$(c c t b \bar{d})$	$(c t t b \bar{d})$	$+2$	0
$(c u t b \bar{b})$	$(c c t b \bar{b})$	$(c t t b \bar{b})$	$+2$	0

TABLE 63: *Some of the properties of the particles predicted by this theory at point* Z_2 *according to case 2 (part II).*

(see next page)

Z_2 CASE 2 (PART III) **pentaquarks/mesobaryonic particles**				
PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
$(tuud\bar{d})$	$(tcud\bar{d})$	$(ttud\bar{d})$	$+2$	0
$(tuud\bar{b})$	$(tcud\bar{b})$	$(ttud\bar{b})$	$+2$	0
$(tuub\bar{d})$	$(tcub\bar{d})$	$(ttub\bar{d})$	$+2$	0
$(tuub\bar{b})$	$(tcub\bar{b})$	$(ttub\bar{b})$	$+2$	0
$(tucd\bar{d})$	$(tccd\bar{d})$	$(ttcd\bar{d})$	$+2$	0
$(tucd\bar{b})$	$(tucd\bar{b})$	$(ttcd\bar{b})$	$+2$	0
$(tucb\bar{d})$	$(cccb\bar{d})$	$(ttcb\bar{d})$	$+2$	0
$(tucb\bar{b})$	$(tccb\bar{b})$	$(ttcb\bar{b})$	$+2$	0
$(tutd\bar{d})$	$(tctd\bar{d})$	$(tttd\bar{d})$	$+2$	0
$(tutd\bar{b})$	$(tctd\bar{b})$	$(tttd\bar{b})$	$+2$	0
$(tutb\bar{d})$	$(tctb\bar{d})$	$(tttb\bar{d})$	$+2$	0
$(tutb\bar{b})$	$(tctb\bar{b})$	$(tttb\bar{b})$	$+2$	0

TABLE 64: *Some of the properties of the particles predicted by this theory at point* Z_2 *according to case 2 (part III).*

(see next page)

Z_2 CASE 2 (PART IV) **pentaquarks/mesobaryonic particles**			
ROW number	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(u u u s \bar{s})$	$+2$	$-1+1=0$
2	$(u u c s \bar{s})$	$+2$	$-1+1=0$
3	$(u u t s \bar{s})$	$+2$	$-1+1=0$
4	$(c u u s \bar{s})$	$+2$	$-1+1=0$
5	$(c u c s \bar{s})$	$+2$	$-1+1=0$
6	$(c u t s \bar{s})$	$+2$	$-1+1=0$
7	$(t u u s \bar{s})$	$+2$	$-1+1=0$
8	$(t u c s \bar{s})$	$+2$	$-1+1=0$
9	$(t u t s \bar{s})$	$+2$	$-1+1=0$
10	$(u c u s \bar{s})$	$+2$	$-1+1=0$
11	$(u c c s \bar{s})$	$+2$	$-1+1=0$
12	$(u c t s \bar{s})$	$+2$	$-1+1=0$
13	$(c c u s \bar{s})$	$+2$	$-1+1=0$
14	$(c c c s \bar{s})$	$+2$	$-1+1=0$
15	$(c c t s \bar{s})$	$+2$	$-1+1=0$
16	$(t c u s \bar{s})$	$+2$	$-1+1=0$
17	$(t c c s \bar{s})$	$+2$	$-1+1=0$
18	$(t c t s \bar{s})$	$+2$	$-1+1=0$
19	$(u t u s \bar{s})$	$+2$	$-1+1=0$
20	$(u t c s \bar{s})$	$+2$	$-1+1=0$
21	$(u t t s \bar{s})$	$+2$	$-1+1=0$
22	$(c t u s \bar{s})$	$+2$	$-1+1=0$
23	$(c t c s \bar{s})$	$+2$	$-1+1=0$
24	$(c t t s \bar{s})$	$+2$	$-1+1=0$
25	$(t t u s \bar{s})$	$+2$	$-1+1=0$
26	$(t t c s \bar{s})$	$+2$	$-1+1=0$
27	$(t t t s \bar{s})$	$+2$	$-1+1=0$

TABLE 65: *Some of the properties of the particles predicted by this theory at point* Z_2 *according to case 2 (part IV).*

9.1.2 Point $Z_{-2}'(-2, 0)$: Electric Charge and Strangeness

Case 1: antiparticles
The electric charge in this case is

$$-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}+\left(\frac{2}{3}-\frac{2}{3}\right)=-\frac{6}{3}+0=-2$$

Because of the quark composition we predict that this case will generate antipentaquarks.

Case 2: antiparticles
The electric charge in this case is

$$-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}+\left(\frac{1}{3}-\frac{1}{3}\right)=-\frac{6}{3}+0=-2$$

Because of the quark composition we predict that this case will generate antipentaquarks.

Case 1: antiparticles

Electric charge condition	$-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}+\frac{2}{3}$
Quarks that satisfy the electric charge condition	$\bar{u}$ $\bar{u}$ $\bar{u}$ $\bar{u}$ u $\bar{c}$ $\bar{c}$ $\bar{c}$ $\bar{c}$ c $\bar{t}$ $\bar{t}$ $\bar{t}$ $\bar{t}$ t

Combining these quarks we get the following pentaquarks

(see next page)

Z_{-2}' CASE 1 (PART I) **antipentaquarks/anti-mesobaryonic particles**					
ROW number	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(\bar{u}\bar{u}\bar{u}\bar{u}u)$	$(\bar{u}\bar{u}\bar{u}\bar{u}u)$	$(\bar{u}\bar{u}\bar{u}\bar{u}u)$	-2	0
2	$(\bar{u}\bar{u}\bar{u}\bar{u}c)$	$(\bar{u}\bar{c}\bar{u}\bar{u}c)$	$(\bar{u}\bar{t}\bar{u}\bar{u}c)$	-2	0
3	$(\bar{u}\bar{u}\bar{u}\bar{u}t)$	$(\bar{u}\bar{c}\bar{u}\bar{u}t)$	$(\bar{u}\bar{t}\bar{u}\bar{u}t)$	-2	0
4	$(\bar{u}\bar{u}\bar{u}\bar{c}u)$	$(\bar{u}\bar{c}\bar{u}\bar{c}u)$	$(\bar{u}\bar{t}\bar{u}\bar{c}u)$	-2	0
5	$(\bar{u}\bar{u}\bar{u}\bar{c}c)$	$(\bar{u}\bar{c}\bar{u}\bar{c}c)$	$(\bar{u}\bar{t}\bar{u}\bar{c}c)$	-2	0
6	$(\bar{u}\bar{u}\bar{u}\bar{c}t)$	$(\bar{u}\bar{c}\bar{u}\bar{c}t)$	$(\bar{u}\bar{t}\bar{u}\bar{c}t)$	-2	0
7	$(\bar{u}\bar{u}\bar{u}\bar{t}u)$	$(\bar{u}\bar{c}\bar{u}\bar{t}u)$	$(\bar{u}\bar{t}\bar{u}\bar{t}u)$	-2	0
8	$(\bar{u}\bar{u}\bar{u}\bar{t}c)$	$(\bar{u}\bar{c}\bar{u}\bar{t}c)$	$(\bar{u}\bar{t}\bar{u}\bar{t}c)$	-2	0
9	$(\bar{u}\bar{u}\bar{u}\bar{t}t)$	$(\bar{u}\bar{c}\bar{u}\bar{t}t)$	$(\bar{u}\bar{t}\bar{u}\bar{t}t)$	-2	0
10	$(\bar{u}\bar{u}\bar{c}\bar{u}u)$	$(\bar{u}\bar{c}\bar{c}\bar{u}u)$	$(\bar{u}\bar{t}\bar{c}\bar{u}u)$	-2	0
11	$(\bar{u}\bar{u}\bar{c}\bar{u}c)$	$(\bar{u}\bar{c}\bar{c}\bar{u}c)$	$(\bar{u}\bar{t}\bar{c}\bar{u}c)$	-2	0
12	$(\bar{u}\bar{u}\bar{c}\bar{u}t)$	$(\bar{u}\bar{c}\bar{c}\bar{u}t)$	$(\bar{u}\bar{t}\bar{c}\bar{u}t)$	-2	0
13	$(\bar{u}\bar{u}\bar{c}\bar{c}u)$	$(\bar{u}\bar{c}\bar{c}\bar{c}u)$	$(\bar{u}\bar{t}\bar{c}\bar{c}u)$	-2	0
14	$(\bar{u}\bar{u}\bar{c}\bar{c}c)$	$(\bar{u}\bar{c}\bar{c}\bar{c}c)$	$(\bar{u}\bar{t}\bar{c}\bar{c}c)$	-2	0
15	$(\bar{u}\bar{u}\bar{c}\bar{c}t)$	$(\bar{u}\bar{c}\bar{c}\bar{c}t)$	$(\bar{u}\bar{t}\bar{c}\bar{c}t)$	-2	0
16	$(\bar{u}\bar{u}\bar{c}\bar{t}u)$	$(\bar{u}\bar{c}\bar{c}\bar{t}u)$	$(\bar{u}\bar{t}\bar{c}\bar{t}u)$	-2	0
17	$(\bar{u}\bar{u}\bar{c}\bar{t}c)$	$(\bar{u}\bar{c}\bar{c}\bar{t}c)$	$(\bar{u}\bar{t}\bar{c}\bar{t}c)$	-2	0
18	$(\bar{u}\bar{u}\bar{c}\bar{t}t)$	$(\bar{u}\bar{c}\bar{c}\bar{t}t)$	$(\bar{u}\bar{t}\bar{c}\bar{t}t)$	-2	0
19	$(\bar{u}\bar{u}\bar{t}\bar{u}u)$	$(\bar{u}\bar{c}\bar{t}\bar{u}u)$	$(\bar{u}\bar{t}\bar{t}\bar{u}u)$	-2	0
20	$(\bar{u}\bar{u}\bar{t}\bar{u}c)$	$(\bar{u}\bar{c}\bar{t}\bar{u}c)$	$(\bar{u}\bar{t}\bar{t}\bar{u}c)$	-2	0
21	$(\bar{u}\bar{u}\bar{t}\bar{u}t)$	$(\bar{u}\bar{c}\bar{t}\bar{u}t)$	$(\bar{u}\bar{t}\bar{t}\bar{u}t)$	-2	0
22	$(\bar{u}\bar{u}\bar{t}\bar{c}u)$	$(\bar{u}\bar{c}\bar{t}\bar{c}u)$	$(\bar{u}\bar{t}\bar{t}\bar{c}u)$	-2	0
23	$(\bar{u}\bar{u}\bar{t}\bar{c}c)$	$(\bar{u}\bar{c}\bar{t}\bar{c}c)$	$(\bar{u}\bar{t}\bar{t}\bar{c}c)$	-2	0
24	$(\bar{u}\bar{u}\bar{t}\bar{c}t)$	$(\bar{u}\bar{c}\bar{t}\bar{c}t)$	$(\bar{u}\bar{t}\bar{t}\bar{c}t)$	-2	0
25	$(\bar{u}\bar{u}\bar{t}\bar{t}u)$	$(\bar{u}\bar{c}\bar{t}\bar{t}u)$	$(\bar{u}\bar{t}\bar{t}\bar{t}u)$	-2	0
26	$(\bar{u}\bar{u}\bar{t}\bar{t}c)$	$(\bar{u}\bar{c}\bar{t}\bar{t}c)$	$(\bar{u}\bar{t}\bar{t}\bar{t}c)$	-2	0
27	$(\bar{u}\bar{u}\bar{t}\bar{t}t)$	$(\bar{u}\bar{c}\bar{t}\bar{t}t)$	$(\bar{u}\bar{t}\bar{t}\bar{t}t)$	-2	0

TABLE 66: *More antiparticles at point* Z_{-2}' .

Z_{-2}' CASE 1 (PART II) **antipentaquarks/anti-mesobaryonic particles**					
ROW number	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(\bar{c}\bar{u}\bar{u}\bar{u}u)$	$(\bar{c}\bar{u}\bar{u}\bar{u}u)$	$(\bar{c}\bar{u}\bar{u}\bar{u}u)$	-2	0
2	$(\bar{c}\bar{u}\bar{u}\bar{u}c)$	$(\bar{c}\bar{c}\bar{u}\bar{u}c)$	$(\bar{c}\bar{t}\bar{u}\bar{u}c)$	-2	0
3	$(\bar{c}\bar{u}\bar{u}\bar{u}t)$	$(\bar{c}\bar{c}\bar{u}\bar{u}t)$	$(\bar{c}\bar{t}\bar{u}\bar{u}t)$	-2	0
4	$(\bar{c}\bar{u}\bar{u}\bar{c}u)$	$(\bar{c}\bar{c}\bar{u}\bar{c}u)$	$(\bar{c}\bar{t}\bar{u}\bar{c}u)$	-2	0
5	$(\bar{c}\bar{u}\bar{u}\bar{c}c)$	$(\bar{c}\bar{c}\bar{u}\bar{c}c)$	$(\bar{c}\bar{t}\bar{u}\bar{c}c)$	-2	0
6	$(\bar{c}\bar{u}\bar{u}\bar{c}t)$	$(\bar{c}\bar{c}\bar{u}\bar{c}t)$	$(\bar{c}\bar{t}\bar{u}\bar{c}t)$	-2	0
7	$(\bar{c}\bar{u}\bar{u}\bar{t}u)$	$(\bar{c}\bar{c}\bar{u}\bar{t}u)$	$(\bar{c}\bar{t}\bar{u}\bar{t}u)$	-2	0
8	$(\bar{c}\bar{u}\bar{u}\bar{t}c)$	$(\bar{c}\bar{c}\bar{u}\bar{t}c)$	$(\bar{c}\bar{t}\bar{u}\bar{t}c)$	-2	0
9	$(\bar{c}\bar{u}\bar{u}\bar{t}t)$	$(\bar{c}\bar{c}\bar{u}\bar{t}t)$	$(\bar{c}\bar{t}\bar{u}\bar{t}t)$	-2	0
10	$(\bar{c}\bar{u}\bar{c}\bar{u}u)$	$(\bar{c}\bar{c}\bar{c}\bar{u}u)$	$(\bar{c}\bar{t}\bar{c}\bar{u}u)$	-2	0
11	$(\bar{c}\bar{u}\bar{c}\bar{u}c)$	$(\bar{c}\bar{c}\bar{c}\bar{u}c)$	$(\bar{c}\bar{t}\bar{c}\bar{u}c)$	-2	0
12	$(\bar{c}\bar{u}\bar{c}\bar{u}t)$	$(\bar{c}\bar{c}\bar{c}\bar{u}t)$	$(\bar{c}\bar{t}\bar{c}\bar{u}t)$	-2	0
13	$(\bar{c}\bar{u}\bar{c}\bar{c}u)$	$(\bar{c}\bar{c}\bar{c}\bar{c}u)$	$(\bar{c}\bar{t}\bar{c}\bar{c}u)$	-2	0
14	$(\bar{c}\bar{u}\bar{c}\bar{c}c)$	$(\bar{c}\bar{c}\bar{c}\bar{c}c)$	$(\bar{c}\bar{t}\bar{c}\bar{c}c)$	-2	0
15	$(\bar{c}\bar{u}\bar{c}\bar{c}t)$	$(\bar{c}\bar{c}\bar{c}\bar{c}t)$	$(\bar{c}\bar{t}\bar{c}\bar{c}t)$	-2	0
16	$(\bar{c}\bar{u}\bar{c}\bar{t}u)$	$(\bar{c}\bar{c}\bar{c}\bar{t}u)$	$(\bar{c}\bar{t}\bar{c}\bar{t}u)$	-2	0
17	$(\bar{c}\bar{u}\bar{c}\bar{t}c)$	$(\bar{c}\bar{c}\bar{c}\bar{t}c)$	$(\bar{c}\bar{t}\bar{c}\bar{t}c)$	-2	0
18	$(\bar{c}\bar{u}\bar{c}\bar{t}t)$	$(\bar{c}\bar{c}\bar{c}\bar{t}t)$	$(\bar{c}\bar{t}\bar{c}\bar{t}t)$	-2	0
19	$(\bar{c}\bar{u}\bar{t}\bar{u}u)$	$(\bar{c}\bar{c}\bar{t}\bar{u}u)$	$(\bar{c}\bar{t}\bar{t}\bar{u}u)$	-2	0
20	$(\bar{c}\bar{u}\bar{t}\bar{u}c)$	$(\bar{c}\bar{c}\bar{t}\bar{u}c)$	$(\bar{c}\bar{t}\bar{t}\bar{u}c)$	-2	0
21	$(\bar{c}\bar{u}\bar{t}\bar{u}t)$	$(\bar{c}\bar{c}\bar{t}\bar{u}t)$	$(\bar{c}\bar{t}\bar{t}\bar{u}t)$	-2	0
22	$(\bar{c}\bar{u}\bar{t}\bar{c}u)$	$(\bar{c}\bar{c}\bar{t}\bar{c}u)$	$(\bar{c}\bar{t}\bar{t}\bar{c}u)$	-2	0
23	$(\bar{c}\bar{u}\bar{t}\bar{c}c)$	$(\bar{c}\bar{c}\bar{t}\bar{c}c)$	$(\bar{c}\bar{t}\bar{t}\bar{c}c)$	-2	0
24	$(\bar{c}\bar{u}\bar{t}\bar{c}t)$	$(\bar{c}\bar{c}\bar{t}\bar{c}t)$	$(\bar{c}\bar{t}\bar{t}\bar{c}t)$	-2	0
25	$(\bar{c}\bar{u}\bar{t}\bar{t}u)$	$(\bar{c}\bar{c}\bar{t}\bar{t}u)$	$(\bar{c}\bar{t}\bar{t}\bar{t}u)$	-2	0
26	$(\bar{c}\bar{u}\bar{t}\bar{t}c)$	$(\bar{c}\bar{c}\bar{t}\bar{t}c)$	$(\bar{c}\bar{t}\bar{t}\bar{t}c)$	-2	0
27	$(\bar{c}\bar{u}\bar{t}\bar{t}t)$	$(\bar{c}\bar{c}\bar{t}\bar{t}t)$	$(\bar{c}\bar{t}\bar{t}\bar{t}t)$	-2	0

TABLE 67: *More antiparticles at point* Z_{-2}' .

Z_{-2}' CASE 1 (PART III) **antipentaquarks/anti-mesobaryonic particles**					
ROW number	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{u}\,u)$	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{u}\,u)$	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{u}\,u)$	-2	0
2	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{u}\,c)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{u}\,c)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{u}\,c)$	-2	0
3	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{u}\,t)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{u}\,t)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{u}\,t)$	-2	0
4	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{c}\,u)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{c}\,u)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{c}\,u)$	-2	0
5	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{c}\,c)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{c}\,c)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{c}\,c)$	-2	0
6	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{c}\,t)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{c}\,t)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{c}\,t)$	-2	0
7	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{t}\,u)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{t}\,u)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{t}\,u)$	-2	0
8	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{t}\,c)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{t}\,c)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{t}\,c)$	-2	0
9	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{t}\,t)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{t}\,t)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{t}\,t)$	-2	0
10	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{u}\,u)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{u}\,u)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{u}\,u)$	-2	0
11	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{u}\,c)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{u}\,c)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{u}\,c)$	-2	0
12	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{u}\,t)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{u}\,t)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{u}\,t)$	-2	0
13	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{c}\,u)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{c}\,u)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{c}\,u)$	-2	0
14	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{c}\,c)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{c}\,c)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{c}\,c)$	-2	0
15	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{c}\,t)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{c}\,t)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{c}\,t)$	-2	0
16	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{t}\,u)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{t}\,u)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{t}\,u)$	-2	0
17	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{t}\,c)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{t}\,c)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{t}\,c)$	-2	0
18	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{t}\,t)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{t}\,t)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{t}\,t)$	-2	0
19	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{u}\,u)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{u}\,u)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{u}\,u)$	-2	0
20	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{u}\,c)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{u}\,c)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{u}\,c)$	-2	0
21	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{u}\,t)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{u}\,t)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{u}\,t)$	-2	0
22	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{c}\,u)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{c}\,u)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{c}\,u)$	-2	0
23	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{c}\,c)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{c}\,c)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{c}\,c)$	-2	0
24	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{c}\,t)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{c}\,t)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{c}\,t)$	-2	0
25	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{t}\,u)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{t}\,u)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{t}\,u)$	-2	0
26	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{t}\,c)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{t}\,c)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{t}\,c)$	-2	0
27	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{t}\,t)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{t}\,t)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{t}\,t)$	-2	0

TABLE 68: *More antiparticles at point* Z_{-2}' .

Case 2: antiparticles

Electric charge condition	$-\frac{2}{3}-\frac{2}{3}-\frac{2}{3}+\frac{1}{3}-\frac{1}{3}$
Quarks that satisfy the electric charge condition (*). (*) Because pentaquarks on the Q axes must have total strangeness of 0, the strange quark s and the anti-strange $\bar{s}$ must be included as a pair $s\bar{s}$ or unit. These pentaquarks are shown in a separate table.	$\bar{u}$ $\bar{u}$ $\bar{u}$ $\bar{d}$ d $\bar{c}$ $\bar{c}$ $\bar{c}$ $\bar{b}$ b $\bar{t}$ $\bar{t}$ $\bar{t}$ $\bar{s}$ s

Combining these quarks we get the pentaquarks shown in the following tables

Z_{-2}' CASE 2 (PART I) **antipentaquarks/anti-mesobaryonic particles**					
ROW number	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(\bar{u}\bar{u}\bar{u}\bar{d}d)$	$(\bar{u}\bar{u}\bar{u}\bar{d}d)$	$(\bar{u}\bar{u}\bar{u}\bar{d}d)$	−2	0
2	$(\bar{u}\bar{u}\bar{u}\bar{d}b)$	$(\bar{c}\bar{u}\bar{u}\bar{d}b)$	$(\bar{t}\bar{u}\bar{u}\bar{d}b)$	−2	0
3	$(\bar{u}\bar{u}\bar{u}\bar{b}d)$	$(\bar{c}\bar{u}\bar{u}\bar{b}d)$	$(\bar{t}\bar{u}\bar{u}\bar{b}d)$	−2	0
4	$(\bar{u}\bar{u}\bar{u}\bar{b}b)$	$(\bar{c}\bar{u}\bar{u}\bar{b}b)$	$(\bar{t}\bar{u}\bar{u}\bar{b}b)$	−2	0
5	$(\bar{u}\bar{u}\bar{c}\bar{d}d)$	$(\bar{c}\bar{u}\bar{c}\bar{d}d)$	$(\bar{t}\bar{u}\bar{c}\bar{d}d)$	−2	0
6	$(\bar{u}\bar{u}\bar{c}\bar{d}b)$	$(\bar{c}\bar{u}\bar{c}\bar{d}b)$	$(\bar{t}\bar{u}\bar{c}\bar{d}b)$	−2	0
7	$(\bar{u}\bar{u}\bar{c}\bar{b}d)$	$(\bar{c}\bar{u}\bar{c}\bar{b}d)$	$(\bar{t}\bar{u}\bar{c}\bar{b}d)$	−2	0
8	$(\bar{u}\bar{u}\bar{c}\bar{b}b)$	$(\bar{c}\bar{u}\bar{c}\bar{b}b)$	$(\bar{t}\bar{u}\bar{c}\bar{b}b)$	−2	0
9	$(\bar{u}\bar{u}\bar{u}\bar{d}d)$	$(\bar{c}\bar{u}\bar{u}\bar{d}d)$	$(\bar{t}\bar{u}\bar{u}\bar{d}d)$	−2	0
10	$(\bar{u}\bar{u}\bar{t}\bar{d}b)$	$(\bar{c}\bar{u}\bar{t}\bar{d}b)$	$(\bar{t}\bar{u}\bar{t}\bar{d}b)$	−2	0
11	$(\bar{u}\bar{u}\bar{t}\bar{b}d)$	$(\bar{c}\bar{u}\bar{t}\bar{b}d)$	$(\bar{t}\bar{u}\bar{t}\bar{b}d)$	−2	0
12	$(\bar{u}\bar{u}\bar{t}\bar{b}b)$	$(\bar{c}\bar{u}\bar{t}\bar{b}b)$	$(\bar{t}\bar{u}\bar{t}\bar{b}b)$	−2	0
13	$(\bar{u}\bar{u}\bar{u}\bar{d}d)$	$(\bar{c}\bar{u}\bar{u}\bar{d}d)$	$(\bar{t}\bar{u}\bar{u}\bar{d}d)$	−2	0
14	$(\bar{u}\bar{c}\bar{u}\bar{d}b)$	$(\bar{c}\bar{c}\bar{u}\bar{d}b)$	$(\bar{t}\bar{c}\bar{u}\bar{d}b)$	−2	0
15	$(\bar{u}\bar{c}\bar{u}\bar{b}d)$	$(\bar{c}\bar{c}\bar{u}\bar{b}d)$	$(\bar{t}\bar{c}\bar{u}\bar{b}d)$	−2	0
16	$(\bar{u}\bar{c}\bar{u}\bar{b}b)$	$(\bar{c}\bar{c}\bar{u}\bar{b}b)$	$(\bar{t}\bar{c}\bar{u}\bar{b}b)$	−2	0
17	$(\bar{u}\bar{c}\bar{c}\bar{d}d)$	$(\bar{c}\bar{c}\bar{c}\bar{d}d)$	$(\bar{t}\bar{c}\bar{c}\bar{d}d)$	−2	0

Z_{-2}' CASE 2 (PART I) **antipentaquarks/anti-mesobaryonic particles**					
ROW number	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
18	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{d}\,b)$	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{d}\,b)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{d}\,b)$	-2	0
19	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{b}\,d)$	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{b}\,d)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{b}\,d)$	-2	0
20	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{b}\,b)$	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{b}\,b)$	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{b}\,b)$	-2	0
21	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{d}\,d)$	$(\bar{c}\,\bar{c}\,\bar{u}\,\bar{d}\,d)$	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{d}\,d)$	-2	0
22	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{d}\,b)$	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{d}\,b)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{d}\,b)$	-2	0
23	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{b}\,d)$	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{b}\,d)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{b}\,d)$	-2	0
24	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{b}\,b)$	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{b}\,b)$	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{b}\,b)$	-2	0
25	$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{d}\,d)$	$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{d}\,d)$	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{d}\,d)$	-2	0
26	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{d}\,b)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{d}\,b)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{d}\,b)$	-2	0
27	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{b}\,d)$	-2	0
28	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{b}\,b)$	-2	0
29	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{d}\,d)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{d}\,d)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{d}\,d)$	-2	0
30	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{d}\,b)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{d}\,b)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{d}\,b)$	-2	0
31	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{b}\,d)$	-2	0
32	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{b}\,b)$	-2	0
33	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{d}\,d)$	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{d}\,d)$	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{d}\,d)$	-2	0
34	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{d}\,b)$	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{d}\,b)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{d}\,b)$	-2	0
35	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{b}\,d)$	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{b}\,d)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{b}\,d)$	-2	0
36	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{b}\,b)$	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{b}\,b)$	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{b}\,b)$	-2	0

TABLE 69: *More antipentaquarks at point* Z_{-2}' *. This table has been split into two different parts to be able to fit it into the pages.*

(see next page)

$Z_{-2}{}'$ CASE 2 (PART II) **antipentaquarks/anti-mesobaryonic particles**			
ROW number	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times $\|e\|$)	STRANGENESS
1	$(\bar{u}\,\bar{u}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
2	$(\bar{u}\,\bar{u}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
3	$(\bar{u}\,\bar{u}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
4	$(\bar{u}\,\bar{c}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
5	$(\bar{u}\,\bar{c}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
6	$(\bar{u}\,\bar{c}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
7	$(\bar{u}\,\bar{t}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
8	$(\bar{u}\,\bar{t}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
9	$(\bar{u}\,\bar{t}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
10	$(\bar{c}\,\bar{u}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
11	$(\bar{c}\,\bar{u}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
12	$(\bar{c}\,\bar{u}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
13	$(\bar{c}\,\bar{c}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
14	$(\bar{c}\,\bar{c}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
15	$(\bar{c}\,\bar{c}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
16	$(\bar{c}\,\bar{t}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
17	$(\bar{c}\,\bar{t}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
18	$(\bar{c}\,\bar{t}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
19	$(\bar{t}\,\bar{u}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
20	$(\bar{t}\,\bar{u}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
21	$(\bar{t}\,\bar{u}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
22	$(\bar{t}\,\bar{c}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
23	$(\bar{t}\,\bar{c}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
24	$(\bar{t}\,\bar{c}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$
25	$(\bar{t}\,\bar{t}\,\bar{u}\,\bar{s}\,s)$	-2	$+1-1=0$
26	$(\bar{t}\,\bar{t}\,\bar{c}\,\bar{s}\,s)$	-2	$+1-1=0$
27	$(\bar{t}\,\bar{t}\,\bar{t}\,\bar{s}\,s)$	-2	$+1-1=0$

TABLE 70: *These are the strange antiparticles at point* $Z_{-2}{}'$ *which contain a pair of strange/anti-strange quarks each (total strangeness, S, equal to zero).*

10. The Complete Matter-Antimatter Way

Not only the expert but also the non-expert can contemplate all the symmetry and beauty the universe exhibits on the microscopic scale of particle physics.

The diagram shown on FIGURE 9 is the complete matter-antimatter way. It includes not only pentaquarks and mesobaryonic particles on the symmetry axis but also pentaquarks and mesobaryonic particles in each and every labelled point of the diagram.

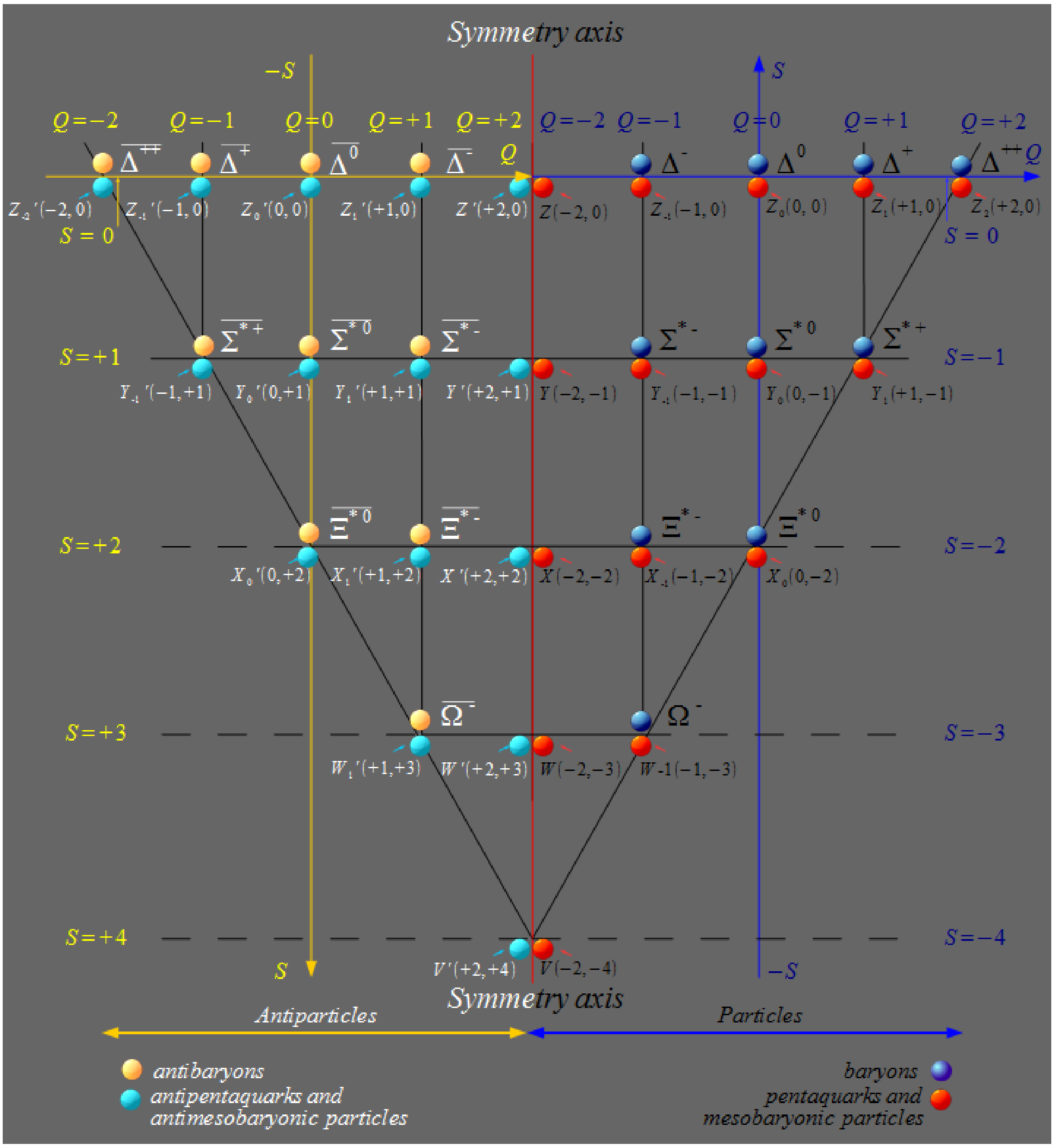

FIGURE 9: ***The Complete Matter-Antimatter Way*** *(or* ***Matter-Antimatter Way****). This theory predicts the existence of pentaquarks and mesobaryonic "molecules" in each labelled point of the diagram. Each red circle represents a set of pentaquarks and mesobaryonic particles while each cyan circle represents the corresponding set of antiparticles. The blue circles represent the baryon decuplet while the yellow circles represent the corresponding anti-baryon decuplet. In order to differentiate baryons from pentaquarks/mesobaryonic particles and anti-baryons from anti-pentaquarks/anti-mesobaryonic particles some colours have been changed with respect to the previous 7 diagrams.*

It is worthwhile to observe that the point Z_1 located on the Q axis on the particles side, contains, among other particles, the pentaquarks and the mesobaryonic molecules with composition: $(u\,u\,d\,c\,\bar{c})$. The existence of these pentaquarks and mesobaryonic particles was confirmed by the CERN's scientists. This agreement between the predicted $(u\,u\,d\,c\,\bar{c})$ particles and the observed ones is one of the main achievements of this theory. The details of these predictions are given in section 13: The Discovery of the $P_c(4380)^+$ and $P_c(4450)^+$ Particles.

11. Do Pentaquarks, Which Contain Quark-Antiquark Pairs of the Same Flavour, Exit?

Some of the pentaquarks predicted by this theory contain quarks and anti-quarks of the same flavour. For example

Example 1) the $(u\,\bar{u}\,\bar{u}\,\bar{u}\,\bar{u})$ antipentaquark contains the $(u\,\bar{u})$ pair
Example 2) the $(u\,u\,d\,d\,\bar{d})$ pentaquark contains the $(d\,\bar{d})$ pair
Example 3) the $(c\,\bar{c}\,\bar{c}\,\bar{c}\,\bar{t})$ antipentaquark contains the $(c\,\bar{c})$ pair
Example 4) the $(t\,\bar{t}\,\bar{t}\,\bar{t}\,\bar{t})$ antipentaquark contains the $(t\,\bar{t})$ pair

It is reasonable to ask: do pentaquarks which contain quark/antiquark pairs of the same flavour, like the ones shown in the above examples, really exit? To answer this question let's have a look at the neutral pi meson, which physicists have denoted with the symbol π^0 . According to quantum mechanics, the π^0 meson is a particle made up by a superposition of two compositions:

1) $(u\,\bar{u})$ and
2) $(d\,\bar{d})$

These two compositions can be found in two different configurations:

$$\text{(configuration 1)} \quad \pi^0 = \frac{(u\,\bar{u}+d\,\bar{d})}{\sqrt{2}}$$

and

$$\text{(configuration 2)} \quad \pi^0 = \frac{(u\,\bar{u}-d\,\bar{d})}{\sqrt{2}}$$

By the way, the composition of the π^0 meson indicates that this meson is its own antiparticle (there is no distinction between the particle and the antiparticle, they are the same entity). Because of its composition, the lifetime of the π^0 meson is about $0.83\times10^{-16}\,S$ which is much shorter than the lifetimes of the π^+ and π^- mesons, which is about $2.6\times10^{-8}\,S$.

Let us consider configuration 1. If we were able to measure the composition of this particle by measuring the electric charge of its constituents, which of the two states would we observe? The answer is that we would observe 50% of the time the $(u\,\bar{u})$ state and the other 50% of the time the $(d\,\bar{d})$ state. (believe it or not we would obtain the same result with configuration 2).

Because the π^0 is real, and because it is made up of a superposition of two quark/antiquark pairs of the same flavour ($u\bar{u}$ and $d\bar{d}$), then it seems that pentaquarks which contain this type of pairs should be real as well. Therefore, I postulate that these pentaquarks also exist. What's more, according to the symmetry principles exposed in this formulation, they have to exist (see references [10, 11, 12]). But one may ask: what about their lifetimes? Their lifetimes must be extremely short, much shorter than that of the pentaquarks that do not contain quark/antiquark pairs of the same flavour.

12. Examples of Naive Pentaquark Diagrams and Naive Mesobaryonic Molecule Diagrams

Naive diagrams of pentaquarks and mesobaryonic molecules are simplified diagrams used to illustrate these particles graphically. The diagrams are naive because they do not include all the parts or "building blocks" of the particles such as additional quark-antiquark pairs and gluons (a large number of them). Another approximation relates to the spin of the pentaquarks and mesobaryonic molecules. The spin of a proton comes not only from its quarks but also from its gluons. Because it is believed that gluons' contribution to the proton's spin is more significant than the contribution from its quarks, it is reasonable to assume that gluons will also carry a significant fraction of the spin of pentaquarks and a significant fraction of the spin of mesobaryonic particles. However, the spin of the quarks shown on the naive diagrams only show the contribution from quarks. Although these graphics have these and other limitations, they are good enough to illustrate the principles outlined in this paper.

Example 1. FIGURE 10 shows the possible lightest pentaquark: $(u\,u\,u\,u\,\bar{u})$ (quadruply up pentaquark) (We do not take into account the mass difference due to the different spin configurations). This pentaquark is made of 4 up quarks (shown in red, green and blue) and one anti-blue up quark (shown in orange). Despite having two identical quantum numbers: colour charge (blue) and flavour (up), quarks u_B^{up} and u_B^{down} , do not violate the Pauli exclusion principle because they have opposite spins: one quark has spin up while the other one has spin down. (We do not take into account the different spin directions possibilities of each quark)

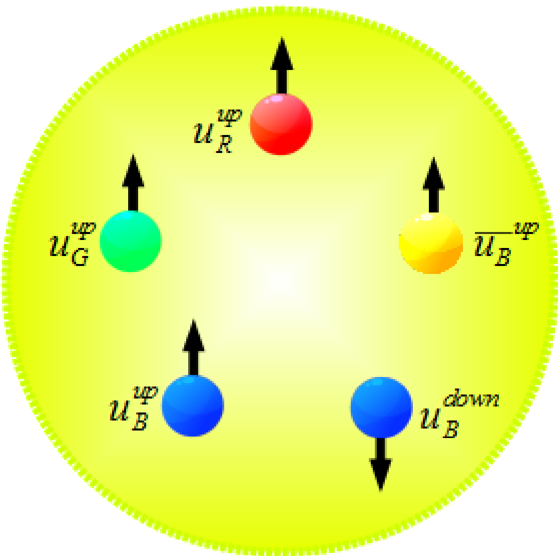

FIGURE 10: *The lightlest pentaquark:* $P_{4u\bar{u}} = (u\,u\,u\,u\,\bar{u})$ *. The two blue quarks have opposite spins due to the Pauli exclusion principle. This configuration is one of the possible combinations of quark colour charges and spins.*

Example 2. FIGURE 11 shows a triply strange pentaquark: $(s\,s\,s\,d\,\bar{u})$ (see TABLE 5). This pentaquark is made of 3 strange quarks (shown in red, green and blue), one down quark (shown in blue) and an anti-blue up quark (shown in orange). Despite having two identical quantum numbers: colour charge (blue) and spin (up), quarks s_B^{up} and d_B^{up} do not violate the Pauli exclusion principle because they have different flavours: one is strange (*s*) and the other one is down (*d*).

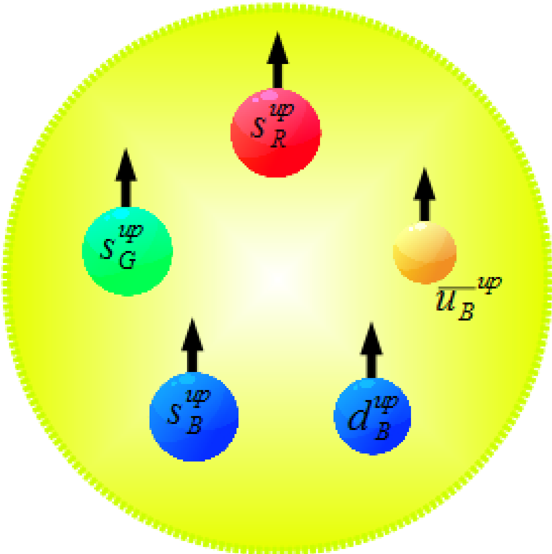

FIGURE 11: *The triply strange pentaquark:* $P_{3sd\bar{u}} = (s\,s\,s\,d\,\bar{u})$ *(in terms of its constituents). In terms of its mass this pentaquark must be between the lightest and the heaviest pentaquarks. This configuration is one of the possible combinations of quark colour charges and spins.*

Example 3. FIGURE 12 shows the possible heaviest pentaquark: $(t\,t\,t\,t\,\bar{t})$ (quadruply bottom pentaquark) (We do not take into account the mass difference due to the different spin configurations). This pentaquark is made of 4 top quarks (2 shown in red, 1 in green and 1 in blue) and one anti-red top quark (shown in cyan). Despite having two identical quantum numbers: colour charge (red) and flavour (top), quarks t_R^{up} and t_R^{down} , do not violate the Pauli exclusion principle because they have opposite spins: one quark has spin up while the other one has spin down.

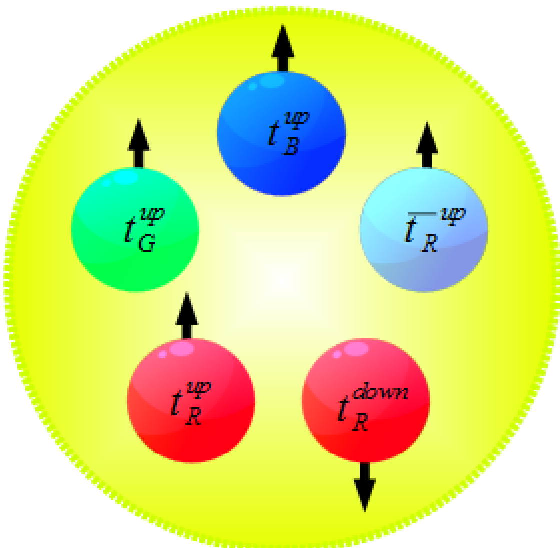

FIGURE 12: *The heaviest pentaquark:* $P_{4t\bar{t}} = (t\,t\,t\,t\,\bar{t})$ *. The two red quarks have opposite spins due to the Pauli exclusion principle. This configuration is one of the possible combinations of quark colour charges and spins.*

The circles representing the constituents (quarks and anti-quarks) are not to scale.

Example 4. FIGURE 13 shows the lightest mesobaryonic particle: $(u\ u\ d\ c\ \bar{c})$
(We do not take into account the mass difference due to the different spin configurations).

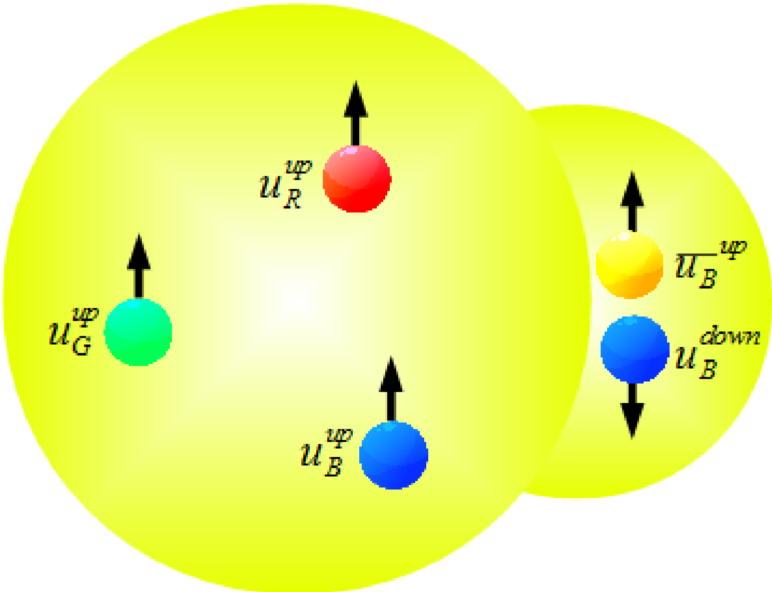

FIGURE 13: *The lightlest mesobaryonic particle:* $M_{4u\bar{u}} = (u\,u\,u\,u\,\bar{u})$ *(in terms of its constituents). The two blue quarks have opposite spins due to the Pauli exclusion principle. This configuration is one of the possible combinations of quark colour charges and spins.*

Example 5. FIGURE 14 shows the position of the pentaquark $(u\ u\ d\ c\ \bar{c})$ in the matter antimatter way. The mesobaryonic particle $(u\ u\ d\ c\ \bar{c})$ occupies the same location in the diagram.

(see next page)

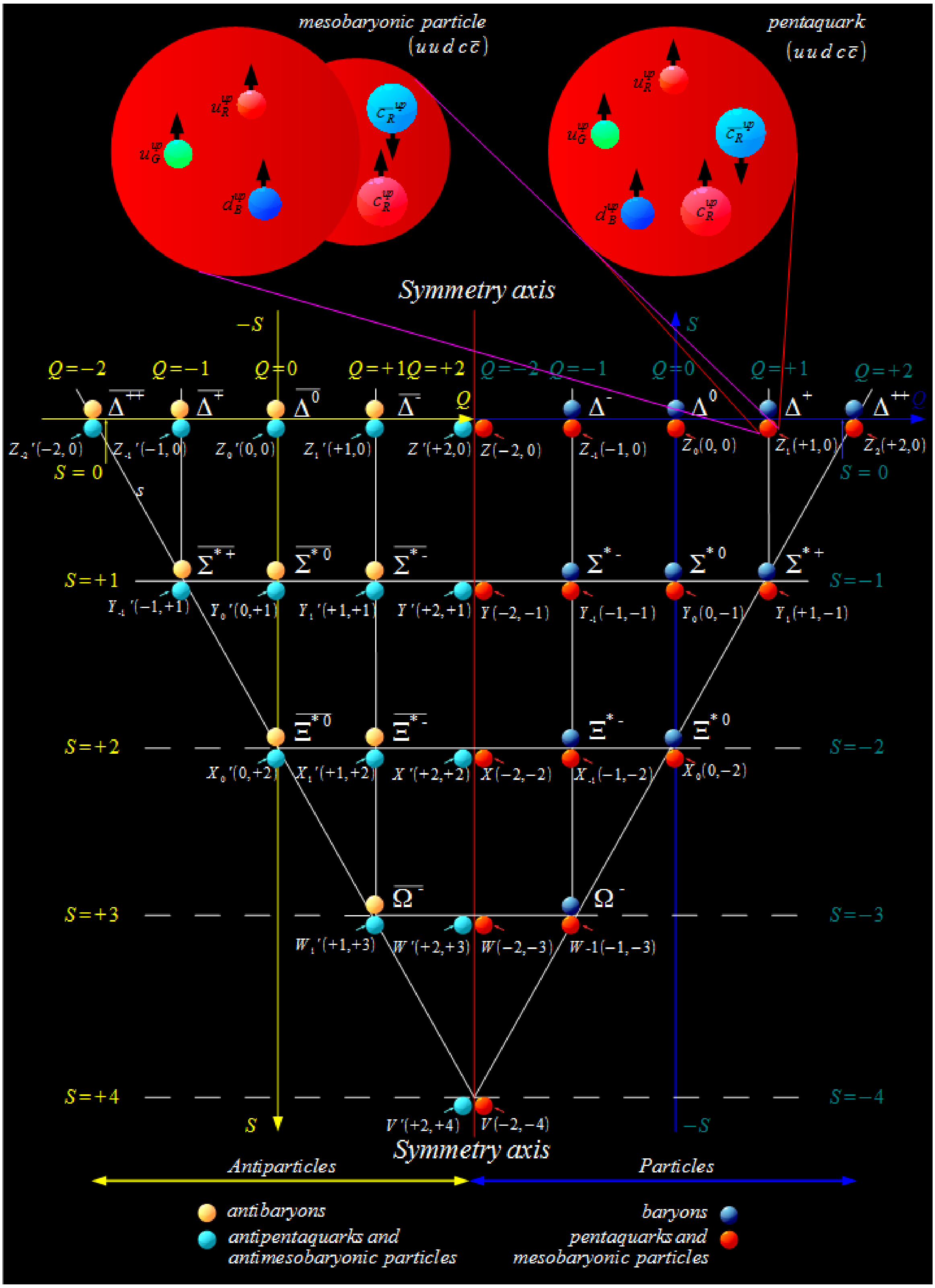

FIGURE 14: *This figure shows the position of the pentaquark* $(u\,u\,d\,c\,\bar{c})$ *and the mesobaryonic particle* $(u\,u\,d\,c\,\bar{c})$ *in the matter-antimatter way. Note that this point* (Z_1) *is shared by other pentaquarks and mesobaryonic molecules. The spin configuration of the quarks shown in this figure is just one possible spin configuration and was chosen for no particular reasons.*

13. The Discovery of the $P_c(4380)^+$ and $P_c(4450)^+$ Particles

An international team of physicists from CERN - the LHCb collaboration - announced the discovery of two **charmonium-pentaquark states** in $\Lambda_b^0 \rightarrow J/\Psi\, K^- p$ decays [11]. According to the LHCb collaboration these states are as follows

State 1) The $P_c(4380)^+$ state has a mass of $4380 \pm 8 \pm 29\ MeV$ and a likely spin of 3/2

State 2) The $P_c(4450)^+$ state has a mass of $4449.8 \pm 1.7 \pm 2.5\ MeV$ and a likely spin of 5/2

I have called state 1 and state 2 to the state with the lowest mass and to the state with the highest mass, respectively. Both states have identical quark contents: $(u\,u\,d\,c\,\bar{c})$ but different spins.

The theory presented in this paper predicts both pentaquarks and mesobaryonic states with exactly this composition. In other words, state 1 and state 2 correspond to the predicted particles $P_{2udc\bar{c}}(4380)$ and $P_{2udc\bar{c}}(4450)$, respectively. These two particles are located at $Z_1(+1,0)$ on the Q axis corresponding to the particles side of the matter-antimatter way (see FIGURE 12). The electric charge of these particles is +1. The following table summarizes the main properties of these two quantum states:

ARBITRARY QUANTUM STATE NAME	LHCb COLLABORATION'S NOMENCLATURE (Observed)	AUTHOR'S NOMENCLATURE pentaquark/ mesobaryonic particle (Predicted) (*)	PARTICLE COMPOSITION (quark contents)	ELECTRIC CHARGE (times |e|)	POSSIBLE PARTICLE SPIN
State 1	$P_c(4380)^+$	$P_{2udc\bar{c}}(4380)$ $M_{2udc\bar{c}}(4380)$	$(u\,u\,d\,c\,\bar{c})$	+1	3/2
State 2	$P_c(4450)^+$	$P_{2udc\bar{c}}(4450)$ $M_{2udc\bar{c}}(4450)$	$(u\,u\,d\,c\,\bar{c})$	+1	5/2

TABLE 71: *The two discovered pentaquark/mesobaryonic particles (either one or the other) and some of their properties. It should be noted that this theory predicts the existence of both pentaquarks and mesobaryonic particles.*

The magnitude of the LHCb collaboration's discovery is gigantic as it has profound implications that extend not only to particle physics but also to astrophysics (e.g. pentaquark stars, quark stars) and cosmology (e.g. the imbalance between matter and antimatter in the universe).

On the one hand, if the discovered particles were pentaquarks then they would be a strongly bound state of 5 quarks. On the other hand, if the discovered particles were mesobaryonic "molecules", then they would be a weakly bound state of a baryon $(u\,u\,d)$ with a meson $(c\,\bar{c})$ or charmonium. Charmonium is a bound state of a charmed quark, *c*, and an anti-charm quark, $\bar{c}$.

(*) In order to differentiate all those particles with the same composition but with different masses, the nomenclature includes the mass of the particle in MeV/c^2 surrounded by parenthesis. For example, the notation $P_{2udc\bar{c}}(4380)$ and $P_{2udc\bar{c}}(4450)$ indicates that there are two different states with the same constituents: $u\,u\,d\,c\,\bar{c}$.

14. Conclusions

The theory I propose in this paper is based on a symmetry principle between matter and antimatter, which in its graphic form, is what I call the matter-antimatter way. The diagram suggests it's possible that there exist both pentaquarks and anti-pentaquarks. In particular, this formulation predicts the existence of:

(1) quadruply up pentaquarks and quadruply up mesobaryonic particles and their antiparticles.
(2) triply up pentaquarks and triply up mesobaryonic particles and their antiparticles,
(3) doubly up pentaquarks and doubly up mesobaryonic particles and their antiparticles,
(4) singly up pentaquarks and singly up mesobaryonic particles, and their antiparticles,
(5) quadruply down pentaquarks and quadruply down mesobaryonic particles; and their antiparticles.
(6) triply down pentaquarks and triply down mesobaryonic particles; and their antiparticles,
(7) doubly down pentaquarks and doubly down mesobaryonic particles; and their antiparticles,
(8) singly strange pentaquarks and singly strange mesobaryonic particles; and their antiparticles,
(9) quadruply strange pentaquarks and quadruply strange mesobaryonic particles; and their antiparticles.
(10) triply strange pentaquarks and triply strange mesobaryonic particles; and their antiparticles,
(11) doubly strange pentaquarks and doubly strange mesobaryonic particles; and their antiparticles,
(12) singly strange pentaquarks and singly strange mesobaryonic particles; and their antiparticles,
(13) quadruply charm pentaquarks and quadruply charm mesobaryonic particles; and their antiparticles.
(14) triply charm pentaquarks and triply charm mesobaryonic particles; and their antiparticles,
(15) doubly charm pentaquarks and doubly charm mesobaryonic particles; and their antiparticles,
(16) singly charm pentaquarks and singly charm mesobaryonic particles; and their antiparticles,
(17) quadruply bottom pentaquarks and quadruply bottom mesobaryonic particles; and their antiparticles.
(18) triply bottom pentaquarks and triply bottom mesobaryonic particles; and their antiparticles,
(19) doubly bottom pentaquarks and doubly bottom mesobaryonic particles; and their antiparticles,
(20) singly bottom pentaquarks and singly bottom mesobaryonic particles; and their antiparticles,
(21) quadruply top pentaquarks and quadruply top mesobaryonic particles; and their antiparticles.
(22) triply top pentaquarks and triply top mesobaryonic particles; and their antiparticles,
(23) doubly top pentaquarks and doubly top mesobaryonic particles; and their antiparticles,
(24) singly top pentaquarks and singly top mesobaryonic particles; and their antiparticles,
(25) two groups of pentaquarks and mesobaryonic particles and their antiparticles with zero total strangeness:

(a) the first group contains neither strange nor anti-strange quarks,
(b) the second group contains a pair of quarks made of a strange quark and an anti-strange quark plus other three non-strange quarks (e.g. $d\,\bar{b}\,\bar{b}\,s\,\bar{s}$),

(26) "bottom-top charmed" pentaquarks and mesobaryonic particles (e.g. $t\,c\,u\,b\,\bar{b}$). This is a type of pentaquark, and also a type of mesobaryonic particle, with 4 different flavours.

Another interesting point to mention is that, according to (26), this theory predicts the existence of pentaquarks and the existence of mesobaryonic particles made of four different flavours. For example the $t\,c\,u\,b\,\bar{b}$ contains four different flavours: up, charm, bottom and top (excluding the anti-bottom quark). Thus, it seems appropriate to group together these types of pentaquarks and these types of mesobaryonic particles under the name of **quadruply flavoured pentaquarks** and **quadruply flavoured mesobaryonic particles**, respectively. This is a feature we cannot find in baryons because, as the reader knows, baryons are made of three quarks only. Now, let's have a look at the most important prediction of this theory:

This theory predicts the existence of both pentaquarks and mesobaryonic particles, which we may group together under the name of **exotic particles** made of 5 quarks. Two of these particles have been discovered by the LHCb collaboration at Geneva, Switzerland (see note 5). The discovered particles are either pentaquarks or mesobaryonic particles. One of the two possibilities has to be true. The composition of the observed particles is $u\,u\,d\,c\,\bar{c}$, this is: of two up quarks, one down quark, one charm quark and one anti-charm quark [11,12, 13]. The experiment that made the discovery is called: the Large Hadron Collider beauty experiment. In general terms the experiment is designed to investigate the differences between matter and antimatter by observing the beauty quark or bottom quark (*b* quark). Because this theory predicts all the pentaquarks and mesobaryonic particles there exist in the universe, the theory also predicts all the exotic particles containing beauty quarks. This makes exotic particles classification not only easier but, for the first time, also complete. Now, not only the expert but also the non-expert can contemplate all the symmetry and beauty the universe exhibits on the microscopic scale of particle physics.

This theory, as all theories, have advantages and limitations. One advantage of this formulation is that it doesn't use the isospin property of particles, which by the way, is a concept very difficult to explain. A second advantage of this theory is the very simple framework on which it is based upon: the matter-antimatter way. A third advantage is that the theory predicts all the pentaquarks and all the mesobaryonic particles there exist in nature. On the other hand, the limitation of this theory is that it does not predict the masses of the predicted particles. This, however, has nothing to do with the correctness or potential of this formulation. In the future this theory may be extended so that it can predict the masses of these exotic particles. But this is not an easy task.

The magnitude of the LHCb collaboration's discovery is titanic as it has profound implications that extend not only to particle physics but also to astrophysics and cosmology. The LHCb experiment and perhaps this and other papers that I'm writing will be able to solve the following mysteries:

a) Do stars/black holes made of pentaquarks exist?
b) Do stars/black holes made of mesobaryonic particles exist?

c) Do stars/black holes made of free quarks exist?
d) What's the cause of the observed imbalance between matter and antimatter of the universe?
e) Do transient pentaquark states inside atomic nuclei exist? (I shall address this question in another paper that I'm writing; in which the answer is yes).

In summary, based on this formulation, I strongly believe that both pentaquarks and mesobaryonic particles are real; as real as the moon and the stars. However, it could take years before all of the predictions presented here are confirmed. Nevertheless, I believe that soon the LHC will detect more pentaquarks and mesobaryonic particles that will further confirm the present formulation.

Appendix 1: Acronyms and Nomenclature

ACRONYMS

The following are the acronyms used in this paper

LHC = large hadron collider
LHCb = large hadron collider beauty experiment
QED = quantum electrodynamics
QCD = quantum chomodynamics
MAW = matter-antimatter way
MBP = mesobaryonic particle (or mesobaryonic molecule or pentaquark molecule). Mesobaryonic particle, baryomesonic particle and pentaquark molecule are different names for the same particle.
$\overline{BMP}$ = anti-baryomesonic particle (anti-baryomesonic molecule). anti-mesobaryonic particle (or anti-mesobaryonic molecule). baryomesonic antiparticle (baryomesonic anti-molecule). mesobaryonic antiparticle (or mesobaryonic anti-molecule). anti-mesobaryonic particle and anti-baryomesonic particle are the same antiparticle.
$\overline{BMP}$ = anti-baryomesonic particle (anti-baryomesonic molecule).

NOMENCLATURE

The following are the symbols used in this paper

$P_{vwxy\bar{z}}$ = pentaquark. The subindex $vwxy\bar{z}$ represents the particle composition where *v*, *w*, *x*, *y* and *z* are quark flavours.
$M_{vwxy\bar{z}}$ = mesobaryonic particle (or mesobaryonic molecule, baryomesonic particle, baryomesonic molecule). The subindex $vwxy\bar{z}$ represents the particle composition where *v*, *w*, *x*, *y* and *z* are quark flavours.
$\bar{P}_{\bar{v}\bar{w}\bar{x}\bar{y}z}$ = anti-pentaquark. The subindex $\bar{v}\bar{w}\bar{x}\bar{y}z$ represents the particle composition where *v*, *w*, *x*, *y* and *z* are quark flavours.
$\bar{M}_{\bar{v}\bar{w}\bar{x}\bar{y}z}$ = anti-mesobaryonic particle (or anti-mesobaryonic molecule, anti-baryomesonic particle, anti-baryomesonic molecule). The subindex $\bar{v}\bar{w}\bar{x}\bar{y}z$ represents the particle composition where *v*, *w*, *x*, *y* and *z* are quark flavours.
$P_{vwxy\bar{z}}(m_0)$ = pentaquark of rest mass m_0 .

$M_{vwxy\bar{z}}(m_0) =$ mesobaryonic molecule of rest mass m_0 .
$\bar{P}_{\bar{v}\bar{w}\bar{x}\bar{y}z}(m_0) =$ anti-pentaquark of rest mass m_0 .
$\bar{M}_{\bar{v}\bar{w}\bar{x}\bar{y}z}(m_0) =$ anti-mesobaryonic molecule of rest mass m_0 .
$Q =$ electric charge of the unknown particle (pentaquark/mesobaryonic particle). Also, in the diagram of FIGURE 2, Q is the electric charge of a baryon or the electric charge of an antibaryon
$q_u =$ electric charge of the up quark
$q_d =$ electric charge of the up quark
$q_s =$ electric charge of the strange quark
$q_c =$ electric charge of the charm quark
$q_b =$ electric charge of the bottom quark
$q_t =$ electric charge of the top quark
$q_{\bar{u}} =$ electric charge of the antiup quark
$q_{\bar{d}} =$ electric charge of the antidown quark
$q_{\bar{s}} =$ electric charge of the antistrange quark
$q_{\bar{c}} =$ electric charge of the anticharm quark
$q_{\bar{b}} =$ electric charge of the antibottom quark
$q_{\bar{t}} =$ electric charge of the antitop quark
$q_5 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark/mesobaryonic particle) (cannot be an *s* quark). This quark will be called the fifth quark.
$q_4 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark/mesobaryonic particle) (cannot be an *s* quark). This quark will be called the forth quark.
$q_3 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark/mesobaryonic particle) (cannot be an *s* quark). This quark will be called the third quark.
$q_2 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark/mesobaryonic particle) (cannot be an *s* quark). This quark will be called the second quark.
$q_1 =$ electric charge of one of the constituents (quark) of the unknown particle (pentaquark/mesobaryonic particle) (cannot be an *s* quark). This quark will be called the first quark.
$\Delta^- =$ Delta-minus particle – composition: *ddd*
$\Delta^0 =$ Delta-zero particle – composition: *udd*
$\Delta^+ =$ Delta-plus particle – composition: *uud*
$\Delta^{++} =$ Delta-plus-plus particle – composition: *uuu*
$\Sigma^- =$ Sigma-minus particle – composition: *dds*
$\Sigma^0 =$ Sigma-zero particle – composition: *uds*
$\Sigma^+ =$ Sigma-plus particle – composition: *uus*
$\Xi^- =$ Xi-minus particle – composition: *dss*
$\Xi^0 =$ Xi-zero particle – composition: *uss*
$\Omega^- =$ Omega-minus particle – composition: *sss*
$\overline{\Delta^-} =$ Delta-minus antiparticle – composition: $\bar{d}\,\bar{d}\,\bar{d}$
$\overline{\Delta^0} =$ Delta-zero antiparticle – composition: $\bar{u}\,\bar{d}\,\bar{d}$
$\overline{\Delta^+} =$ Delta-plus antiparticle – composition: $\bar{u}\,\bar{u}\,\bar{d}$
$\overline{\Delta^{++}} =$ Delta-plus-plus antiparticle – composition: $\bar{u}\,\bar{u}\,\bar{u}$
$\overline{\Sigma^-} =$ Sigma-minus antiparticle – composition: $\bar{d}\,\bar{d}\,\bar{s}$

$\overline{\Sigma^0}$ = Sigma-zero antiparticle – composition: $\bar{u}\,\bar{d}\,\bar{s}$
$\overline{\Sigma^+}$ = Sigma-plus antiparticle – composition: $\bar{u}\,\bar{u}\,\bar{s}$
$\overline{\Xi^-}$ = Xi-minus antiparticle – composition: $\bar{d}\,\bar{s}\,\bar{s}$
$\overline{\Xi^0}$ = Xi- zero antiparticle – composition: $\bar{u}\,\bar{s}\,\bar{s}$
$\overline{\Omega^-}$ = Omega-minus antiparticle – composition: $\bar{s}\,\bar{s}\,\bar{s}$
$\Sigma^{*\,-}$ = Excited state of the Sigma-minus particle – composition: *dds*
$\Sigma^{*\,0}$ = Excited state of the Sigma-zero particle – composition: *uds*
$\Sigma^{*\,+}$ = Excited state of the Sigma-plus particle – composition: *uus*
$\Xi^{*\,-}$ = Excited state of the Xi-minus particle – composition: *dss*
$\Xi^{*\,0}$ = Excited state of the Xi-zero particle – composition: *uss*
$\Sigma^{*\,-}$ = Excited state of the Sigma-minus antiparticle – composition: $\bar{d}\,\bar{d}\,\bar{s}$
$\overline{\Sigma^{*\,0}}$ = Excited state of the Sigma-zero antiparticle – composition: $\bar{u}\,\bar{d}\,\bar{s}$
$\overline{\Sigma^{*\,+}}$ = Excited state of the Sigma-plus antiparticle – composition: $\bar{u}\,\bar{u}\,\bar{s}$
$\overline{\Xi^{*\,-}}$ = Excited state of the Xi-minus antiparticle – composition: $\bar{d}\,\bar{s}\,\bar{s}$
$\overline{\Xi^{*\,0}}$ = Excited state of the Xi-zero antiparticle – composition: $\bar{u}\,\bar{s}\,\bar{s}$
u = up quark
d = down quark
s = strange quark
c = charm quark
b = bottom quark
t = top quark
$\bar{u}$ = antiup quark or anti-up quark
$\bar{d}$ = antidown quark or anti-down quark
$\bar{s}$ = antistrange quark or anti-strange quark
$\bar{c}$ = anticharm quark or anti-charm quark
$\bar{b}$ = antibottom quark or anti-bottom quark
$\bar{t}$ = antitop quark or anti-top quark
u_R = up quark carrying red colour
u_G = up quark carrying green colour
u_B = up quark carrying blue colour
d_R = down quark carrying red colour
d_G = down quark carrying green colour
d_B = down quark carrying blue colour
s_R = strange quark carrying red colour
s_G = strange quark carrying green colour
s_B = strange quark carrying blue colour
c_R = charm quark carrying red colour
c_G = charm quark carrying green colour
c_B = charm quark carrying blue colour
b_R = bottom quark carrying red colour
b_G = bottom quark carrying green colour
b_B = bottom quark carrying blue colour
t_R = top quark carrying red colour
t_G = top quark carrying green colour
t_B = top quark carrying blue colour
u_R^{up} = up quark carrying red colour and spin up
u_G^{up} = up quark carrying green colour and spin up
u_B^{up} = up quark carrying blue colour and spin up

$d_R^{up} =$ down quark carrying red colour and spin up
$d_G^{up} =$ down quark carrying green colour and spin up
$d_B^{up} =$ down quark carrying blue colour and spin up
$s_R^{up} =$ strange quark carrying red colour and spin up
$s_G^{up} =$ strange quark carrying green colour and spin up
$s_B^{up} =$ strange quark carrying blue colour and spin up
$c_R^{up} =$ charm quark carrying red colour and spin up
$c_G^{up} =$ charm quark carrying green colour and spin up
$c_B^{up} =$ charm quark carrying blue colour and spin up
$b_R^{up} =$ bottom quark carrying red colour and spin up
$b_G^{up} =$ bottom quark carrying green colour and spin up
$b_B^{up} =$ bottom quark carrying blue colour and spin up
$t_R^{up} =$ top quark carrying red colour and spin up
$t_G^{up} =$ top quark carrying green colour and spin up
$t_B^{up} =$ top quark carrying blue colour and spin up
$u_R^{down} =$ up quark carrying red colour and spin down
$u_G^{down} =$ up quark carrying green colour and spin down
$u_B^{down} =$ up quark carrying blue colour and spin down
$d_R^{down} =$ down quark carrying red colour and spin down
$d_G^{down} =$ down quark carrying green colour and spin down
$d_B^{down} =$ down quark carrying blue colour and spin down
$s_R^{down} =$ strange quark carrying red colour and spin down
$s_G^{down} =$ strange quark carrying green colour and spin down
$s_B^{down} =$ strange quark carrying blue colour and spin down
$c_R^{down} =$ charm quark carrying red colour and spin down
$c_G^{down} =$ charm quark carrying green colour and spin down
$c_B^{down} =$ charm quark carrying blue colour and spin down
$b_R^{down} =$ bottom quark carrying red colour and spin down
$b_G^{down} =$ bottom quark carrying green colour and spin down
$b_B^{down} =$ bottom quark carrying blue colour and spin down
$t_R^{down} =$ top quark carrying red colour and spin down
$t_G^{down} =$ top quark carrying green colour and spin down
$t_B^{down} =$ top quark carrying blue colour and spin down
$\overline{u_R} =$ antiup quark carrying antired colour
$\overline{u_G} =$ antiup quark carrying antigreen colour
$\overline{u_B} =$ antiup quark carrying antiblue colour
$\overline{d_R} =$ antidown quark carrying antired colour
$\overline{d_G} =$ antidown quark carrying antigreen colour
$\overline{d_B} =$ antidown quark carrying antiblue colour
$\overline{s_R} =$ antistrange quark carrying antired colour
$\overline{s_G} =$ antistrange quark carrying antigreen colour
$\overline{s_B} =$ antistrange quark carrying antiblue colour
$\overline{c_R} =$ anticharm quark carrying antired colour
$\overline{c_G} =$ anticharm quarkv carrying antigreen colour

$\overline{c}_B =$ anticharm quark carrying antiblue colour
$\overline{b}_R =$ antibottom quark carrying antired colour
$\overline{b}_G =$ antibottom quark carrying antigreen colour
$\overline{b}_B =$ antibottom quark carrying antiblue colour
$\overline{t}_R =$ antitop quark carrying antired colour
$\overline{t}_G =$ antitop quark carrying antigreen colour
$\overline{t}_B =$ antitop quark carrying antiblue colour
$\overline{u}_R^{up} =$ antiup quark carrying antired colour and spin up
$\overline{u}_G^{up} =$ antiup quark carrying antigreen colour and spin up
$\overline{u}_B^{up} =$ antiup quark carrying antiblue colour and spin up
$\overline{d}_R^{up} =$ antidown quark carrying antired colour and spin up
$\overline{d}_G^{up} =$ antidown quark carrying antigreen colour and spin up
$\overline{d}_B^{up} =$ antidown quark carrying antiblue colour and spin up
$\overline{s}_R^{up} =$ antistrange quark carrying antired colour and spin up
$\overline{s}_G^{up} =$ antistrange quark carrying antigreen colour and spin up
$\overline{s}_B^{up} =$ antistrange quark carrying antiblue colour and spin up
$\overline{c}_R^{up} =$ anticharm quark carrying antired colour and spin up
$\overline{c}_G^{up} =$ anticharm quark carrying antigreen colour and spin up
$\overline{c}_B^{up} =$ anticharm quark carrying antiblue colour and spin up
$\overline{b}_R^{up} =$ antibottom quark carrying antired colour and spin up
$\overline{b}_G^{up} =$ antibottom quark carrying antigreen colour and spin up
$\overline{b}_B^{up} =$ antibottom quark carrying antiblue colour and spin up
$\overline{t}_R^{up} =$ antitop quark with carrying antired colour and up
$\overline{t}_G^{up} =$ antitop quark with carrying antigreen colour and up
$\overline{t}_B^{up} =$ antitop quark with carrying antiblue colour and up
$\overline{u}_R^{down} =$ antiup quark carrying antired colour and spin down
$\overline{u}_G^{down} =$ antiup quark carrying antigreen colour and spin down
$\overline{u}_B^{down} =$ antiup quark carrying antiblue colour and spin down
$\overline{d}_R^{down} =$ antidown quark carrying antired colour and spin down
$\overline{d}_G^{down} =$ antidown quark carrying antigreen colour and spin down
$\overline{d}_B^{down} =$ antidown quark carrying antiblue colour and spin down
$\overline{s}_R^{down} =$ antistrange quark carrying antired colour and spin down
$\overline{s}_G^{down} =$ antistrange quark carrying antigreen colour and spin down
$\overline{s}_B^{down} =$ antistrange quark carrying antiblue colour and spin down
$\overline{c}_R^{down} =$ anticharm quark carrying antired colour and spin down
$\overline{c}_G^{down} =$ anticharm quark carrying antigreen colour and spin down
$\overline{c}_B^{down} =$ anticharm quark carrying antiblue colour and spin down
$\overline{b}_R^{down} =$ antibottom quark carrying antired colour and spin down
$\overline{b}_G^{down} =$ antibottom quark carrying antigreen colour and spin down
$\overline{b}_B^{down} =$ antibottom quark carrying antiblue colour and spin down
$\overline{t}_R^{down} =$ antitop quark carrying antired colour and spin down
$\overline{t}_G^{down} =$ antitop quark carrying antigreen colour and spin down
$\overline{t}_B^{down} =$ antitop quark carrying antiblue colour and spin down

Notes

Note 1

There are other properties that have been left out because they are not relevant to this paper.

Note 2

Definition

Charge conjugation (C symmetry) is the operation of changing the reflection of the particles (in the mirror) by its antiparticles.

This definition deserves an explanation. The definition means that we have to reverse not only the electric charge but also all the internal quantum numbers such as the strangeness, the charmness, the bottomness, the topness, the lepton number, the baryon number, time, etc. However we do not have to reverse the energy, mass, the momentum and the spin. This means that electric charge reversal, strangeness reversal (if there are particles with strange quarks), charmness reversal (if there are particles with charm quarks), bottomness reversal (if there are particles with bottom quarks), topness reversal (if there are particles with top quarks), time reversal (*T* symmetry), etc., should all be included into the *C* operation.

The reason of including time reversal into the *C* operation is because, according to Feynman [6], antiparticles are particles with negative energy travelling backward in time, thus the direction of time flow or time travel is one of the properties of particles (move forward in time) and also one of the properties for antiparticles (move backward in time). In order to avoid confusions, it is better to think that there are physical entities moving backwards in time. Whether, these physical entities, are called particles or something else is irrelevant. Because the direction of time travel for particles and antiparticles does not coincide, we must reverse it, otherwise we would not be *changing the reflection of the particles (in the mirror) by its antiparticles* as the definition requires. We would be changing the reflection of the particles by something else (not antiparticles!). Therefore, according to the above definition, time reversal should be included into the *C* operation. This seems to be only a matter of definition but, unfortunately, is not. Having a separate time reversal operation is conceptually wrong and it may lead to incomplete or wrong interpretations or results. This is the reason why nature, in general, exhibits *PC+* symmetry (*CPT* symmetry) and not *PC* symmetry (or *CP* symmetry).

Note 3

Some of the symbols shown on Appendix 1 are not used in this article. They are shown for completeness only.

Note 4

There are two conventions when referring to anti-quarks. The first convention is (1) anti-up quark, anti-down quark, anti-strange quark, anti-charm quark, anti-bottom quark and anti-top quark. The second convention is (2) up anti-quark, down anti-quark, strange anti-quark, charm anti-quark, bottom anti-quark and top anti-quark. In this article I use the first convention.

Note 5

CERN researchers have later announced that the data is insufficient to indicate whether all five quarks are in a strong bound state (as the constituents of a single particle or pentaquark) or in a loose bound state (mesobaryonic particle or baryomesonic particle).

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