Leptoquarks and charged higgs using Preon Model #9

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Abstract

A CERN article of May 2019 hints at a possible use of two non-Standard Model bosons in decays of the bottom quark (b --> c τ ν'). Three paths are explored in the present paper and exact properties of the hypothetical charged higgs and leptoquark are derived using Preon Model #9 which is a minor adaption of Preon Model #6 (Fearnley, May 2015). Finding these structures does not guarantee the existence of these new particles nor their use in the bottom decay paths as the preon model says nothing about energy requirements. The leptoquark found here has electric charge +2/3, spin zero, weak isospin +0.5, and a strong colour charge (red, green or blue). The charged higgs found here has electric charge -1, spin zero, weak isospin -0.5 and no colour charge. The leptoquark has as many preons as the higgs (16 preons in Model #9) whereas the charged higgs has 24 preons: which makes this charged higgs occupy a higher generation category than the higgs.

Aims

The CERN Courier of 2 May 2019 carried an article *The flavour of new physics* (ref. CERN, 2 May 2019). The current paper explores the suspicion, discussed in that article, of a faint possibility (with less than 5 sigma statistical significance) of new physics. Figure 1 of the CERN article shows a small number of decay paths of which one is considered here: the b → c τ ν' decay. In that article, the decays are treated in three ways. First, the Standard Model path through the decay, second the use of a leptoquark to find a path and, third, the use of a charged higgs to find a pathway.

Three decay paths are explored in the current paper with the aim of describing the exact properties of the charged higgs and the leptoquark and finding the exact preon structures of these particles, and also showing how these decays would use higgs bosons extracted from the vacuum. Finding paths and structures does not guarantee the existence of these new particles. The paths were described using Preon Model #9.

A brief description of Preon Model #9 is given in Part 1 below together with some simple interactions of particles to exemplify the use of the model. In Part 2, the model is applied to the b --> c τ ν' decays. Part 3 contains details of the preon content of elementary particles as used in Preon Model #9 and some examples of interactions in the decays of the K^+ meson, and more information on the model.

PART 1 Introduction to Preon Model #9

Preon Model #6 was described in Fearnley (May 2015). For the purposes of this paper, the more recent preon models #7 and #8 can be ignored as they deal with gravitons. Gravitons may or may not exist and, whichever the case, they are not relevant to the decay paths examined here. Preon Model #6 has four preons: A, B C and D whereas later models used preons A, B, C and E. Preon E was required to cater for the graviton and therefore Preon Model #6 has needed to be re-casted as Model #9 using the more useful Preon E rather than the earlier Preon D, and dropping any references to gravitons. The key properties of elementary particles are: electric charge, spin, weak isospin and colour charge and these are listed in that order in parentheses (electric charge, spin, weak isospin [, and colour charge if relevant]). The preons are explainable in terms of halves of the electron and neutrino, although that arrangement was really stumbled upon during the long period of development. Fermions have left-handed and right-handed forms.

The left–handed electron has [excluding mass] properties: (-1, -0.5, -0.5) while the right-handed electron has the properties: (-1, 0.5, 0). The left-handed neutrino has properties: (0, -0.5, 0.5). Reminder: (electric charge, spin, weak isospin).

The left-handed electron is split in this preon model into two parts: (-0.5, -0.5, -0.5) and (-0.5, 0, 0). These two parts are Preons A and C respectively. This only makes half the content of the electron as there is a preon-antipreon pair also present, for example it could be AA' where A' is (+0.5, +0.5, +0.5), which is the antipreon of A. So the LH electron could be say AC.AA' which is an aggregate of four preons. By analogy with genetics one could call AC the pexons (or preon exons) while AA' are the pintrons (or preon introns). The pexons can be thought of as the active ingredients while the pintrons are neutral makeweights. For a general description, one can denote the specific AA' pair by the more general X, where X' = X, that is, the antimatter version of X is X. The pintrons have properties: (0, 0, 0, no colour) but they seem to be able to add mass to the particles. In this model, the LH electrons, muons and taus all have the same pexons [AC] but more pintrons are acquired for the higher generations [X for the electron, XXXXX for the muon, and XXXXXXXXX for the tau]. This applies to all fermions which all have four preons in the first generation, twelve preons in the second generation and twenty preons in the third generation. Detached or stand-alone sets of pintrons could maybe contribute to dark matter as their only net property is mass.

The right-handed electron is also split into two parts: (-0.5, 0.5, 0) and (-0.5, 0, 0) which are the two preons: B and C. The right-handed electron is generally composed of BC.X which specifically could be say the four preons: BC.BB' or BC.AA' or BC.CC' or BC.EE'.

The left-handed neutrino is split in the model into two parts: (0.5, -0.5, 0.5) and (-0.5, 0, 0) which are the two preons E' and C. Where E' is the antipreon of E. So the LH neutrino has pexons E'C and a general content E'C.X which specifically could be say E'C.CC' in the first generation.

One reason for having such a design for Preon C, which has no spin or weak isospin, is that it may be sub-divided into three colour components of the preons without having fractions of spin and charge coming into play and complicating matters. (Maybe Preon C is the chargon sub-particle within the electron.) If a quark has a strong colour charge of 'red' it contains the three sub-preons of C, that is Cr C'g' C'b'. The preon C is composed of Cr, Cg and Cb and is net colour neutral. The (anti)preon C' is composed of C'r', C'g', C'b' and is also colour neutral. So a preon-antipreon pairing of CC’ could be rearranged [were this to be possible] into Cr C‘g’ C’b’ and C’r’ Cg Cb which is a red property and an antired property. Each is equivalent in content to one preon and are described, for brevity, as red and antired [or red’] (pseudo)preons later in the paper. (Note that Cg Cb themselves also have a combined effect of being antired.

Those are all the preons in Model #9, and they cater for all the Standard Model elementary particles. The down quark preons mostly resemble the electron preons while the up quark preons derive akin to the neutrino preons. The use of preon E in addition to preon A means that many elementary particles can be formed of two alternative sets of preons. However, preon E was necessary to make some of the particles in the first generation, given an assumed constraint of them containing only four preons.

The gauge boson force carriers in Model #9 come in at least three generations: photon, Z, W, gluon and higgs. The boson generations have 4, 8, 16, 24 and (likely) 32 preons-per-particle respectively. A photon- {that is, with spin -1} has four preons and has pexons: AE’ (or B’B’CC). The Z- is AE’.XXX with eight preons while the red-antigreen gluon- has sixteen preons containing the four pexons AE’ { Cr C‘g’ C’b’}{ Cr C‘g’ Cb} and also twelve pintrons: XXXXXX.

The higgs in Model #9 exists in various generations.

The ¼-higgs- is B’E.X or ABC’C’

The ½-higgs- is B’E.XXX or ABC’C’.XX

The higgs- is B’E.XXXXXXX or ABC’C’.XXXXXX

The bosons, apart from the W, come in two forms: spin -1 and spin +1. [The W- has two such forms and the W+ also has two such forms making four in total for the W.] The spin -1 photon is sometimes referred to in this paper as photon-. This terminology is poor when referring to the W boson where the minus sign in W- refers to electric charge. So, for the sake of brevity, LH and RH have sometimes been used very deviantly to denote spin – and spin + bosons in this paper. If spin is zero then LH refers to a weak isospin of -0.5 and RH refers in this paper to a weak isospin of +0.5. [Despite weak isospin actually being more related to electric charge than to spin.] Note that the LH photon is the antiparticle of the RH photon in this preon model, and similarly for the Z, the higgses and the gluons, but not for the W boson.

In model #9, preons are conserved in particle interactions. The preons going into an interaction all come out again, in the same way as chemical elements are conserved in chemical reactions. This allows weak isospin to be conserved in interactions. In Standard Model interactions, weak isospin is not conserved, which is because the vacuum ‘energy’ contains the higgs fields where weak isospin and mass are the only known property of the higgs boson. That is, the higgs can be described as (0, 0, -0.5) or (0, 0, +0.5). Therefore the weak isospin has to be fed, in the preon model, into the interactions via higgs bosons. It may be quibbled that the weak isospin enters the interactions as field interactions rather than as particles, but nevertheless the weak isospin enters into and stays with the outgoing particles of an interaction and so the higgs inputted are treated in Model #9 as particle interactions. This is reminiscent of the phlogiston period in chemistry when substance (oxygen) in the form of a gas was not at first realised to become (say) solid oxides after interaction. There are substances (preons of higgs) in the vacuum which become part of (preons of) elementary particles after interaction. Descriptions of decays written as b --> c τ ν' have no overt acknowledgement in that description of the inputted higgs preons, whereas the Preon Model interactions include higgses as incoming and outgoing substance.

Next to some implications of Preon Model #9 in interactions. How does an accelerated electron emit a photon?

LH Electron + ¼-higgs+ → RH electron + photon-

(-1, -0.5, -0.5) + (0, 0, 0.5) → (-1, 0.5, 0) + (0, -1, 0)

AC.X + BE'.X → BC.X + AE'.X

Where all the preons incoming are all also outgoing: that is, ABCE' are pexons on both sides of the interaction.

The model can say that an interaction is possibly permitted, though the model says nothing about energy considerations which of course are important. Just as a chemical reaction can be written as an exchange of chemical elements, despite the potential for a swap, the elements may not swap if (say) the heat supplied is not sufficient.

The subsequent emission of a photon from a RH electron is as follows:

RH electron + ¼-higgs- → LH electron + photon+

(-1, 0.5, 0) + (0, 0, -0.5) → (-1, -0.5, -0.5) + (0, 1, 0)

BC.X + B'E.X → AC.X + A'E.X which does balance because the interaction has

BB'CE pexons as incoming and AA'CE pexons as outgoing which balances, as long as the incoming pintrons contain AA' and the outgoing pintrons contain BB'.

Note that in a series of emissions of photons from an accelerated electron, the electron changes its handedness at each emission. Also alternating handednesses of higgs are used at successive emissions and alternating handednesses (or rather 'spins') of photons are emitted at successive emissions. Also note that the LH electron has a different structure to the RH electron. Further, an individual preon never changes its spin, and an individual particle never changes its spin except by swapping preons at an interaction and thereby changing its structure.

In the next section there is a demonstration of the use of the preon model on muon and tau decays.

Demonstration of the use of Preon Model #9 on muon and tau decays

The demonstration in this section is merely a warm up exercise before the use of the preon model in the suspected decays of the bottom quark via leptoquark and charged higgs intermediaries.

The muon decays as:

muon → muon neutrino & electron & electron antineutrino.

This could maybe be expressed as:

(-1, -0.5, -0.5) → (0, -0.5, 0.5) + (-1, -0.5, -0.5) + (0, 0.5, -0.5)

But in the preon model there are 12 preons incoming to that reaction and 20 preons outgoing which does not balance. So, instead, the preon model prefers interactions with two incoming particles and two outgoing particles and the muon decay can be expressed as two successive such interactions:

Interaction 1 RH muon + RH ¼-higgs → LH muon neutrino + RH W-, followed by

Interaction 2 RH W- + LH ¼-higgs → RH electron + RH electron antineutrino

Where Interaction 1 is

(-1, 0.5, 0) + (0, 0, 0.5) → (0, -0.5, 0.5) + (-1, 1, 0) with numbers of preons

as 12 + 4 → 12 + 4 which balances.

Interaction 2 is

(-1, 1, 0) + (0, 0, -0.5) → (-1, 0.5, 0) + (0, 0.5, -0.5) with preon numbers as

4 + 4 → 4 + 4 which balances.

In terms of actual preon content these interactions are

Interaction 1:

BC.XXXXX + E'B.X → CE'.XXXXX + BB.X which balances.

Interaction 2

BB.X + B'E.X → BC.X + C'E.X which balances, as long as the incoming pintrons contain CC' and one of the outgoing particles has BB' in its pintrons.

A summary of the preon content of all elementary particles in the Standard Model is given later, in Part 3.

PART 2 Use of the preon model in b → c τ ν' decays of the bottom quark

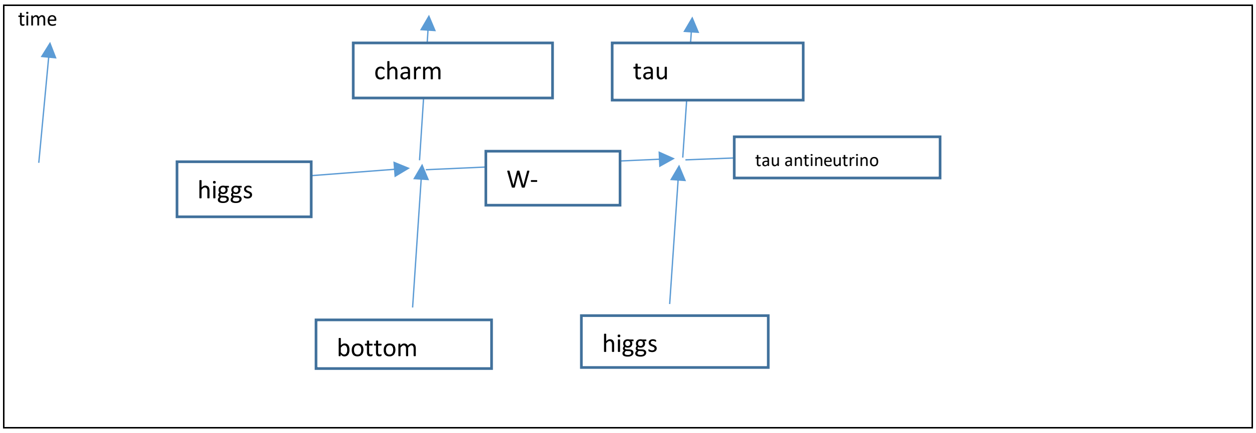
There are three sections in the analyses in Part 2:
Section 2A b → c τ ν' decay via the standard Model W boson

Section 2B b → τ c ν' decay via the leptoquark
Section 2C b → c τ ν' decay via the charged higgs

Section 2A b → c τ ν' decay via the standard Model W boson

A diagrammatic representation of the b → c τ ν' decay is shown in Figure 2A

Figure 2A Standard Model W- exchange between b c and τ ν'



Bottom → charm & tau & tau antineutrino

is here expressed as:

Interaction 1 RH bottom + RH higgs → LH charm + RH W-, followed by

Interaction 2 RH W- + LH higgs → RH tau + RH tau antineutrino

Where Interaction 1 is

(-1/3, 0.5, 0, red) + (0, 0, 0.5) → (2/3, -0.5, 0.5, red) + (-1, 1, 0) with numbers of preons

as 20 + 16 → 12 + 24 which balances.

Interaction 2 is

(-1, 1, 0) + (0, 0, -0.5) → (-1, 0.5, 0) + (0, 0.5, -0.5) with preon numbers as

24 + 16 → 20 + 20 which balances.

In terms of actual preon content these interactions are

Interaction 1:

Bred.XXXXXXXXX + E'B.XXXXXXX → E'red.XXXXX + BB.XXXXXXXXXXX which balances.

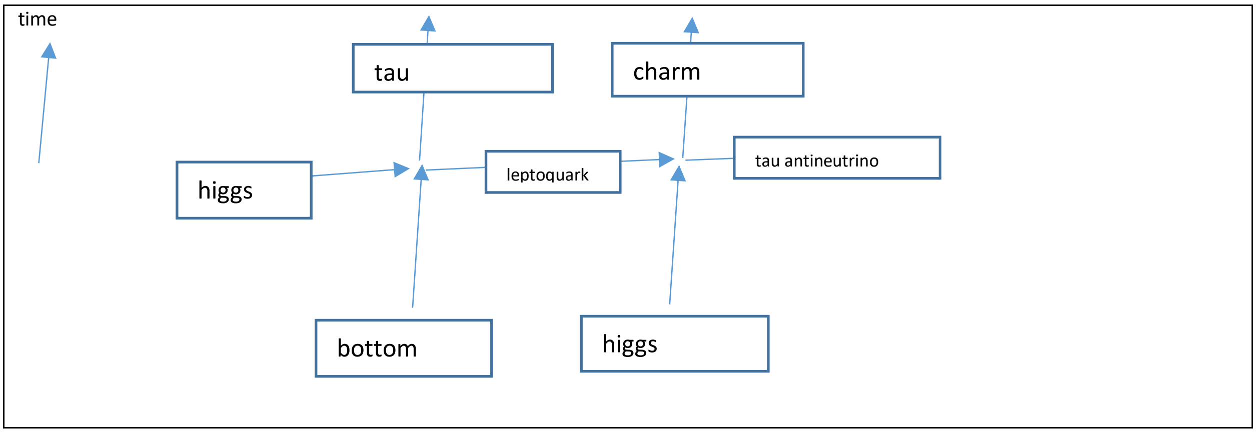
Interaction 2

BB.XXXXXXXXXXX + B'E.XXXXXXX → BC.XXXXXXXXX + C'E.XXXXXXXXX which balances, as long as one 'X' in the incoming pintrons contain CC' and one of the outgoing pintrons contains BB'.

Section 2B b → τ c ν' decay via the leptoquark

A diagrammatic representation of the b → τ c ν' decay is shown in Figure 2B.

Figure 2B Leptoquark exchange between b τ and c ν'



Bottom → tau & charm & tau antineutrino.

is here expressed as:

Interaction 1 LH bottom + RH higgs → LH tau + RH leptoquark, followed by

Interaction 2 RH leptoquark + LH higgs → LH charm + RH tau antineutrino

Where Interaction 1 is

(-1/3, -0.5, -0.5, red) + (0, 0, 0.5) → (-1, -0.5, -0.5) + (2/3, 0, 0.5, red) with numbers of preons

as 20 + 16 → 20 + 16 which balances.

Interaction 2 is

(2/3, 0, 0.5, red) + (0, 0, -0.5) → (2/3, -0.5, 0.5) + (0, 0.5, -0.5) with preon numbers as

16 + 16 → 12 + 20 which balances.

In terms of actual preon content these interactions are

Interaction 1:

Ared.XXXXXXXXX + A'B'CC.XXXXXX → AC.XXXXXXXXX + A'B'Cred.XXXXXX which balances.

Interaction 2

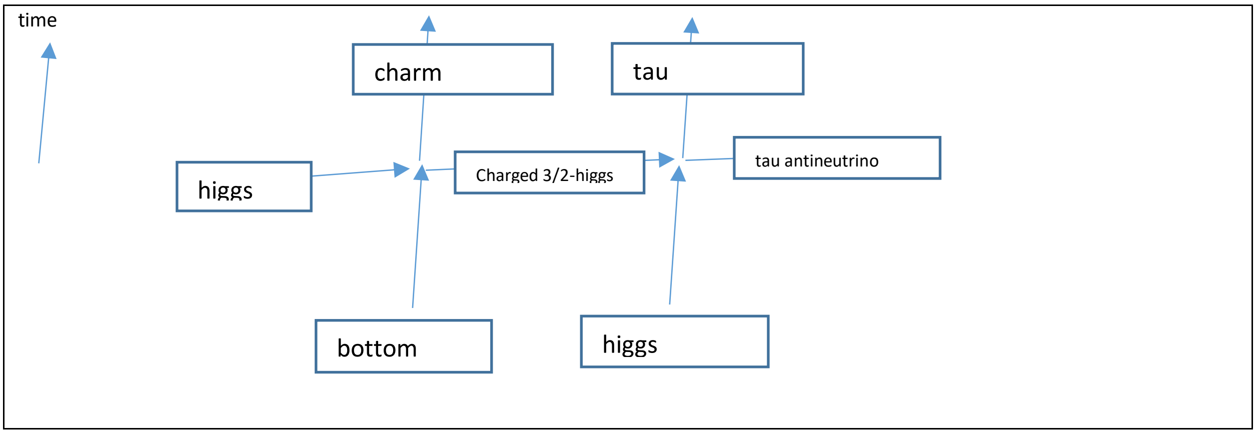
A'B'Cred.XXXXXX + ABC'C'.XXXXXX → E'red.XXXXX + EC'.XXXXXXXXX which balances, as long as the incoming particles have EE' in their pintrons and the outgoing particles have AA' and BB' in their pintrons.

The decay path could alternatively be drawn using a leptoquark containing 24 preons (and using higgses of different generations). The alternative path to be used would depend on energy considerations.

Section 2C b → c τ ν' decay via the charged higgs

A diagrammatic representation of the b → c τ ν' decay is shown in Figure 2C.

Figure 2C Charged 3/2-higgs exchange between b c and τ ν'



Bottom → charm & tau & tau antineutrino.

is here expressed as:

Interaction 1 LH bottom + RH higgs → LH charm + LH –ve charged 3/2-higgs, followed by

Interaction 2 LH –ve charged 3/2-higgs + LH higgs → LH tau + RH tau antineutrino

Where Interaction 1 is

(-1/3, -0.5, -0.5, red) + (0, 0, 0.5) → (2/3, -0.5, 0.5, red) + (-1, 0, -0.5) with numbers of preons as 20 + 16 → 12 + 24 which balances.

Interaction 2 is

(-1, 0, -0.5) + (0, 0, -0.5) → (-1, -0.5, -0.5) + (0, 0.5, -0.5) with preon numbers as

24 + 16 → 20 + 20 which balances.

In terms of actual preon content these interactions are

Interaction 1:

Ared.XXXXXXXXX + E'B.XXXXXXX → E'red.XXXXX + AB.XXXXXXXXXXX which balances.

Interaction 2

AB.XXXXXXXXXXX + B'E.XXXXXXX → AC.XXXXXXXXX + C'E.XXXXXXXXX which balances, as long as the incoming pintrons contains a CC' and the outgoing pintrons contain a BB'.

The decay path could alternatively be drawn using a charged higgs containing 16 preons (and using higgs of different generations). The alternative path to be used would depend on energy considerations.

Summary of Results

The b --> τ c ν' decay could possibly, subject to allowable energy conditions, use leptoquarks with the following structure:

RH positively-charged leptoquark	Q = 2/3	Spin = 0	w.i. = + 0.5	Colour = r (or g or b)	No. of preons = 16 or 24

with exact preon content = A'B'C red.XXXXXX or A'B'C red.XXXXXXXXXX

The b --> c τ ν' decay could possibly, subject to allowable energy considerations, use a charged higgs with the following structure:

LH negatively-charged higgs	Q = - 1	Spin = 0	w.i. = - 0.5	Colour = none	No. of preons = 16 or 24

Where Q = electric charge; w.i. = weak isospin; and r, g and b are strong colour charges.

With exact preon content = AB.XXXXXXX or AB.XXXXXXXXXXX

Where A'B'Cred and AB are the 'active ingredients' or pexons which are common across all generations of the same particle, and the Xs are the net neutral pintrons which are 'makeweights' of preons-antipreons which give extra masses to the higher generations of a particle.

PART 3 More details of Preon Model #9

Table 1 shows all elementary particles categorised by their generation and the numbers of preons contained. In this table, the Z is shown as equivalent to a second generation photon. The gluon does not appear until the third generation. The higgs boson found experimentally appears to contain 16 preons and to be of the third generation. However this preon model has long since, for the want of a better understanding, used the terms ¼-higgs and ½-higgs for the first two generations of higgs so that is how it appears in Table 1. Likewise, the model has always placed the W as naturally occurring with eight preons, as too has its partner Z, which leads to terms such as ½-W being required.

Table 1 Generations of elementary particles as determined by numbers of preons contained

Number of preons and generation numbers

	Fermions and bosons	Bosons only	Fermions only	Bosons only	Fermions only	Bosons only	Fermions only	Bosons only
Fermion generation	1	-	2	-	3	-	-	-
Boson generation	1	2	-	3	-	4	-	5
Number of preons	4	8	12	16	20	24	28	32
	electron		muon		tau			
	electron-neutrino		muon-neutrino		tau-neutrino			
	down		strange		bottom			
	up		charm		top			
	photon	Z		2-Z?				
				gluon		gluon?		gluon?
	½-W	W		2-W		3-W		
	¼-higgs	½-higgs		higgs		3/2-higgs		2-higgs?
Hypothetical				**leptoquark**		**leptoquark**		
particles				**charged higgs**		**charged higgs**		

The terminology in the table is getting complicated for elementary particle descriptions, but fortunately it is simpler when dealing with preons as there are only four preons. However, there can be many preons per particle, though the pexons (active ingredients) are small in numbers per particle and the bulk of the preons in higher generation particles are neutral makeweights or pintrons. ‘Neutral’ is not sufficiently explicit as neutral in the preon model always implies a balance of opposites. To see this one needs to look at how preons themselves are constructed out of hexarks (Fearnley, May 2015). There is nothing neutral about individual hexarks. A single hexark has a polar attitude to every important possible quality of a particle (except mass). So a single hexark could be positive for charge, negative for spin, and antiblue for colour etc. Preon C is neutral for spin and so would contain an equal number of spin – and spin + hexarks. In a similar way, a neutral particle for spin such as a higgs has within it the say preon E’ and B which have negative and positive spins respectively. On interaction the E’ and B could be, and are, separated and thus can impart different spin components into outgoing particles despite the higgs itself being net zero for spin. Also, the many pintrons in a higgs can, at interaction, be separated into individual preons and antipreons for which each preon can have its own spin, or not, to use in outgoing particles.

Preon content of elementary particles

Some liberties have been taken with the definition of handedness here. Normally LH refers to negative spin, and even then only for fermions. This has been extended here to have LH referring to negative weak isospin, but only when spin is zero. And also to include spins of bosons. This is for my convenience only and also is not strictly correct as weak isospin has connection with electric charge or hypercharge rather than spin.

In the preon structure, {C'g' Cr C'b'} is equivalent to one preon as C'g' is a sub-preon which is coloured (antigreen), one-third slice of preon C and so three such sub-preons make up the equivalent of a whole preon, at least in quantity of matter contained. This particular aggregate of three coloured sub-preons causes the net colour Red. The twelve pintrons in the leptoquark (XXXXXX) are net neutral in properties (except mass) as each X is a pair comprising a preon and an antipreon, for example, AA', where A' is the antipreon of preon A.

Table 2 shows the particle properties and the preons in the pexons (or active ingredients) for the Standard Model elementary particles.

Table 2 Elementary particles as determined by the preons they contain as pexons, or active ingredients, plus the makeweight neutral pintrons

Particle**	Electric charge	Spin	Weak isospin	Colour charge	Preon count in whole particle	Preon content in pexons only*
LH electron	-1	-1/2	-1/2	0	4	AC
LH neutrino	0	-1/2	1/2	0	4	E’C
LH down	-1/3	-1/2	-1/2	R	4	Ared
LH up	2/3	-1/2	1/2	R	4	E’red
RH electron	-1	1/2	0	0	4	BC

RH neutrino***	0	1/2	0	0	4	A'B'CE or BC'
RH down	-1/3	1/2	0	R	4	Bred
RH up	2/3	1/2	0	R	4	BC'C'red or A'B'Ered
LH W-	-1	-1	-1	0	4+	AA
RH W-	-1	1	0	0	4+	BB
photon-	0	-1	0	0	4	B'B'CC or AE'
Z-	0	-1	0	0	8	B'B'CC or AE'
gluon-	0	-1	0	R G'	16	B'B'CCred green' or AE'red green'
higgs-	0	0	-1/2	0	4+	ABC'C' or EB'
RH positron	1	1/2	1/2	0	4	A'C'
RH antineutrino	0	1/2	-1/2	0	4	EC'
RH antidown	1/3	1/2	1/2	R'	4	A'red'
RH antiup	-2/3	1/2	-1/2	R'	4	Ered'
LH positron	1	-1/2	0	0	4	B'C'
LH antineutrino***	0	-1/2	0	0	4	ABC'E' or B'C
LH antidown	1/3	-1/2	0	R'	4	B'red'
LH antiup	-2/3	-1/2	0	R'	4	B'CCred' or ABE'red'
RH W+	1	1	1	0	4+	A'A'
LH W+	1	-1	0	0	4+	B'B'
photon+	0	1	0	0	4	BBC'C' or A'E
Z+	0	1	0	0	8	BBC'C' or A'E
gluon+	0	1	0	R' G	16	BBC'C'red' green or A'Ered' green
higgs+	0	0	+1/2	0	4+	A'B'CC or E'B

** red = Cr C'g' C'b' and is equivalent to one preon in content. red has electric charge = +1/6.*
green' [I.e. antigreen] = Cr C'g' Cb and is equivalent to one preon in content. green' has electric charge = -1/6.
*** Some liberties are taken with the definition of handedness here. Normally LH refers to negative spin. This has been extended here to have LH referring to negative weak isospin, but only when spin is zero. This only applies to the higgs and the leptoquark and is for my convenience only and also is not strictly correct as weak isospin has connection with electric charge or hypercharge rather than spin.*
**** is not seen to occur in experiments. It is a 'sterile' RH neutrino or a 'sterile' LH antineutrino.*

A simple totalling of the numbers of preons (in Model #9) before and after decay of the bottom quark shows that there are more preons outputted into c τ ν' (n = 52) than are inputted by b (n = 20). This discrepancy is due to extra preons inputted from the vacuum. In other decays described by this preon model it is normally a higgs boson which is taken from or given up to the vacuum. Also, spontaneous random decay is anathema to this model and the interactions in this model are exactly balanced before and after the interaction, as with a chemical reaction.

Weak isospin is not conserved in Standard Model interactions. This point is at odds with this preon model as conservation of preons implies also the conservation of weak isospin. Weak isospin in the vacuum is contained within the higgs, so to conserve preons in this model, the preons in the higgs need to be inputted into the interaction equations.

In this model it is clear that colour charge exactly determines electric charge at preon level. This is a symmetry which is broken at elementary particle level where colour charge does not directly give the electric charge.

Another bottom quark interaction modelled by Preon Model #9

B0 meson → charmonium + K0 meson

The B0 meson is a composite of a down quark and an antibottom quark and a K0 meson is a composite of a down quark and an antistrange quark.

First interaction,
RH antibottom + ½-higgs+ --> LH anticharm + RH 2-W+
20 + 8 → 12 + 16 preons
(1/3, 1/2, 1/2, R') + (0, 0, 1/2) → (-2/3, -1/2, 0, R') + (1, 1, 1)
{which are the particle properties: (electric charge, spin, weak isospin, colour)}
A'red'.XXXXXXXXX + A'B'CC.XX → B'CCred'.XXXX + A'A'.XXXXXXX
which balances exactly.

Second interaction,
RH 2-W+ + ½-higgs- -> RH charm + RH antistrange
16 + 8 → 12 + 12 preons
(1, 1, 1) + (0, 0, -1/2) → (2/3, 1/2, 0, R) + (1/3, 1/2, 1/2, R')
A'A'.XXXXXXX + ABC'C'.XX → BC'C'red.XXXX + A'red'.XXXXX
Which balances if one of the outgoing Xs pairings can be the incoming A and A' preons.

Third, down (from the incoming B0) + antistrange (outgoing from the second interaction) --> K0
Fourth, anticharm (outgoing from the first interaction) + charm (outgoing from the second interaction) combine to form charmonium.

Next are shown some decay paths of the K^+ meson.

Decay of K^+ meson (that is, up & antistrange)

Two decay paths of the K+ meson are illustrated here:

$K^+ \rightarrow \mu^+ \nu'_\mu$
$K^+ \rightarrow \pi^0 \mu^+ \nu'_\mu$

Decay of K^+ meson to $\mu^+ \nu'_\mu$

RH u & RH s' + H^- → RH μ^+ + RH ν'_μ
has particle properties as follows (2/3, 1/2, 0, red) + (1/3, 1/2, 1/2, red') + (0, 0, -1/2) →
(1, 1/2, 1/2) + (0, 1/2, -1/2)
with numbers of preons 4 + 12 + 8 → 12 + 12

and as actual preons:
A'B'Ered + A'red'.XXXXX + ABC'C'.XX → A'C'.XXXXX + C'E.XXXXX
Which balances if three of the Xs in the outgoing pintrons are AA', BB' and red red'

Decay of K^+ to π^0 μ^+ ν'_μ

STEP 1 u & RH s' + LH W^- → u + LH u' + H^-
has particle properties as follows
u + (1/3, 1/2, 1/2, red') + (-1, -1, -1) → u + (-2/3, -1/2, 0, red') + (0, 0, -1/2)
with numbers of preons [4] + 12 + 8 → [4] + 4 + 16
and has actual preons:
[u] + A'red'.XXXXX + AA.XXX → [u] + B'CCred' + ABC'C'.XXXXXX
AA' → BB' CC'CC'
which balances exactly if one of the Xs in the incoming pintrons is BB' and two Xs of incoming pintrons are each CC' and one of the outgoing Xs is AA'.
The outgoing particles are u u' H^- = π^0 H^-

STEP 2 π^0 + H^- + RH W^+ → π^0 + RH μ^+ + RH ν'_μ + H^+
has particle properties as follows
π^0 + (0, 0, -1/2) + (1, 1, 1) →
π^0 + (1, 1/2, 1/2) + (0, 1/2, -1/2) + (0, 0, 1/2)
with numbers of preons [8] + 16 + 16 → [8] + 12 + 12 + 8
and has actual preons:
π^0 + ABC'C'.XXXXXX + A'A'.XXXXXXX → π^0 + A'C'.XXXXX + C'E.XXXXX + E'B.XXX

Which balances exactly if one of the Xs in the incoming pintrons is EE' and one of the outgoing Xs is AA'. The outgoing particles are π^0 μ^+ ν'_μ & H^- ,where the H- returns to the vacuum. Note that the incoming H^- and the outgoing H^- are made of different preons from each other, and they are of different generations, which is evidence that they each took an active part in the interaction by engaging in the swapping of preons. Note also that the W- and W+ used in the two interactions could have come from the decay of a single higher generation higgs so that this path could have been driven entirely by products of higgs from the vacuum. Just as fermions decay from higher to lower generations, the higgs in the vacuum are also decaying from higher to lower generations.

References

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