A Conjectural Preon Theory and its Implications

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A Conjectural Preon Theory and its Implications

At present the dominant paradigm in particle physics is the Standard Model. This theory has taken hold over the last 30 years as its predictions of new particles have been dramatically borne out in increasingly sophisticated experiments. Despite this it would seem that the Standard Model has some shortcomings and leaves a number of questions unanswered. The number of arbitrary constants and parameters incorporated in the Model is one unsatisfactory aspect, as is its inability to explain the masses of the quarks and leptons. Another problematic area often cited is the Model's failure to account for the number of generations of quarks and leptons. The plethora of "fundamental" particles also appears to represent a major weakness in the Standard Model. There are 16 "fundamental" or "elementary" particles, as well as their anti-particles, engendered in the Standard Model, along with 8 types of gluons. This difficulty may be further compounded by theorizing based on supersymmetry, as an extension of the Standard Model, because it requires heavier twins for the known particles. Furthermore the Higgs mechanism, postulated to generate mass in particles, has not as yet been validated experimentally. In addition, the Standard Model is clearly incomplete as there is no satisfactory theory to explain gravity and to date the graviton, postulated to be a massless spin 2 boson, has not been found.

In some respects the extensive list of fundamental particles bears a resemblance to the list of elements at the time when Mendeleev developed the periodic table. The absence of an adequate explanation of this feature of the Model indicates that perhaps there is, as some have suggested, a deeper layer of structure, as yet undiscovered. In the past a class of alternative models, known as preon theories, have been proposed but these have not been widely accepted.[1] However, a preon theory is presented here that may overcome many of the shortcomings of previous models.

This theory begins with the observation that neutrinos are ubiquitous in terms of the normal neutrino flux, at least 6.5 x 10^{10} passing through every square centimetre per second. It is also noted that neutrinos are commonly and copiously produced in particle decays and interactions where so-called weak interactions are involved. Neutrinos are produced in decays of numerous particles, such as the muon, as well. It is also noted that the fractional quantum Hall effect suggests the existence of composite fermionic leptons.[2]

The preon theory outlined in this paper assumes there are bound state composite fermions and bosons, based on a number of basic propositions. These are:

1. There is only one fundamental particle, and its antiparticle, the neutrino.
2. There is only one type of neutrino.
3. Neutrinos have no mass.
4. That the Pauli Exclusion Principle does not apply to neutrinos.[3]
5. The spin of each particle is the sum of the spin of its constituents in accordance with the conventions adopted below.
6. The frame of reference for the spin of each of the constituent particles is relative to the other constituent particles.

[1] e.g. Pati and Salam 1974; Harari 1979; Ne'eman 1979; Shupe 1979; Harari and Sieberg 1982; Yershov 2005; Zenczykowski 2008.
[2] Tsui, Stormer, and Gossard 1982; Jain 1989,2007.
[3] See Dolgov and Smirnov 2005.

The justification for these propositions will follow.

In the preon theory proposed here, the leptons, low mass mesons and gauge bosons are considered together. The table below lists various permutations of combinations of neutrinos and anti-neutrinos, and identifies them with known particles where possible, or differential spin states of known particles. The assumptions made in tabulating these combinations and their associated particles are:

1. That J </= 1
2. That Q = 0 or $\pm$ 1
3. That neutrinos have J = +½ and antineutrinos have J = -½
4. That by convention Q^- are anti-particles with opposite spin to Q^+ particles
5. That J and Q is conserved in all interactions
6. That the spin of each bound state composite particle is the sum of the spin of its constituent particles
7. That the photon (γ) does not combine with other particles

Table 1 – Particles Formed by Combinations of Neutrinos

υ#	Permutation	Particle	Composition	Alternative Forms	J	Q
1	υ ῡ	υ ῡ			½ -½	- -
2	υυ ῡῡ	γ $\underline{\gamma}$	υ υ ῡ ῡ		1 -1	- -
2	υῡ ῡυ	Z^0 $\underline{Z}^0$	ῡ υ υ ῡ		0 0	- -
3	υυῡ ῡῡυ	e^+ e^-	Z^0υ $\underline{Z}^0$ῡ		½ -½	+ 1 - 1
4	υυῡῡ ῡῡυυ	M^0 $\underline{M}^0$	Z^0 $\underline{Z}^0$ $\underline{Z}^0$ Z^0		0 0	0 0
4	υυῡῡ ῡῡυυ	W^+ W^-	e^+ ῡ e^- υ		0 0	+ 1 - 1
4	υυυῡ υῡῡῡ	W^{*+} W^{*-}	e^+ υ e^- ῡ		1 -1	+ 1 - 1
5	υυυῡῡ υυῡῡῡ	μ^+ μ^-	W^+ υ W^- ῡ	W^{*+} ῡ W^{*-} υ e^+ Z^0 e^- $\underline{Z}^0$	½ -½ ½ -½	+1 - 1
6	υυυῡῡῡ	π^0 π^0	Z^0 M^0 $\underline{Z}^0$ $\underline{M}^0$	e^- e^+	0 0	0 0
6	υυυῡῡῡ ῡῡῡυυυ	${}_0\pi^+$ ${}_0\pi^-$	μ^+ ῡ μ^- υ	W^+ Z^0 W^- $\underline{Z}^0$	0 0	+ 1 - 1
6	υυυυῡῡ υυῡῡῡῡ	${}_1\pi^+$ ${}_1\pi^-$	μ^+ υ μ^- ῡ	W^{*+} Z^0 W^{*-} $\underline{Z}^0$	1 -1	+ 1 - 1
7	υυυυῡῡῡ υυυῡῡῡῡ	τ^+ τ^-	${}_0\pi^+$ υ ${}_0\pi^-$ ῡ	μ^+ Z^0 μ^- $\underline{Z}^0$	½ -½	+1 -1

In essence the formation of the bound state composite particles listed is additive, each generation being formed by the incorporation of an additional neutrino. It will be shown later that there are direct relationships between the neutrino number and the mass of each particle. It should also be noted that some particles have alternative forms which manifest in the formation of composite particles of greater mass and in the nature of interactions they undergo.

The Propositions of the Theory

A number of propositions were made earlier that require justification.

There is only one fundamental particle, and its antiparticle, the neutrino

This is the most fundamental proposition of this theory. It is a simple proposition that solves the problem of the multiplicity of elementary particles in the Standard Model. By forming various combinations of neutrinos and anti-neutrinos, as set out in Table 1, in accordance with seven conventions listed above, all the leptons, low mass mesons and gauge bosons are described.

It will be noted that there are particles in the table, such as the M^0 particle and the $W^{\pm}$, along with the 'vector' pion, which are not recognised particles. It is proposed that the M^0 particle and the charged particles with a neutrino number (υ#) of 4, the bosons ($W^{*\pm}$ and $W^{\pm}$) are what provide mass to all particles greater in mass than the electron. Proof of this will be provided in the section on *Origin of mass*. It is also proposed that the 'vector' pion is real, as there is experimental evidence indicating that the charged pion may not be a pseudoscalar particle in all instances.[4] Therefore the theory proposed here indicates that there are both pseudoscalar and vector charged pions.

The γ, Z^0 and $W^{*\pm}$ equate structurally to known gauge bosons, whereas the $W^{\pm}$ does not. But, as mentioned above, it is proposed that $W^{\pm}$ is a real particle, being a component of the pseudoscalar charged pion, and as will become apparent, of other mesons as well. It is also noted that the Z^0 particle with $\upsilon^{\#} = 2$ in Table 1 has zero spin, based on the convention that particle spin is the sum of the spins of the constituent particles. This differs from Z^0 gauge boson which has a spin of 1. However, the Z^0 gauge boson always decays into a fermion-anti-fermion pair, which, in accordance with Assumption 6, leads to the conclusion that its spin is actually zero.

It will argued in the section on *Weak interactions* that the Z^0, $W^{\pm}$ and $W^{*\pm}$ are constituent units of bound states forming mesons and nucleons, that may be transferred or decay during interactions, but that the only gauge boson involved in such interactions is the photon (γ).

Types of neutrinos

The first proposition, that the neutrino, along with the anti-neutrino, is the only truly fundamental particle, forms the basis of this theory. However, the Standard Model

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[4] Perkins 2007

incorporates three different types of neutrino, which are claimed to undergo neutrino flavour oscillations. The assertion here, that there is only one type of neutrino, is based on the proposition that what appear to be different types of neutrino is the result of the characteristic, quantised, momentum imparted in the annihilation and decay processes that produce neutrinos. This quantisation of momentum reflects the different binding forces involved in the structure of secondary particles.[5] It is further hypothesised that so-called neutrino oscillations are the product of neutrinos with their characteristic quantised momentum interacting with other neutrinos and transferring a part of their momentum.

Neutrinos have no mass

The hypothesis that neutrinos have mass is based on evidence of neutrino mixing and neutrino oscillations. This hypothesis creates significant difficulties for the Standard Model and is contradicted by the Theory of Special Relativity. Furthermore, other experiments, such as at MINOS, have shown that the neutrino moves at the speed of light,[6] indicating they are massless particles. If neutrinos do not have mass, then it follows that there is only one type of neutrino. This is consistent with a framework for light and gravity that will be outlined below.

That the Pauli Exclusion Principle does not apply to neutrinos

Particles to be formed from neutrinos, as outlined in Table 1, would appear to be in contravention of the Pauli Exclusion Principle. A similar issue arises for quarks, this being theoretically resolved by the investing quarks with colour, of course adding another layer of complexity. It is proposed here that the Pauli Exclusion Principle does not apply to neutrinos because they do not have charge or occupy space.[7]

That the frame of reference for the spin of each of the constituent particles is relative to the other constituent particles.

The rationale for this proposition is based on the observation that at a quantum level there is no physical frame of reference.

This proposition provides a mechanism for analysis of the composition of bound state composite particles. By applying this ‘rule’, particularly where the constituent particles are charged, with oppositely charged particles having opposite spin, a consistent framework for the classification of the known particles is developed.

Additional Propositions

There are further propositions of fundamental significance that arise from this theory. They are:

[5] This evident in the decay of the muon, if seen as a 2-step decay of two bound state particles, firstly $\mu^- > W*^- + \upsilon$, and then $W^{*-} > e^- + \bar{\upsilon}$

[6] Adamson *et al* 2007., arXiv:0706.0437

[7] See Dolgov and Smirnov 2005. Possibly existing in Groenewold-Moyal space instead.

That the appearance of a particle made depend upon how one 'looks' at it.

Using the example of the photon, it will be noted that according to the structure proposed here it is made up of two neutrinos with aligned or parallel spin. The formation of such a particle involves the creation of a bound state between the neutrinos. Because the dimensions involved are so small the photon appears to be a point-like particle. However, its dual nature is revealed in experiments that, depending on the method, show it to be a particle or a wave. In the case of the wave, what is being identified is the resonance of the bond between the neutrinos, accounting for the phenomenon of wave-particle duality. By extension, it is proposed that the apparent structure of some particles is dependent on the experimental method, how one 'looks' at the particle, the nature of the interaction. The alternative structures listed in Table 1 are further examples.

Photon Composition

As stated, in the preon model proposed here two neutrinos form a photon, or anti-photons in the case of anti-neutrinos, in a bound state. Similarly, it is proposed that the Z^0 boson is a bound state, formed by the combination of a neutrino and anti-neutrino. De Broglie originally proposed in 1932 that light (photons) was composed of neutrinos.[8] However, the difficulty with this conception was that the conditions imposed by Bose-Einstein commutation relations, and connection between spin and polarisation, were incompatible. Light waves are polarised transversely while neutrino 'waves' are polarised longitudinally.[9] However, in terms of the Bose-Einstein commutation relations this may not be the case.[10] Furthermore, it has been shown that it is possible to obtain transversely polarized photons from neutrinos.[11] Greenburg and Wightman have shown that this is valid in the one-dimensional case,[12] and so if, as is proposed as a subsidiary conjecture here, neutrinos are one-dimensional, then photons formed by two linked neutrinos are two-dimensional.

Fundamental Interactions and Forces

Fundamental interactions and forces are the interactions or potentials between particles, such as gravity, electromagnetism and so forth. Each type of interaction, along with subsidiary conjectures, will be considered in turn, along with the implications and interpretations arising from this preon theory. For reasons that will become evident, it will be proposed that all interactions, including gravitational and electromagnetic interactions, ultimately arise from the fundamental affinity neutrinos, and bound state particles based on neutrinos, have for each other.

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[8] de Broglie 1932a,b, 1934
[9] Pryce 1938; Berezinskii 1966.
[10] Perkins 1972.
[11] Kronig 1936; Perkins 1965.
Composite photons also satisfy Maxwell's equations.
[12] Greenberg and Wightman 1955.

The origin and nature of gravity

According to the preon theory proposed here, neutrinos combine to form bonds and create various particles (such as the photon, Z boson and electron) which then combine to form bound state composite particles, such as the W boson, the M particle, the muon and pions. It will be argued that in fact all other particles - mesons, nucleons and hyperons, are also bound state composite particles, made up of lower mass particles.

It is proposed that gravity arises from resonances of the bonds between the constituent neutrinos and anti-neutrinos that make up composite particles, and that the neutrino mediates these resonances and is in effect the force carrier, the graviton. As the photon, according to this preon theory, is in a bound state made up to two neutrinos with parallel spin, it is proposed that it too is affected by gravity, in accordance with its energy, its effective mass, expressed as $m = E/c^2$. The bending of light by astronomical objects is an example of this, as are black holes which exert sufficient gravitational force to prevent any form of electromagnetic radiation or particle from escaping. In effect the escape velocity of the black hole exceeds the speed of light.[13] It is worth noting in this context that even the graviton is able to 'escape' from a black hole. This is consistent with the notion that the neutrino is the graviton.[14]

While Einstein Field Equations formally describe the curvature of space-time in geometric terms, a corollary of the conjecture that gravity arises from resonance between fundamental neutrino bonds, and that light is affected by gravity, is that this is what gives rise to the apparent curvature.

Time and Space

As a further conjecture it is proposed that neutrino bonds, beginning with the photon and Z boson, also provide the fundamental dimensionality of space, the length of such bonds being equivalent to the the Planck length, $1.616199(97) \times 10^{-35}$ m. From this it is further conjectured that the differential relations between dimensions, where some change or form of interaction takes place, resulting in a change in energy, gives rise to time. Those interactions are communicated or mediated by electromagnetic radiation, the photon, relative to the speed of light between reference frames of observers. It is suggested that if, as proposed above, light is directly affected by gravity, then the speed of light and hence relative time is affected by the strength of gravitational fields. Thus time slows noticeably in proximity to black holes because of the gravitational effect on photons and hence the speed of light.
This has been expressed mathematically as,[15]

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[13] This simple notion, that photons are directly affected by gravity, may offer a solution to a number of outstanding cosmological problems.
[14] It is assumed, as proposed earlier, that the neutrino has no mass. It is also noted that there does not appear to be any evidence that the neutrino is affected by gravity, which is consistent with the notion that it is the graviton.
[15] Einstein 1911:906.

$$c' = c_o\left(1 + \frac{\Phi}{c^2}\right)$$

where Φ is the gravitational potential relative to the point where the speed of light c_0 is measured.[16]

The origin of electromagnetism

It is hypothesised in this preon theory that electromagnetism is an interference effect arising because the particle involved, the electron, is composed of a fermion (a neutrino) and a boson (Z^0). Electrons and positrons in bound state particles form the fundamental charge in other charged particles.

The mesons and nucleons

As an extension of this preon theory, it is also proposed that the mesons are bound state composite particles, forming in a manner analogous to ionic and covalent bonds in molecules. The nature of these bound states will be outlined more fully a little later when considering the weak and strong interactions. By extension, it is also proposed that the heavier mesons and baryons are bound states as well, though analysis of these is beyond the scope of this paper.

A fundamental feature of this preon theory is that it dispenses with quarks and their problematic features - free quarks have never been observed, even though they are fundamental particles they 'disappear' in decay and annihilation, they have fractional charge, the quark composition in some case is indeterminate,[17] and they necessitate additional layers of complexity in terms of flavour changing, colour charge and colour force.

As an extension of this preon theory it is proposed that mesons and nucleons are also composite particle, formed from the particles identified in Table 1. The composition of each particle and its assigned neutrino number ($\nu^{\#}$) is based on its mode(s) of decay, its relative mass, consistency in relation the structural elements it is composed of, and the mathematical relationships that emerge. The structure of each meson and the nucleons as determined by this approach is indicated below.

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[16] Also formulated as:

$$\frac{\sqrt{{dx_1}^2 + {dx_2}^2 + {dx_3}^2}}{dl} = 1 - \frac{\kappa}{4\pi}\int \frac{\sigma dV_0}{r}$$

by Einstein (1955:92-93). See also Bergman 1987:65-66 and Cheng 2005:48-49,93.

[17] As in the case of the η^0 mesons.

Table 2 - Meson Structure

Assumption: That by convention, Q^- particles have opposite spin to Q^+ particles

Mass (MeV)	Particle	$\nu^{\#}$	Composition	Alternative Form[18,19]	J	Q	Quark Assignment
134.9766	π^0	6	$Z^0 M^0$ $\underline{Z}^0\underline{M}^0$	$(e^- e^+)$	0	0	$\frac{(uu - dd)}{\sqrt{2}}$
139.570	$_0\pi^c$	6	$Z^0 W^+$ $\underline{Z}^0 W^-$	$\mu^+ \bar{\upsilon}$ $\mu^- \upsilon$	0	± 1	$u\underline{d}$, $d\underline{u}$
139.570	$_1\pi^c$	6	$Z^0 W^{*+}$ $\underline{Z}^0 W^{*-}$	$\mu^+ \upsilon$ $\mu^- \bar{\upsilon}$	1	± 1	
493.677	K^-	10	$_0\pi^0 W^-$		0	-1	$u\underline{s}$, $s\underline{u}$
493.677	K^+	10	$_0\pi^0 W^+$		0	1	$u\underline{s}$, $s\underline{u}$
497.614	K_S^0	10	$\mu^+ \mu^-$	$(\mu^+ \mu^-)$	0	0	$\frac{(ds - sd)}{\sqrt{2}}$
497.614	K_L^0	10	$_0\pi^+ W^-$		0	0	$\frac{(ds + sd)}{\sqrt{2}}$
547.853	η^0	12	$_0\pi^0\, {}_0\pi^0$	$({}_0\pi^+\, {}_0\pi^-)$	0	0	$\frac{(uu + dd - 2\,ss)}{\sqrt{6}}$
775.11	ρ^-	14	$K^0 W^{*-}$		1	-1	$d\underline{u}$
775.49	ρ^0	14	$K^c M^0$ [20]		1	0	$\frac{(uu - dd)}{\sqrt{2}}$
775.11	ρ^+	14	$K^0 W^{*+}$		1	1	$u\underline{d}$
782.65	ω^0	14	$K^0 W^-$ [21] $K^0 W^+$		1	0	$\frac{(uu + dd)}{\sqrt{2}}$
891.66	K^{*+} K^{*-}	18	$\rho^0 W^+$ $\rho^0 W^-$		1	± 1	$u\underline{s}$, $s\underline{u}$
895.94	K^{*0}	18	$\rho^- W^+$ $\rho^+ W^-$		1	0	$d\underline{s}$,$s\underline{d}$
957.78	η^{*0}	18	$\eta^0\pi^0$		0	0	$\frac{(uu + dd + ss)}{\sqrt{3}}$
1019.445	ϕ^0	22	$K^{*-} W^+$ $K^{*+} W^-$		1	0	$s\underline{s}$

Nucleons

938.2723	p^+	15	$\mu^+ \mu^- \mu^+$	$_0\pi^+ e^+ {}_0\pi^-$	½	+1	uud
939.5656	n^0	19	$\mu^+ \mu^- \mu^+ W^{*-}$	$p^+ W^{*-}$	-½	0	udd

18 The Alternative Forms in brackets indicates they are particle/anti-particle pairs and likely to decay by annihilation very quickly.

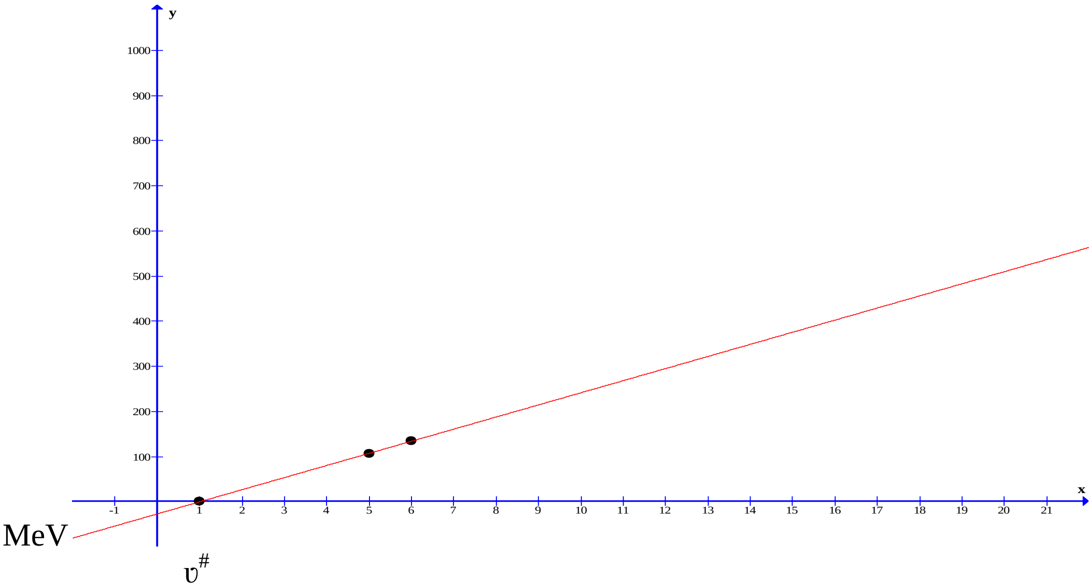
19 The 'Composition' and 'Alternative Form' for the $_0\pi^c$ and $_1\pi^c$ have been reversed from Table 1 to make their possible relationship to other mesons clearer.

20 See section on *Origin of mass* for explanation as to why this particle does not appear to structurally be a vector meson, and has apparent charge but is still neutral.

21 See section on *Origin of mass* for explanation as to why this particle does not appear to structurally be a vector meson, and has apparent charge but is still neutral. If the ω^0 meson were a pseudoscalar rather than a vector meson a more consistent framework could result.

In considering the validity of this classification and the assignment of $\nu^{\#}$ for the particles included in Tables 1 and 2, their relationships were explored in terms of their mass. This assumed that the rest mass of the Z^0, like its $\nu^{\#} = 2$ partner the photon (γ), is zero. This first linear relationship considered was that between the neutrino, muon and neutral pion, as seen in Graph 1.

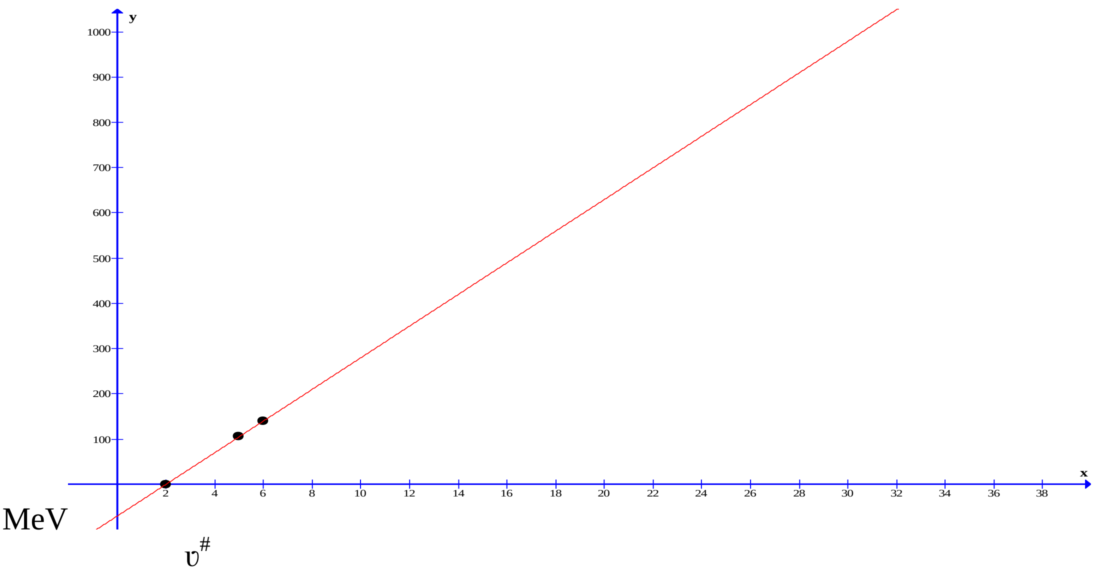
Graph 1: υ – μ^c – $_0\pi^0$
$\upsilon^{\#}$ 1 5 6



$m = 26.829371\upsilon^{\#} - 27.105952$ ($R^2 = 0.9997$)

This second linear relationship considered was that between the Z^0, muon and charged pseudoscalar pion, as seen in Graph 2.

Graph 2: Z^0 – μ^c – $_0\pi^c$
$\upsilon^{\#}$ 2 5 6

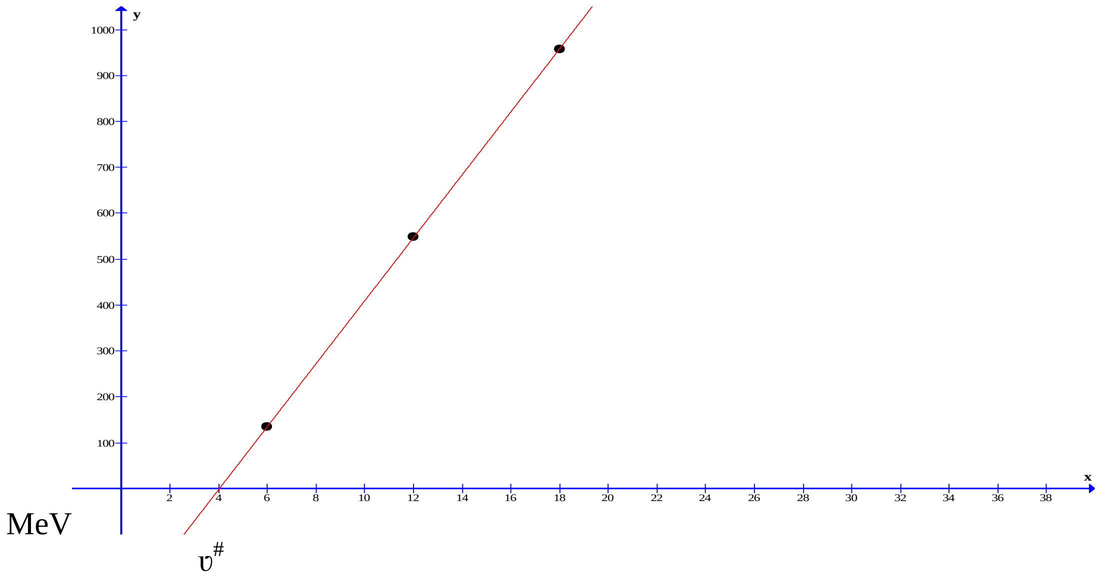


$m = 34.967923\upsilon^{\#} - 69.785$ ($R^2 = 0.9999$)

When relationships between lower mass particles and meson are considered, again other linear relationships are apparent. The first example is that between the neutral pion and the eta mesons.

Graph 3: $_0\pi^0 - \eta^0 - \eta^{*0}$

$\upsilon^{\#}$ 6 12 18

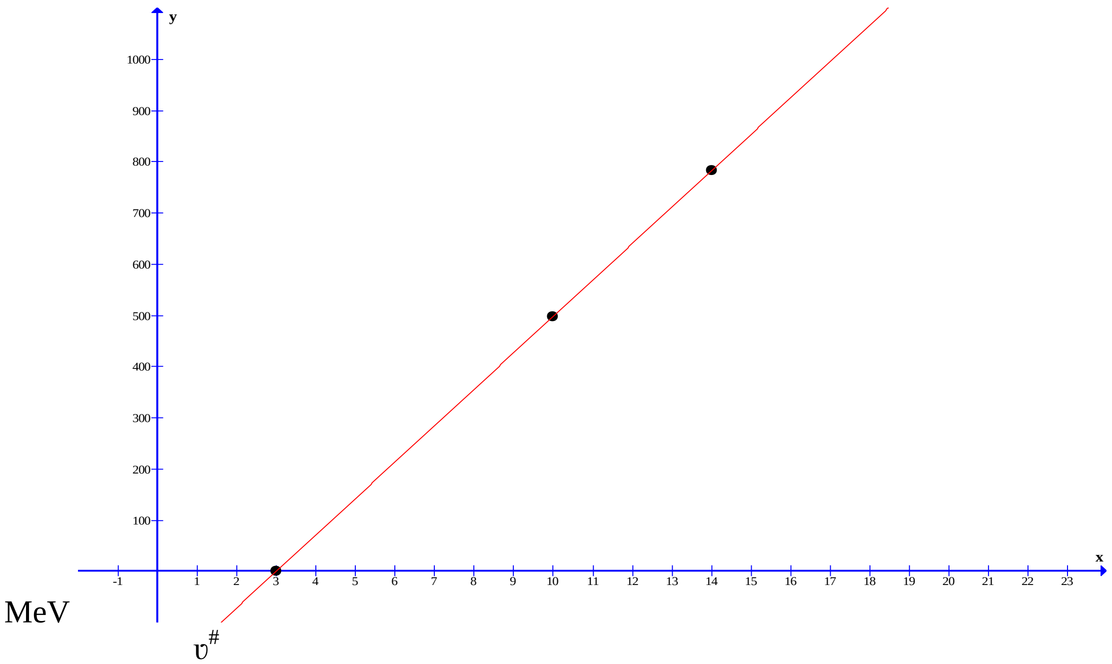


$$m = 68.56695\upsilon^{\#} - 275.93353 \ (R^2 = 1)$$

Other relationships are evident between leptons and mesons, in this instance between the electron, neutral kaon and omega meson.

Graph 4: $e^c - K^0 - \omega^0$

$\upsilon^{\#}$ 3 10 14

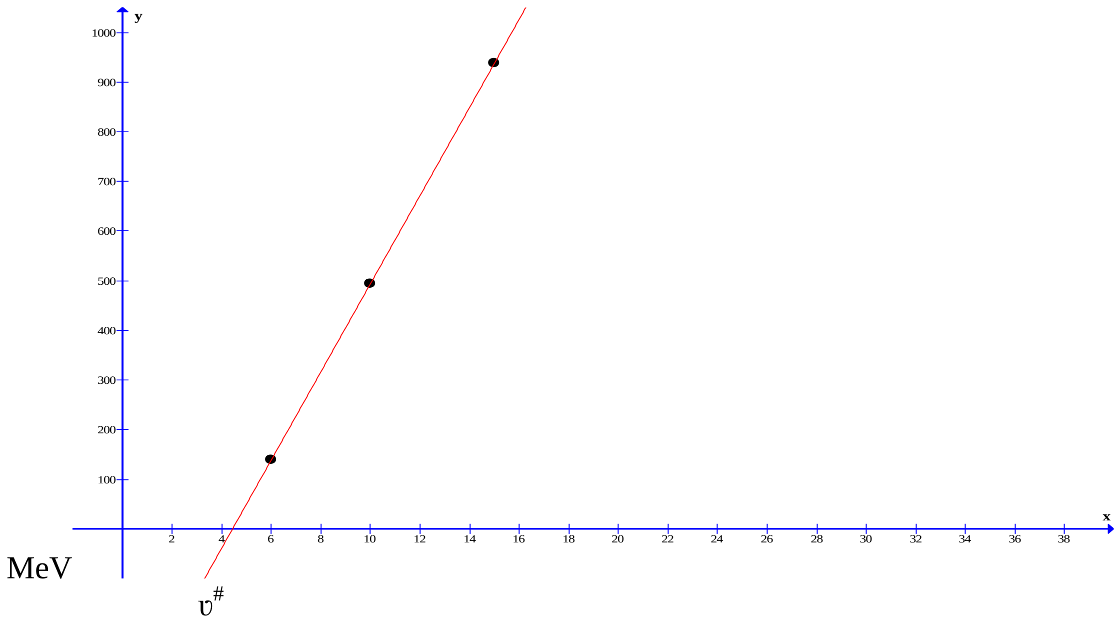


$$m = 71.093516\upsilon^{\#} - 212.91665 \ (R^2 = 1)$$

This form of analysis can be extended to mesons and nucleons, as shown in Graphs 5 and 6.

Graph 5: $_0\pi^c - K^c - p^c$

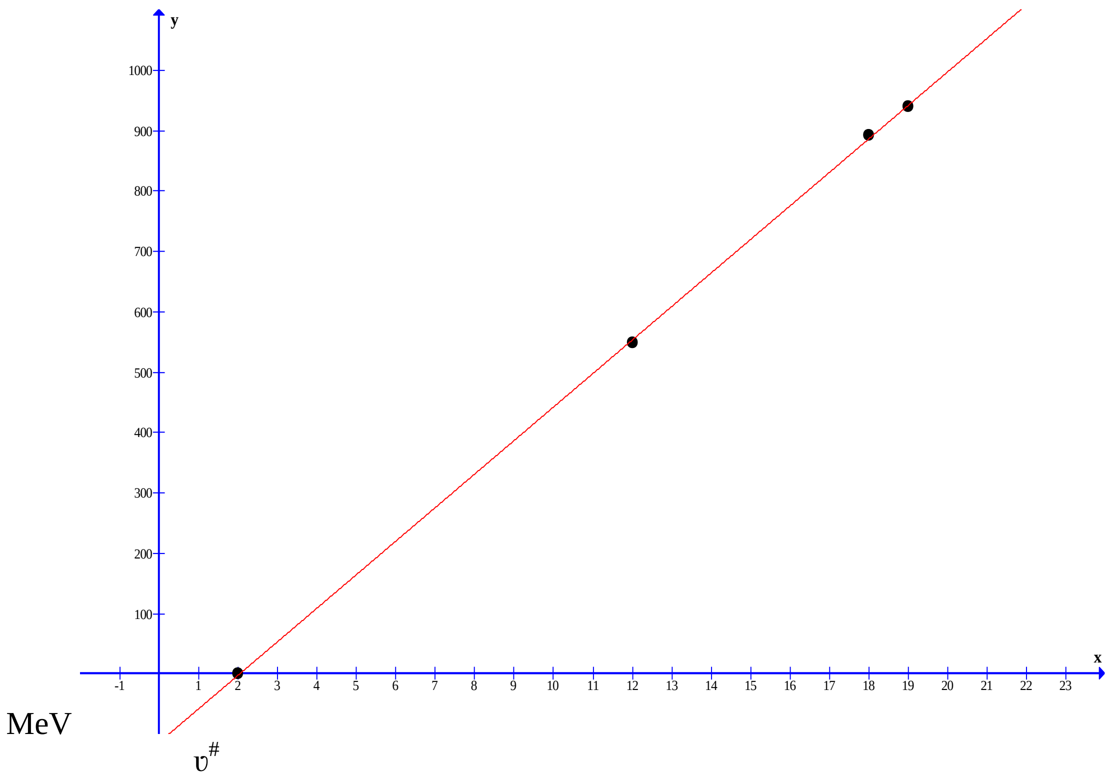
$\upsilon^\#$ 6 10 15



$m = 88.751846\upsilon^\# - 393.26264$ ($R^2 = 1$)

Graph 6: $Z^0 - \eta^0 - K^{*c} - n^0$

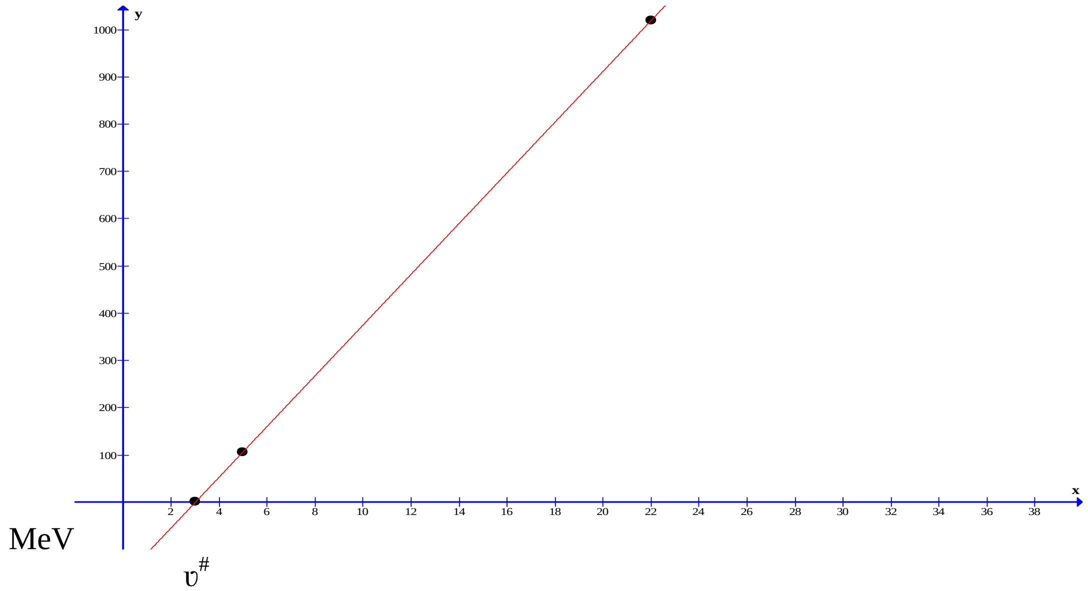
$\upsilon^\#$ 2 12 18 19



$m = 55.499919\upsilon^\# - 112.85432$ ($R^2 = 0.9999$)

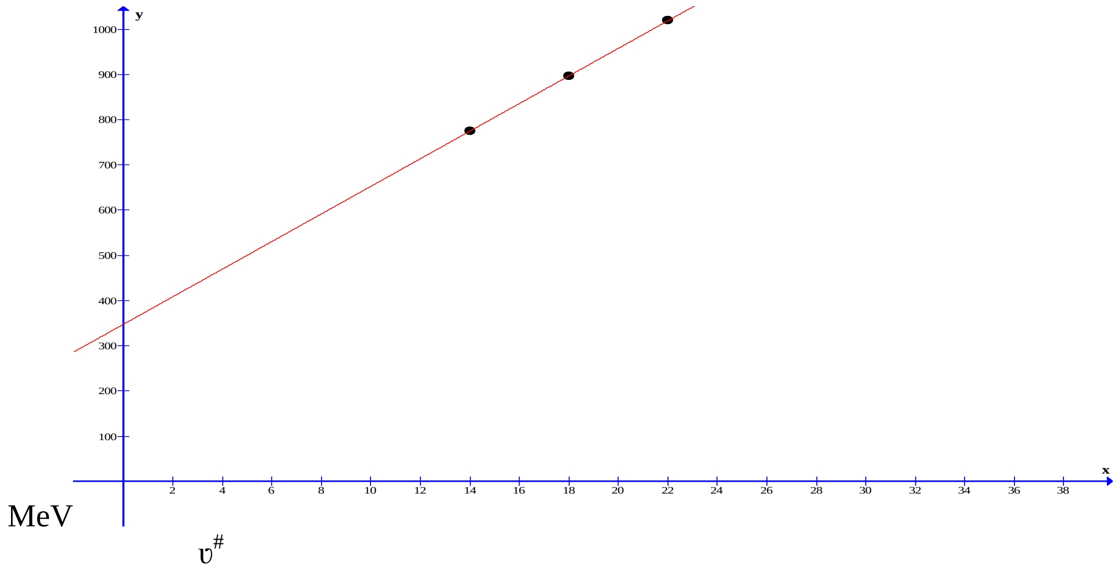
Relationships, such as between the leptons, the electron and muon, and the vector phi meson are also evident in Graph 7, as are those between the vector mesons $\rho^{0/c}$, K^{*0} and ϕ^0 as shown in Graph 8.

Graph 7: $e^c - \mu^c - \phi^0$
$\upsilon^{\#}$ 3 5 22



$$m = 53.676482\upsilon^{\#} - 161.56015\ (R^2 = 1)$$

Graph 8: $\rho^{0/c} - K^{*0} - \phi^0$
$\upsilon^{\#}$ 14 18 22

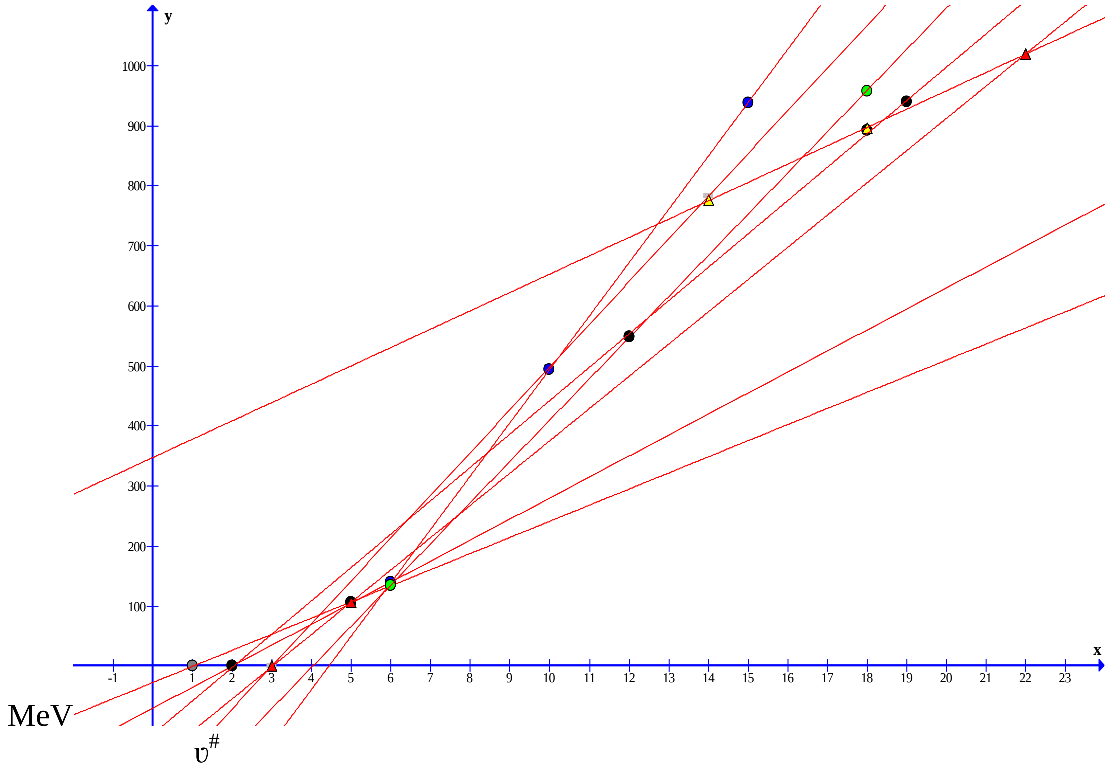


$$m = 30.518125\upsilon^{\#} + 347.56875\ (R^2 = 1)$$

It should be noted that every identified particle up to the phi meson (ϕ^0) is in a linear relationship with at least 2 other particles. Even the tau (τ^c), with a mass of 1776.84

MeV, lies on the Z^0 – μ^c – ${}_0\pi^c$ sequence, with a $\upsilon^\#$ of 53.[22] But only by consolidating all sequences, as in Graph 9 below, does a structural pattern emerge.

Graph 9: All linear relationships for particles up to ϕ^0



It is also noteworthy that most particles, particularly Z^0, e^c, μ^c, π^c and π^0, lie at the intersection of two or more linear equations. In essence it would appear that these linear relationships are consistent with the concept that a series of 'building blocks' are intrinsic to the formation of all the particles included in this analysis. These combinations of particles include 'building blocks' with $\upsilon^\#$s of 1,2,3,4,5 for particles with a mass up to and including the pions. For the mesons and nucleons with a mass greater that the pions, the 'building blocks have $\upsilon^\#$s of 3,4,5,6 or multiples of those.

Origin of mass

It will be noted that there are three particles assigned a $\upsilon^\#$ of 4 - M^0, W^c and W^{*c}. Only one of these, W^{*c}, equates structurally to a recognised particle, the W gauge boson. It will also be observed that two linear equations, $\mathbf{Z^0}$ – $\boldsymbol{\mu^c}$ – ${}_0\boldsymbol{\pi^c}$ and $\mathbf{e^c}$ – $\mathbf{K^0}$ – $\boldsymbol{\omega^0}$, intersect very close to $\upsilon^\#$ of 4 (3.962). At this point, the mass is 68.760 MeV, designated here as M_{q-1}. Based on the conjecture that the $\upsilon^\#$4 particles may carry a fundamental quantum of mass, and substituting 4 into the applicable linear equation for each, yields masses of 70.087 MeV (M_{q-2}) and 71.487 MeV (M_{q-3}). It is suggested that these represent M^0, W^c and W^{*c} respectively.

[22] m = 34.831433$\upsilon^\#$ - 69.201645 (R^2 = 1) It is noteworthy that the difference between the $\upsilon^\#$s of the muon (5) and tau (53) is 48.

From this the approximate mass of the pions and particles of greater mass can be calculated, following the formula:

$$P_m = C_m + xM_q$$

where P_m is particle mass, C_m is mass of the component particles, and xM_q is multiples of one of the mass quanta. For example:

Table 3 - Mass Calculations

	[Actual Mass]
P_m (π^0) = 68.760 (M^0) + 68.760 ($1M_{q-1}$) = 137.520 MeV	[134.9766 MeV]
P_m (π^c) = 70.087 (W^c Z^0) + 70.087 ($1M_{q-2}$) = 140.174 MeV	[139.570 MeV]
P_m (K^c) = 205.0636 (π^0 W^c) + 285.948 ($4M_{q-3}$) = 491.0116 MeV	[493.677 MeV]
P_m (K_L^0) = 210.541 (π^c W^c) + 285.948 ($4M_{q-3}$) = 496.489MeV	[497.614 MeV]
P_m (K_S^0) = 211.316 (μ^c μ^c) + 285.948 ($4M_{q-3}$) = 497.264 MeV	[497.614 MeV]
P_m (η^0) = 269.9532 (π^0 π^0) + 275.040 ($4M_{q-1}$) = 544.9932 MeV	
P_m (η^0) = 279.140 (π^c π^c) + 275.040 ($4M_{q-1}$) = 554.180 MeV	
Average 549.5866 MeV	[547.853 MeV]
P_m (ρ^0) = 562.437 (K^c M^0) + 214.461 ($3M_{q-3}$) = 776.898 MeV	[775.490 MeV]
P_m (ρ^c) = 569.101 (K^0 W^{*c}) + 206.280 ($3M_{q-1}$) = 775.381 MeV	[775.110 MeV]
P_m (ω^0) = 567.701 (K^0 W^c) + 214.461 ($3M_{q-3}$) = 782.162 MeV	[782.650 MeV]
P_m (p^+) = 316.974 (μ^+ μ^- μ^+) + 618.84 ($9M_{q-1}$) = 935.814 MeV	[938.2723 MeV]
P_m (n^0) = 388.461 ($\mu^+\mu^-\mu^+W^{*-}$) + 550.080 ($8M_{q-1}$) = 938.541 MeV	[939.5656 MeV]

When a particle collides with its anti-particle mutual annihilation occurs, resulting in the emission of pure energy. Similarly, when some particles, such as π^0 and η^0 decay, only photons with energy equivalent to the mass are produced. It was proposed above that one of the particles carrying mass is the hypothetical M^0, a 'pure mass' particle. The structure of M^0 is given as Z^0 $\underline{Z}^0$, being the product of 2 neutrino-antineutrino particles composed of $\upsilon\bar{\upsilon}, \bar{\upsilon}\upsilon$. If this formation is annihilated or decays it is proposed that the constituent neutrinos, $\bar{\upsilon}$ $\bar{\upsilon}$ υ υ, manifest not as separate Z^0 and $\underline{Z}^0$ but as γ (υ υ) and $\underline{\gamma}$ ($\bar{\upsilon}$ $\bar{\upsilon}$). This provides a mechanism to explain the connection between energy and mass as expressed by the well-known formula, $E = mc^2$.

In the proposed structure of particles set out in Table 2, there appears to be an anomaly in the structure of the neutral rho meson ($\rho^0 = K^+ M^0, K^- M^0$) and the omega meson ($\omega^0$ = K^0 W^+, K^0 W^-), in terms of both charge and spin. However, this is nullified because each has the mass quantum $3M_{q-3}$, equivalent to $W^{*+/-}$ $W^{*+/-}$ $W^{*+/}$, which provides a net charge to neutralise the charge of the particle components, and deliver the requisite spin as well.

It will be noted from the examples in Table 3 that the difference between the calculated mass and the actual mass varies from 2.665 MeV below (K^c) to 2.543 MeV (π^0) above the experimentally determined mass. However, the variation is within less than 1.0% of the actual mass in all instances, apart from π^0, where it is 1.88%. This variation may arise because of the dynamics involved in the composition of each particle and the calculation of mass using simple linear equations.

Weak interactions

Weak interactions are identified as being responsible for radioactive decay and changing quark flavours. The emission of neutrinos and the exchange of Z and W gauge bosons are involved in weak interactions. However, as indicated earlier, it is proposed here that the W^{*c} and Z^0 are not gauge bosons but units that are involved in the formation of composite bound particles, that are then revealed in decays. For example, the neutron ($_{-1/2}n^0$) incorporates a proton ($_{+1/2}p^+$) and a W^{*-} and has a mass quantum of $8M_{q-1}$ (= 8 M^0). When a neutron decays, the proton and the W^{*-} are emitted. The W^{*-} component decays to an electron and anti-neutrino, carrying away a unit of spin, with most of the mass being retained by proton with a + charge, opposite spin to the neutron and a mass quantum of $9M_{q-1}$.

It will be noted that all bound state particles incorporate $W^{+/-}$, $W^{*+/-}$ and Z^0 as structural units, or are part of other structural units (e.g. pions). These clearly are involved in the transfer of charge, spin, and along with M^0, mass. Where interactions take place such units appear in particle decay and as components in the formation of new particles. When these units are in non-contact proximity or otherwise involved in some form of interaction, the mass and energy of the system changes. While new particles may be formed through decays or in new bound states, with changes in the binding energies, only the photon as a particle is unbound, and so according to this preon theory, it is the only gauge boson mediating these interactions.

Strong Interactions

This preon theory dispenses with quarks and hence the necessity for colour force. However, the distinction between the force responsible for the formation of bound state composite nucleons (protons and neutrons), usually characterised as being the colour force, and those acting up those nucleons when part of an atoms nucleus, the residual strong interaction/force (strong nuclear force), is significant in understanding strong interactions, as will become apparent.

This analysis of the nature of strong interactions begins by noting that the primary structure of the proton is identified as being a three-body bound state composite particle, μ^+ μ^- μ^+, with a $\upsilon^\#$ of 15, and having an alternative structure which may manifest in other interactions as $_0\pi^+$ e^+ $_0\pi^-$. The second observation to be made is that there are only four particles that do not decay, the neutrino, the photon, the electron and the proton. Setting aside the photon as being a force carrier and a boson, that leaves the other three particles, all fermions, that do not decay - the neutrino, the electron and the proton. The $\upsilon^{\#}$s of these are 1, 3 and 15 respectively. It would appear that it is possible bound state particles made up of three identical types of particle are very tightly bound and highly stable. One might expect, therefore, that a $\upsilon^{\#}$ 9 particle, comprising three electrons and/or positrons, should exist and be highly stable. But one does not. And yet the proton, made up of three muons, according to this conjecture, does. The proposed explanation for this is that a $\upsilon^{\#}$ 9 particle made of three electrons or positrons is not stable because of repulsion of the charges. Whatever configuration or electrons and positrons that could be considered, there would be at least two like charges that would repel each other. This dynamic could also present a problem for the proposed primary structure for the proton. However, one of the alternative forms of the muon is Z^0 e^+, $\underline{Z}^0$ e^-. Consequently, it is proposed that the proton consists of an electron and two positrons, buffered by the three neutral Z^0s. This is analogous to the nucleus, which consists of protons and neutrons. With stable lower mass nuclei there is a near equality of protons and neutrons, and without the near parity (or an excess) of neutrons the nucleus is unstable.

This proposed structure would, nevertheless, still contravene the Pauli Exclusion Principle. However, if it has a dual identity, the alternative structure, ${}_0\pi^+$ e^+ ${}_0\pi^-$, does not contravene the Pauli Exclusion Principle and this may nullify the stricture.

In terms of the interactions/forces involved, the proton is clearly a very strongly bound composite particle. By dispensing with quarks and considering its structure as formulated here, this greatly simplifies the nature of interactions involving protons. Rather than 8 gluons, only one gauge boson is required, the photon, which has the same characteristics as a gluon in terms of mass (zero), charge (zero) and spin (1).

Residual Strong Interactions/Strong Nuclear Force

The interactions/force involved in binding the nucleus, the residual strong interaction/strong nuclear force, is qualitatively different from the strong interaction involved in the formation of proton and the neutron as bound state composite particles. The residual strong interaction/strong nuclear force is the interaction that takes place between these particles rather than the interaction that produces them. As a particle with a structure of μ^+ μ^- μ^+, the proton and the neutron (μ^+ μ^- μ^+ W^{*-}) the strong nuclear force could be characterised as a 'residual' resonance between the common constituents, analogous to van der Waals forces between the electromagnetic components of neutral atoms. Current models of nuclear dynamics involve the transmission of gluons in the form of virtual rho and pi mesons between the nucleons. However, a different explanation can be provided if the alternative structure of the proton, ${}_0\pi^+$ e^+ ${}_0\pi^-$ (and by extension ${}_0\pi^+$ e^+ ${}_0\pi^-$ W^{*-} for the neutron) is considered. In terms of the protons and neutrons, if this structure is the form that is involved in nuclear interactions, then they may simply be exchanging pions. Rho mesons may be involved as well in these exchanges as they are the lowest mass meson to incorporate the W^{*-},[23] which is also one of the constituents of the neutron.

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[23] It could be argued that if ${}_1\pi^c$ ($\upsilon^{\#}$ - 6) exists it would be the lowest mass meson, though the charged rho meson (ρ^c) is in effect a heavier version ($\upsilon^{\#}$ - 14) of the ${}_1\pi^+$.

Predictions

A number of predictions could be made as a result of the arguments laid out in this conjectural preon theory. The simplest is that there are W^c and M^0 particles, having masses in close agreement with those specified earlier. The existence of a vector charged pion (${}_1\pi^c$) is also an outcome consistent with the conjecture.

Conclusions

This paper has put forward a range of propositions arising from the conjectural preon theory as outlined. The preon theory and the proposition that followed have potentially significant implications for our understanding of the universe and the structure of matter. Some basic conclusions that arise from this work are:

- There is only one fundamental type of particle - the neutrino
- There are only two force carriers - the neutrino (gravity) and the photon (other interactions)
- That all known subatomic particles apart from the neutrino are bound state composite particles.
- The neutrino forms two primary bound state particles, the photon and the Z boson.
- Other particles that have charge and mass are composite particles formed either by addition of a neutrino or by combination of lower mass bound state particles.
- Direct interactions between bound state composite particles results in virtual and actual exchanges of bound state composite particles, or in a recombination of the constituent bound state composite particles.
- Where such exchanges or recombinations occur, energy and mass (or its equivalent) may be transferred, along with charge and spin.

Further Speculation

I conclude this paper with a number of speculative observations and proposals, as outlined below.

The first of these speculations is based on the observation that there may be a link between the maximum number of electrons filling electron shells, which are 2 (s), 6 (p), 10 (d), 14 (f) and 18 (g) and the $\upsilon^{\#}$s for the bosons - the photon and Z boson (2), pions (6) kaons (10), rho mesons and the omega meson (14) and vector kaons (18). This may be coincidental, it may be an outcome of the preon conjecture, or it may a manifestation of some form of fundamental quantisation, perhaps of space itself.

The second speculative proposal relates to the Big Bang. It has been conjectured here that neutrinos form primary bonds and gravity arises because of the resonance between those bonds. It is also known that when sufficient mass accumulates condensed matter states, such as neutron stars and black holes, form. If sufficient mass accumulates, approaching what is sometimes characterised as a singularity, it is possible the gravitational pressure becomes sufficient to break the bonds between the neutrinos. At that point gravity would break down and there would be a sudden and catastrophic release of all the neutrinos. This may be the origin of the Big Bang.

Given the hypothetical role of photons, as primary bound state particles, in time, as discussed earlier, as a final speculation it is suggested that the Arrow of Time may be due to the helicity of neutrinos.

References

Adamson, P. *et al.* MINOS Collaboration 2007 'Measurement of neutrino velocity with the MINOS detectors and NuMI beams'. *Physical Review D* 76:072005. (arXiv:0706.0437)

Berezinskii, V.S. 1966 ‘Pryce's theorem and the neutrino theory of light’. *Zh. Eksperim. I Teor. Fiz.* **51**:1374–1384., translated in *Soviet Physics JETP*, **24**: 927 (1967)]

Bergman, P.G. 1987 *The Riddle of Gravitation*. New York: Charles Scribner's Sons.

Cheng, T. 2005 *Relativity, Gravitation, and Cosmology*. Oxford: Oxford University Press.

de Broglie, L. 1932a ‘Sur une analogie entre l’électron de Dirac et l’onde électromagnétique’. *Compte Rendus de l'Académie des Sciences* 195:536-537.

de Broglie, L. 1932b ‘Sur le champ électomagnétique de l’onde lumineuse’. *Compte Rendus de l'Académie des Sciences* 195:862-864;

de Broglie, L. 1934 *Une Novelle Conception de la Lumiere*. Paris: Hermann et Cie.

Dolgov, A.D. and Smirnov, A.Yu. 2005 'Possible violation of the spin-statistics relation for neutrinos: cosmological and astrophysical consequences'. *Physics Letters B* 621:1-10. (arXiv:hep-ph/0501066v3)

Einstein, A. 1911 'Über den Einfluß der Schwerkraft auf die Ausbreitung des Lichtes' *Annalen der Physik* 4(35):898-908.

Einstein, A. 1955 *The Meaning of Relativity*. Princeton: Princeton University Press.

Greenberg, O.W. and Wightman, A.S. 1955 ‘Re-examination of the neutrino theory of light’. *Physical Review* 99: 675 A.

Harari, H. 1979 'A schematic model of quarks and leptons'. *Physics Letters B* 86(1):83-86. (doi:10.1016/0370-2693(79)90626-9)

Harari, H. and Sieberg, N. 1982 'The rishon model'. *Nuclear Physics B* 204:141-167.

Jain, J.K. 1989 'Composite fermion approach for fractional quantum Hall effect.' *Physical Review Letters* 63 (2):199-202. (10.1103/PhysRevLett.63.199)

Jain, J.K. 2007 *Composite Fermions*. Cambridge: Cambridge University Press.

Kronig, R.d.L. 1936 'On a relativistically invariant formulation of the neutrino theory of light'. *Physica* 3(10):1120–1132. doi:10.1016/S0031-8914(36)80340-1.

Ne'eman, Y. 1979 'Irreducible gauge theory of a consolidated Weinberg-Salam model'. *Physics Letters B* 81(2):190–194. (doi:10.1016/0370-2693(79)90521-5)

Pati, J.C. and Salam, A. 1974 'Lepton number as the fourth 'color''. *Physical Review D* 10:275-289. (doi:10.1103/PhysRevD.10.275)

Perkins, W.A. 1965. 'Neutrino theory of photons'. *Physical Review* 137(5B):1291-1301. (doi:10.1103/PhysRev.137.B1291.)
Perkins, W.A. 1972 'Statistics of a composite photon formed of two fermions'. *Physical Review D* 5(6):1375–1384. doi:10.1103/PhysRevD.5.1375.
Perkins, W.A. 2008 'Pion-muon asymmetry revisited'. *International Journal of Theoretical Physics* 47(5):1316-1321. (10.1007/s10773-007-9566-0)
Pryce, M.H.L. 1938 'On the neutrino theory of light'. *Proceedings of the Royal Society* (London) A165: 247–271.
Shupe, M. 1979 'A composite model of quarks and leptons.' *Physic Letters B* 86(1):87-92.
Tsui, D.C., Stormer, H.L. and Gossard, A.C. 1982 'Two-dimensional magnetotransport in the extreme quantum limit.' *Physical Review Letters* 48(22):1559-1562. (doi:10.1103/PhysRevLett.48.1559)
Yershov, V.N. 2005 'Equilibrium configurations of tripolar charges'. *Few-Body Systems* 37 (1–2):79–106.
(arXiv:physics/0609185; doi:10.1007/s00601-004-0070-2)
Zenczykowski, P. 2008 'The Harari–Shupe preon model and nonrelativistic quantum phase space.' *Physics Letters B* 660(5):567–572. doi:10.1016/j.physletb.2008.01.045.