



A Complete Set of 22 Elementary Particles for an Expanded Standard Model (Version 2)

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Abstract

Our best understanding of how the known elementary particles and three of the forces (electromagnetic, weak and strong) are related to each other and explain the nature and behavior of matter is encapsulated in the Standard Model of particle physics. However, the Standard Model is incomplete as it fails to explain a number of phenomena. The Standard Model relies on a set of elementary particles which are also known to be incomplete. This paper presents a complete set of elementary particles to serve as the basis for an expanded Standard Model. The set of elementary particles contains all known elementary particles and 6 extra elementary particles which relate only to mass and gravity. They include the graviton, a Higgs-like particle (but 6.13 times heavier than the Higgs), 2 heavy dark matter particles and 2 light dark matter particles for a total of 22 elementary particles (the W and Z bosons are seen as manifestations of a single entity).

Subject Areas

Theoretical Physics, Particle Physics

Keywords

Elementary Particles, Standard Model, Beyond the Standard Model, Dark Matter Particles, Dark, Higgs

1. Introduction

It is widely accepted by the scientific community that everything in the universe is made from several elementary particles and is governed by four fundamental forces. Our best understanding of how the known elementary particles and three of the fundamental forces (electromagnetic, weak and strong) are related to each other and explain the nature and behavior of matter is encapsulated in the Stan-

Standard Model of particle physics.

As successful as the Standard Model is, we know it's incomplete in several areas. For example: the Standard Model does not incorporate gravity, it does not deal with dark matter, it does not explain why there are three levels of matter particles and it fails to provide a relationship between at least 18 parameters [1] that must be derived experimentally; including the masses of most of the particles.

As the Large Hadron Collider (LHC) continues to produce more results we expect to see physics expand beyond the Standard Model. In fact, in late 2015 it's possible that a new particle in the 750 GeV range was observed [2] [3]. Many proposals for models beyond the Standard Model, whether extensions (like supersymmetry) or new concepts (like string theory with its extra dimensions), have been proposed.

As the Standard Model sheds little light on the elementary particle masses, we have little guidance as to where to look for new particles.

This paper proposes a model for a complete set of elementary particles, including those not dealt with by the Standard Model. The Standard Model has 12 matter particles (that come in three generations of 6 quarks and 6 leptons), 4 force carrier particles (2 for the weak force), and the Higgs. The proposed set of elementary particles presented in this paper includes these particles, in addition to 6 other particles that relate only to mass and gravity. These 6 other particles include: the graviton (thought to be the force carrier for gravity), a Higgs-like particle (but 6.13 times heavier than the Higgs), 2 heavy dark matter particles and 2 light dark matter particles, for a total of 22 particles (as will be shown in this proposed model the W and Z bosons governing the weak interaction are seen as manifestations of a single entity).

The complete set of 22 elementary particles is derived from a manuscript [4] dating back to at least the first century, which categorizes all building blocks of the universe in detail. This manuscript is purely a theoretical construct, as opposed to the Standard Model which has been built by advancing theories and confirming them experimentally.

The author understands that it is unacceptable to use these kinds of manuscripts in order to motivate new theories. Nonetheless, the manuscript does shed much light on what is already known and does predict additional particles and their masses not found in the Standard Model. In addition, most of the extensions of the Standard Model are motivated by a belief in unification and simplicity, also without any scientific source; but in fact, in agreement with the source text of the manuscript relied upon herein.

2. The Complete Set of 22 Elementary Particles

The complete set of 22 elementary particles in the proposed model is shown in **Figure 1**. In the manuscript [5] the model is derived by interconnecting 10 channels, which are arranged in three columns, in all possible ways. These connections naturally lead to 3 horizontal connections, 12 diagonal connections and

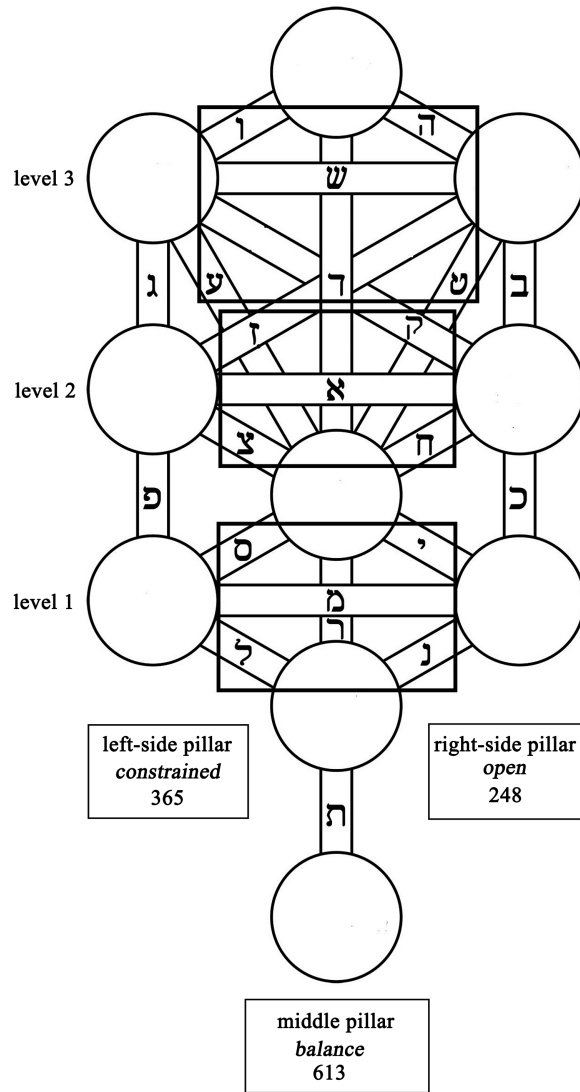


Figure 1. The complete set of 22 elementary particles.

7 vertical connections. In total, the connections represent the 22 building blocks of nature (which correspond to the 22 Hebrew letters).

Figure 1 consists of 10 circles connected by 22 lines. Each of the 22 lines individually represent an elementary particle—denoted by a Hebrew letter. Each Hebrew letter has a name, symbol, value and a simple value as indicated in **Table 1**. The value denotes the number that each Hebrew letter represents, and the simple value denotes the sequential number of the letter in the Hebrew alphabet.

We note the following characteristics of the 22-particle proposed model depicted in **Figure 1**:

- 1) There are 3 letters along horizontal lines (horizontal particles), there are 12 letters along diagonal lines (diagonal particles), and there are 7 letters along vertical lines (vertical particles).
- 2) Horizontal particles. The 3 horizontal particles [6] carry the 3 non-gravitational forces: a) the Shin ψ , the electromagnetic; b) the Aleph \aleph , the weak; and c) the

Table 1. Hebrew letter names and values.

Name	Alef	Bet	Gimel	Dalet	Hey	Vav	Zayin	Het
Symbol	א	ב	ג	ד	ה	ו	ז	ח
Value	1	2	3	4	5	6	7	8
Simple value	1	2	3	4	5	6	7	8
Name	Tet	Yud	Kaf	Lamed	Mem	Nun	Samesh	Ayin
Symbol	ט	י	כ	ל	מ	נ	ס	ע
Value	9	10	20	30	40	50	60	70
Simple value	9	10	11	12	13	14	15	16
Name	Pe	Tzadi	Kuf	Resh	Shin	Tav		
Symbol	פ	צ	ק	ר	ש	ת		
Value	80	90	100	200	300	400		
Simple value	17	18	19	20	21	22		

Mem מ, the strong force. These non-gravitational forces do not interact with the vertical particles, only with the diagonal particles. Note that the Aleph א is a composite of two letters (corresponding to the W and Z bosons) as will be explained in section 3, entitled *Letter Shapes and Particles*.

3) Diagonal particles. There are 12 diagonal particles [7] in 3 levels of 4 particles each, indicated within each of the dark boxes in **Figure 1**. At each level there are 2 particles on the left-side—associated with constraint and bound, and 2 on the right-side—associated with unconstraint. The particles on the left-side are the quarks at each of the 3 energy levels, and the particles on the right-side are the leptons at each of the three energy levels.

4) Vertical particles. There are 7 vertical particles [8] that emanate in 3 pillars. The middle pillar contains the mass and gravity related particles. At the bottom, the Tav ת is the carrier of the gravitational force [9] or graviton. The next particle upward, the Resh ר, is the Higgs, and the top particle, the Dalet ד, is a Higgs-like particle but heavier (note the physical similarity between the shapes of these letters). In the left-side pillar are the 2 dark matter particles. As is the case for the left-side diagonal particles, these particles are heavy and constrained. In the right-side pillar are 2 lighter unconstrained dark matter particles. Unlike quarks and leptons which come in three energy levels, dark matter particles come in only two energy levels. They occur between energy levels 1 and 2 and energy levels 2 and 3.

5) Horizontal and vertical axis are independent. Thus, vertical particles do not interact via horizontal particles, *i.e.*, via the 3 non-gravitational forces, they only interact with the force of gravity. Diagonal particles interact with horizontal and vertical forces, *i.e.*, all forces and also vertical mass particles in the middle pillar (Higgs and Higgs-like).

6) The right-side, left-side and middle pillars are associated with the pillar's numbers of 248, 365 and 613, respectively (these numbers correspond to the

positive biblical commandments, negative commandments and total commandments).¹

7) Each energy level has a particular scale factor which, when multiplied by the Hebrew letter value, determines the particle's mass, as will be shown in section 4, entitled *Particle Masses—Some Predictions*. a) To determine the scale factor of a higher energy level one multiplies the scale factor of the lower energy level by the associated pillar number then divides by 2, e.g., by 365/2 for the left-side pillar. b) To correlate scale factors at the lowest level on the right-side with the left-side pillars one simply multiplies the scale factor by the ratio of the pillar numbers; thus to go from the scale factor on the right-side pillar to the scale factor on the left-side pillar one multiplies by 365/248. c) To correlate the scale factors at the lowest level on the middle pillar with the right-side pillar one multiplies the right-side pillar lowest level scale factor by 40; the value of the letter Mem \aleph connecting the lowest levels.

8) Each Hebrew letter shape reveals an underlying reality and will be illustrated in section 3, entitled *Letter Shapes and Particles*.

9) Under this reality [10] the particles at the lowest level manifest eternally; they can't decay or be destroyed. But everything else made from them can and will decay. All particles with zero mass also exist forever because they don't experience time and can't decay. Although the higher-level particles are not eternal (thus decay), they are still out-of-nothing creations, are perfect, and have constant, changeless properties.

3. Letter Shapes and Particles

The Hebrew alphabet consists of 22 letters. Each Hebrew letter has 3 modalities; a pictogram, a letter and a number. Each of these modalities provides underlying information about it as a building block of nature. We examine the three horizontal force particles and their associated letter shapes, for illustration purposes.

1) Electromagnetic force: The Shin \aleph has 3 heads and is actually pronounced differently when a dot is placed over the rightmost or leftmost head. These two ways to pronounce the letter Shin \aleph correlate to polarizations of the photon.

2) The strong force: The Mem \aleph actually comes in 2 shapes—the 1st shape (shown in **Table 1**) is used when the letter Mem appears anywhere but at the end of the word. The 2nd Mem shape \aleph , (which is close to a simple square) is used when the letter Mem appears at the end of a word. Thus, one Mem \aleph consists of four lines (sides of a square) and the other Mem \aleph consists of 2 lines at the right and bottom and 2 modified lines at the top and left. In total the Mem consists of 8 components (6 identical and 2 slightly different). These 8 components correspond to the 8 gluons (6 of which have mathematically symmetrical characterizations).

3) The weak force: The Aleph \aleph is actually a composite of 3 letters; on the top

¹These numbers correspond to the number of commandments for the Israelites: 613 in total (or middle pillar) divided into 248 positive, e.g., give charity (associated with the right-side pillar), and 365 negative, e.g., do not kill (associated with the left-side pillar).

right and bottom left are 2 identical Yuds ך, and separating them is 1 diagonal Vav ן. The 2 Yuds clearly represent the $\pm W$ boson, and the Vav represents the Z boson.

4. Particle Masses—Some Predictions

The letter's numerical value is a measure of its energy and can thus be used to calculate the particle's mass. Measured particle masses versus predicted particle masses are illustrated in **Table 2(a)**.

Table 2. (a) Particle masses; (b) Massless particles.

(a)							
1	2	3	4	5	6	7	8
Particle	Letter	Letter value	Scale factor	Predicted mass (MeV/c ²)	Measured mass (MeV/c ²)	Measurement Error/range	Comment
up quark	lamed	30	0.0752	2.26	2.16	+0.49, -0.26	<1 sigma
down quark	samesh	60	0.0752	4.51	4.67	+0.48, -0.17	<1 sigma
charm quark	tzadi	90	13.7254	1235.28	1270.0	±20	<2.1 sigma
strange quark	zayin	7	13.7254	96.08	93.0	+11, -5	<1 sigma
top quark	ayin	70	2504.8800	175,341.60	172,760.0	±700	<3 sigma
bottom quark	vav	6	2504.8800	15,029.28	4180.0	+30, -20	Out of range
electron	yud	10	0.0511	0.51	0.51		Control
muon	kuf	100	1.0561	105.61	105.66	±0.0000024	Out of range
tau	hey	5	355.4411	1777.21	1776.86	±0.12	Out of range
dark 1	pe	80	6.9003	552.02			
dark 2	gimel	3	1259.3027	3777.91			
dark 3	kaf	20	0.5536	11.07			
dark 4	bet	2	178.2486	356.50			
Higgs boson	resh	200	626.4847	125,296.94	125,100.00	±140	<1.4 sigma
Higgs-like	dalet	4	192,017.5630	768,070.25			
Z boson	alef-yud	1000		91,187.60	91,187.60	±2.1	Control
W boson	alef-vav		0.8831	80,524.53	80,379.00	±12	Out of range
(b)							
1	2	3	4	5	6	Note	
Particle	Letter	Letter value	Scale factor	Predicted wavelength (m)	Calculated wavelength (m)		
photon	shin	300	2845.0734	1.616255E-35	1.616255E-35	Planck length	
gluon	mem	40	0.1263	2.731E-30			
graviton	tav	400	2.0440	1.687E-32			

Column 1 of **Table 2(a)** contains the particle names (where the author has provided a descriptive name for those particles still to be discovered). Columns 2 and 3 contain the corresponding Hebrew letters and their numerical values. Columns 4 and 5 contain a scale factor and the predicted particle masses which are obtained, and will be discussed below. The actual measured mass for each particle, with its error range, is represented in Columns 6 and 7. These mass values are obtained from the Particle Data Group 2020 update [11]. Finally, column 8 specifies whether predicted and actual mass agree within measurement error. The letter values and energy levels provide a relative relationship between the particles. However, to obtain a prediction in units familiar to us we need to use one control particle.

1) Matter particles: The electron, with its well-defined mass, is used as the control factor to compute the matter particle masses. The electron corresponds to the letter Yud י, whose value is 10. The scale factor for level 1 (lowest energy) on the right-side pillar is the electron mass divided by 10 or 0.0511. To obtain the scale factor for level 1 on the left-side pillar we multiply by the pillar ratio $365/248$ and obtain 0.0752. Then to obtain level 2 scale factor on the left-side pillar we multiply level 1 scale factor by $365/2$ and again to obtain the level 3 scale factor we multiply the level 2 scale factor by $365/2$. To obtain the predicted mass for any given particle we multiply the letter value by the scale factor by (Column 3 times Column 4). All results for quarks (rows above the electron on **Table 2**) are within measurement error except for the bottom quark. The muon and tau masses are computed in a similar way. However, an extra scale factor relating to cross letter ratios must be applied to obtain a fit to the data. At level 2 the scale factor is modified by dividing it by 6, the ratio of the letters Samesh ס to Yud י, and at the level 3 it is further modified by dividing by $7/19$, the ratio of the letters Zayin ז over Kuf כ (using their simple values as shown in **Table 1**). It is unclear why these modifications are required. The predicted lepton masses are very close to the measured masses but nonetheless outside the measurement error. The author has not worked on neutrino masses.

2) Dark particles: These same scale factors derived above are used to predict dark particle masses. Since these occur between energy levels the average of the scale factor of the level above and below are used. One obtains a heavy dark matter particle around 552 MeV and a light dark matter partner at about 11 MeV, with corresponding higher energy pairs at 3.78 GeV and 357 MeV. As expected, from the vertical particles' discussion in section 2, the left-side dark particles are heavier and the right-side dark particles are lighter.

3) Higgs-like particle: The scale factor for level 1 (lowest energy) on the right-side pillar is 0.0511. To obtain the scale factor for level 1 on the middle pillar we multiply by 40 and obtain 2.044. Then to obtain level 2 scale factor on the middle pillar we multiply level 1 scale factor by $613/2$ and again to obtain the level 3 scale factor we multiply the level 2 scale factor by $613/2$. To obtain the predicted mass for any given particle we multiply the letter value by the scale

factor (Column 3 times Column 4). The Higgs's (a level 2 particle) predicted mass is within measurement error. Its higher mass cousin, at exactly 6.13 times the Higgs mass or 768 GeV, compares well with preliminary observations of a potential particle at around 750 GeV (750 and 760 respectively for ATLAS and CMS) [2] [3].

4) Weak force particles: Intuitively the horizontal particles would be expected to have zero mass. We know, however, that the weak force particles have mass due to symmetry breaking. And one can see in **Figure 1** that level 2 is not as symmetric as level 1. The ratio of the components of the letter Aleph \aleph : Vav \aleph (6) over Yud \aleph (10); times the ratio of the pillars they connect (365/248) yields 0.883 for the ratio of the mass of W boson over the Z boson force particles. This ratio is used to predict the W boson mass from the Z boson mass. The predicted W boson mass is approximately correct but outside of measurement error.

In the case of massless particles, like the photon, one can still calculate an energy and since the particle is massless the energy can be converted to a wavelength. To obtain the scale factor for the photon we sum the right- and left-hand side scale factors for the level 3 which the photon connects and subtract the sum the right- and left-hand side scale factors for level 2 and 1. By multiplying this scale factor by the letter's numerical value, we obtain an energy (and thus a wavelength) for the photon. See **Table 2(b)** where columns 1 to 4 are identical to those in **Table 2(a)** but the next two columns, 5 and 6, do not represent masses in units of energy as in **Table 2(a)** but energy converted to wavelengths. The photon wavelength calculated must be some kind of fundamental wavelength derived from the model. The calculated wavelength is $1.616E-35$ m. This value is within about 0.01% of the Planck wavelength. The uncertainty in the calculation of the Planck wavelength is a result of the uncertainty in the gravitational constant and is about 1/10 smaller than the disagreement between the predicted value above (which makes no use of the gravitational constant) and the calculated value. However, the gravitational constant has been measured many ways and some of those results differ by 0.05% from the accepted value [12] and are consistent with a Planck length matching the one predicted herein. In the same manner a fundamental wavelength can be calculated for the gluon and the graviton as indicated in **Table 2(b)**. The calculated gluon's wavelength corresponds to an energy roughly 5 orders of magnitude less than the Planck energy, consistent with the GUT energy at which the strong force is thought to have separated from the other fundamental forces [13]. Gravity is thought to separate near the Planck energy [13]. However, the wavelength calculated above is about 2 orders of magnitude lower than the Planck energy and perhaps it represents when gravity separated.

5. Conclusion

The Standard Model is a triumph of physics. However, it is incomplete in several areas. In particular, it does not incorporate gravity, it does not deal with dark

matter particles, it does not explain why there are three levels of matter particles, and it fails to provide a relationship between the masses of most of the particles. An ancient manuscript contains a model for all building blocks of the physical world that is more complete. This model consists of 22 particles at 3 energy levels. It includes both matter particles, force particles and several gravity/mass particles which do not interact with the known forces other than with gravity. It also provides a means to calculate particle masses. Such a model sheds some light on where we might look to find more particles. Among the model's predictions are 1) a heavier Higgs-like particle at 6.13 times the Higgs mass, 2) heavy dark matter particles at about 0.55 and 3.8 GeV, and 3) light dark matter particles at around 11 and 357 MeV. The model also yields a photon wavelength very close to the Planck length derived using only the electron mass and without any knowledge of the gravitational constant.

Notes

The first version of this paper was published in May 2016. This revised version contains major changes:

- 1) In the original the experimental data obtained from the literature was as of 2015; in the revised version it is as of 2020. Many of the particles parameters have changed in that time and that has resulted in several changes to the main table in the paper **Table 2(a)** and the subsequent discussion of the table and references.
- 2) The new paper has been expanded to deal with three massless particles that the original work did not deal with. This has resulted in a new table **Table 2(b)** and a new paragraph discussing it.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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