The Five Moiety Model of the Composition of the Universe

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This document describes a model of the composition of all of the matter in the universe. With this model, the universe is comprised of only five separate types of components. These are called a moieties. Each moiety comprises two parts, which are called a particle and a field. It is the field which generates the force on the particle of another moiety. A field of a moiety is described by a potential function, which fully specifies the properties of the moiety. The subdivision of each subatomic particle into moieties is made in such a way so that the fields of one moiety type exerts forces on particles of the same moiety type, only. The model described herein is not at odds with any data which has been used to support the Standard Model. Furthermore, the Standard Model does not contradict anything said here about the moieties or their properties.

I. THE FIVE MOIETY MODEL

A model is presented herein to describe the makeup of the entire universe. In this model, it is stated that the universe comprises combinations of only five basic building blocks, which are called moieties.

II. THE DEFINITION OF A MOIETY

A moiety is an entity which comprises a particle component (called a *particle*) and a field component (called a *field*). Please notice the use of italics to indicate that these two words refer to the two components of a moiety. The use of the term without italics implies the conventional meaning.

There is no *particle* that is alone (without a *field*) Also, there is no *field* that is not associated with a *particle*.

In the Five Moiety Model, forces come from a *particle* interacting with *fields*, which are everywhere. There are no exchanges of particles to produce force. Also, in this model there are no virtual particles. The *fields* of one moiety type do not act on *particles* of a different moiety type.

The entire universe is composed of protons, neutrons, electrons, neutrinos and their anti-particle counterparts. In addition, there are photons. These are all built out of an admixture of moieties.

III. MOIETY *FIELDS* AND POTENTIAL FUNCTIONS

It is the *field* of a moiety that gives rise to the forces exerted on all the other *particles* of the same moiety type. That is to say, The *field* of one moiety type exerts forces on *particles* of the same moiety type, only.

The *field* of one moiety type at any point in space is the sum of all of the *fields* of all of the other moieties of the same moiety type.

The *field*s of all of the moieties are enough to explain all of the forces in the universe.

A force and potential differences are measurable in experiments. However, a potential, per se, is not measurable. A potential is described by a mathematical function that, in most cases, is not unique. Nevertheless, putting forth an expression for a potential gives us the ability to calculate the value of the force, even though we are not able to measure the value of the potential. The potential functions define and describes the *fields* in the discussions, below.

Potential functions referred to by the symbol, V, are single valued, differentiable, except perhaps at isolated points, and have no singularities.

The *field* of each of the moieties is of infinite extent in space. In other words, the *field* associated with each *particle* will extend over an infinite distance, and in all directions. It follows that there is no point in the universe at which a *field* does not exist.

For the purposes of discussion, let us say that the distance from the center of a particle is divided into two regions, from r=0 to roughly the size of a large molecule (called 'subatomic'), and that beyond the subatomic region (called 'classical').

It will be interesting to see whether or not the *field* potentials can not be specified, at subatomic distances, to explain the Strong and Weak forces of conventional wisdom.

As *particles* move in space, the changes in the *fields* propagate at the speed of light. Proper relativistic properties of the moieties is assumed. Relativistic corrections to the potential functions are given by: Jefimenko's equations.

The equations that are given in the following paragraphs to describe potential functions of the moieties are correct for the classical range of distances, only. For subatomic distances, the potential functions are not correct. These must be replaced with other forms. The nature of the potentials at subatomic distances are discussed in section XI.

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IV. MOIETY *PARTICLES*

A *particle* is a highly localized region in space that may possess the attributes of mass, charge, spin and perhaps other things. The *particle* of each of the moieties is not an entity that is localized to a point. Rather, it must be described by a probability distribution function (wave function) and delt with using techniques of quantum mechanics.

Nevertheless, for the purposes of this discussion, the *particle* may be viewed as a small (but finite) diameter sphere containing a uniform plasma like stuff which is peculiar to the moiety type.

V. MOIETY TYPES

There are five types of moieties. These are the charge-moiety, the mass-moiety, photon-moiety, the spin-moiety, and the neutrino-moiety.

The elementary particles of current wisdom, e.g., the electron, the proton, the neutron, the neutrinos and the photons (or quarks and the gluon instead of protons and neutrons, if one prefers), are each built of a combination of moieties. Stern selection rules dictate that there are only certain values of the attributes of the *particle*s that may exist. Furthermore, only specific combinations of moieties may make up the elementary particles (and higher combinations) of the Standard Model.

VI. THE CHARGE-MOIETY

The charge-moiety comprises two parts: the charge-moiety *particle* and the charge-moiety *field*. The charge-moiety has a field which is both scalar and vector.

The vector portion of the charge-moiety *field* is called a vector potential. The charge moiety scalar potential and vector potential express themselves in two familiar ways: an electric field and a magnetic field. Some rather straightforward equations containing the scalar potential and the vector potential are used to specify the fields which were considered conventional before the development of quantum mechanics.

The electric and magnetic fields, **E** and **B**, are specified by the scalar potential ϕ, and the vector potential, **A**. [1]

$$\mathbf{B} = \nabla \times \mathbf{A} \tag{1}$$

$$\mathbf{E} = -\nabla\phi - \frac{\partial \mathbf{A}}{\partial t} \tag{2}$$

The force, **F**, on a charge, q, moving with velocity, **v**, is given in terms of the electric field, **E**, and the magnetic field, **B**. by

$$\mathbf{F} = q(\mathbf{E} + \mathbf{v} \times \mathbf{B}) \tag{3}$$

Usually, however the expression for the force is given for a large number of charges, that is, in terms of a charge density ρ and a current density, **J**, thus:

$$\mathbf{F} = \rho(\mathbf{E} + \mathbf{J} \times \mathbf{B}) \tag{4}$$

From this, Oliver Heaviside was able to render Maxwell's equations as follows:

$$\nabla \times \mathbf{B} - \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t} = \frac{4\pi}{c}\mathbf{J} \tag{5}$$

$$\nabla \times \mathbf{E} + \frac{1}{c}\frac{\partial \mathbf{B}}{\partial t} = \mathbf{0} \tag{6}$$

$$\nabla \cdot \mathbf{B} = 0 \tag{7}$$

$$\nabla \cdot \mathbf{E} = 4\pi\rho \tag{8}$$

The electromagnetic Poynting's vector is given by:

$$\mathbf{P} = \frac{1}{\mu_0}\mathbf{B} \times \mathbf{E} \tag{9}$$

The value of the total electric field at a point in space and the value of the total magnetic field at a point are the vector sum of the *fields* of all of the other charge-moieties.

The electric and magnetic fields are entirely specified by the scalar and vector potentials. So, we may now, in turn, specify the force exerted on a particle. These equations are obeyed completely by the scalar potential and the vector potential of the charge-moiety *fields*.

When an electric field and a magnetic field are specified by a scalar potential, ϕ, and a vector potential **A**, another pair of potential functions can be generated that produce identically the same electric and magnetic fields. This is is acomplished by what is called a gauge transformation. So, given an arbitrary, but reasonably behaved function, ψ, a new pair of potential functions are given by the following:

$$\phi \to \phi + \frac{\partial \psi}{\partial t} \tag{10}$$

and

$$\mathbf{A} \to \mathbf{A} - \nabla\psi \tag{11}$$

.

Nevertheless, The scalar and vector potentials must obey the following:

$$\nabla \cdot \mathbf{A} + \epsilon\mu\frac{\partial \phi}{\partial t} = 0 \tag{12}$$

$$\nabla^2\mathbf{A} - \epsilon\mu\frac{\partial^2 \mathbf{A}}{\partial t^2} = -\mu\mathbf{J} \tag{13}$$

$$\nabla^2\phi - \epsilon\mu\frac{\partial^2 \phi}{\partial t^2} = \frac{-\rho}{\epsilon} \tag{14}$$

All of the above assumes that the charge velocities are much less than the velocity of light. If this is not true, relativity must be taken into account.

VII. THE MASS-MOIETY

The mass-moiety comprises two parts: the mass-moiety *particle* and the mass-moiety *field*. Like the charge-moiety, the mass-moiety has a field which is both scalar and vector.

The *fields* associated with the mass-moiety behave in a manner similar to that of the *fields* of the charge-moiety, except that their strengths(forces on the *particle*) are much less than that of the charge-moiety.

The vector portion of the mass-moiety *field* is also called a vector potential. The mass-moiety scalar potential and vector potential express themselves in two ways: a gravitational field and a cogravitational field. Some rather straightforward equations containing the scalar potential and the vector potential are used to specify the fields which were considered conventional before the development of quantum mechanics.

The gravitational field,$\mathbf{g}$, and the co-gravitational field, $\mathbf{K}$, are specified by the scalar potential ϕ, and the vector potential, $\mathbf{A}$. These two potential functions are different from the two potential functions of the charge-moiety, but the forms of the equations are the same. [2]

These are given by:

$$\mathbf{K} = \nabla \times \mathbf{A} \tag{15}$$

and

$$\mathbf{g} = -\nabla\phi - \frac{\partial \mathbf{A}}{\partial t} \tag{16}$$

The force, $\mathbf{F}$, on a mass, m, moving with velocity, $\mathbf{v}$, is given in terms of the gravitational field, $\mathbf{g}$, and the cogravitational field, $\mathbf{K}$. by

$$\mathbf{F} = m(\mathbf{g} + \mathbf{v} \times \mathbf{K}) \tag{17}$$

Usually, however the expression for the force is given for a large number of masses, that is, in terms of a mass density ρ and a current density, $\mathbf{J}$, thus:

$$\mathbf{F} = \rho(\mathbf{g} + \mathbf{J} \times \mathbf{K}) \tag{18}$$

As with the charge-moiety potential functions, it may be stated that the equations can be rendered as follows:

$$\nabla \times \mathbf{K} - \frac{1}{c^2}\frac{\partial \mathbf{g}}{\partial t} = -\frac{4\pi G}{c^2}\mathbf{J} \tag{19}$$

$$\nabla \times \mathbf{g} + \frac{\partial \mathbf{K}}{\partial t} = \mathbf{0} \tag{20}$$

$$\nabla \cdot \mathbf{K} = 0 \tag{21}$$

$$\nabla \cdot \mathbf{g} = -4\pi G\rho \tag{22}$$

The gravitational Poynting's vector is given by:

$$\mathbf{P} = \frac{c^2}{4\pi G}\mathbf{K} \times \mathbf{g} \tag{23}$$

This treatment of gravity was first reported by Oliver Heaviside in 1893. [3] [4] The value of the total gravitational field at a point in space and the value of the total cogravitational field at a point are the vector sum of the *fields* of all of the other mass-moieties. The gravitational and cogravitational fields are entirely specified by the scalar and vector potentials. So, we may now, in turn, specify the force exerted on a *particle*. These equations are obeyed completely by the scalar potential and the vector potential of the mass-moiety *fields*.

When a gravitational and a cogravitational field are specified by a given scalar potential function and a given vector potential function, another set of functions can be generated (by a gauge transformation) that produce identically the same gravitational and cogravitational fields.

The above assumes that the mass velocities are much less than the velocity of light. If this is not true, relativity must be taken into account. In the equations for the charge-moiety and the mass-moiety, some of the same symbols are used. Clearly, the symbols in the two moiety types refer to different things.

VIII. THE PHOTON-MOIETY

The photon is considered to be an alternate form of the mass-moiety. The photon is listed as a separate moiety type because it has an infinite lifetime.

The photon has no rest mass but it has a spin of 1. It has no charge. Its energy, E, is equal to Plank's constant, h, multiplied by the frequency of the photon. Its momentum is its energy, E, divided by the velocity of light, c.

It has been clearly shown that it is possible for an electron and its anti-particle counterpart, the positron, to meet in space and annihilate, causing both of the particles to disappear and be replaced by two photons of an energy equal to the sum of the energies of the two annihilated particles. Also, it should be noted that as the photon progresses, it is possible that another event can occur: the creation of a positron-electron pair.

The photon moves at the speed of light. However, when a photon is absorbed by a particle, the energy of the photon is converted into an increase in mass of the particle according to the famous equation $E = m\,c^2$. From this, we can see that one moiety type can be transformed into a different type.

IX. THE SPIN-MOIETY

The spin moiety has potential functions which are like those of a magnetic dipole. If $\mathbf{m}$ is the magnetic moment and as long as the distance, $\mathbf{r}$ is not too small, the vector potential is given by:

$$\mathbf{A} = \frac{\mu_0}{4\pi r^2}\frac{\mathbf{m}\times\mathbf{r}}{r} = \frac{\mu_0}{4\pi}\frac{\mathbf{m}\times\mathbf{r}}{r^3}. \tag{24}$$

From this, the field is given by:

$$\mathbf{B} = \nabla\times\mathbf{A} = \frac{\mu_0}{4\pi}\left(\frac{3\mathbf{r}(\mathbf{m}\cdot\mathbf{r})}{r^5} - \frac{\mathbf{m}}{r^3}\right). \tag{25}$$

A scalar potential is given by:

$$\phi = \frac{\mathbf{m}\cdot\mathbf{r}}{4\pi r^3}. \tag{26}$$

so that the field is given by:

$$\mathbf{H} = -\nabla\phi = \frac{1}{4\pi}\left(\frac{3\mathbf{r}(\mathbf{m}\cdot\mathbf{r})}{r^5} - \frac{\mathbf{m}}{r^3}\right) = \mathbf{B}/\mu_0. \tag{27}$$

X. THE NEUTRINO-MOIETY

It has been shown that the rest mass of the neutrino (as observed) is not zero, as was predicted by the Standard Model. Therefore, the neutrino does not move at precisely the speed of light; it actually moves somewhat more slowly.

The neutrino essentially does not interact with charge and the interaction with mass is almost completely negligible. Nevertheless, there are lots of them out there. It could well be that the sum of the rest masses of the neutrinos account to a great extent for the dark matter and dark energy that has been discussed recently so vigorously. The neutrino as observed is made up of a neutrino-moiety, a spin moiety, and a very small part which is a mass-moiety.

XI. *FIELDS* WITHIN *PARTICLES*

In all of the above equations for the potential functions of each moiety, it is assumed that the distances specified are all greater than the diameter of a large molecule. If not, quantum effects must be taken into account.

In Newton's theory of gravitation, the relative velocity of each particle is 0. So,

$$\mathbf{F} = q\mathbf{E} = -q\nabla\phi = \frac{qk}{r^2} \tag{28}$$

That is to say that

$$\phi = \frac{k}{r} \tag{29}$$

Notice that as r approaches 0, that $\mathbf{E}$, $\mathbf{F}$, and ϕ become infinite.

In the companion document, [5] The Golf Ball Problem , it is asserted that within a sphere of radius R with density ρ, that the potential function is given by:

$$\phi = -\frac{2}{3}km\pi\rho r^2 \tag{30}$$

and the magnitude of the force, $\mathbf{F}$ is given by:

$$F = \frac{4}{3}km\pi\rho r \tag{31}$$

All of this is to be used to approximate the potential functions within the moiety *particle*

There are also two results that are expected by the study of The Golf Ball Problem. The first is to see how quantum mechanical distribution functions can be viewed in a 'classical' way - to make it easier to visualize and to give a feeling of how a wave function can be thought of as existing at a point. The second reason is to show how the potential functions are non-Newtonian at subatomic distances.

XII. STABLE SUBATOMIC PARTICLES

There are only a few sub-atomic particles that have been observed that have an infinite mean lifetime. These are: the electron with a mass of 0.511, a charge of -1, and a spin of 1/2, the positron with a mass of 0.511, a charge of +1, and a spin of 1/2, the proton with a mass of 938, a charge of +1, and a spin of 1/2, the antiproton with a mass of 938, a charge of -1, and a spin of 1/2, the photon with a mass of 0, a charge of 0, and a spin of 1, the neutrino with a mass 0, a charge of 0, and a spin of 1/2.

Notice that the antielectron, the positron, has the same mass and spin of the electron, but the charge is of opposite sign. Also, notice that the antiproton has the same mass and spin of the proton, but the charge is of opposite sign.

Hereinafter, we will use the term stable subatomic particle to refer to them.

XIII. DARK MATTER

It has been said that there is not insufficient matter in the universe to hold the universe together. The force that is involved is that of gravity. The substance that is supposed to be the origin of this force to hold the universe together is called 'dark matter'.

Experiments are being designed and conducted at places like CERN that seek to observe and identify what is thought to be the dark matter particle. So far, these particles have not been found.

At the time of the 'Big Bang', all of the moieties that comprise the universe were created. For reasons that have not been explained, the different moieties have combined in quite specific proportions to form stable subatomic particles.. These proportions have been stated in a previous paragraph. A stable subatomic particle is comprised of very specific amounts of the different moieties.

When we look across the universe, we see an equal numbers of electrons and protons, the carriers of mass and charge. If the numbers were not equal, the universe would have a net charge and would tend to repel and expand.

It is possible that at the time of the Big Bang, the amount of the mass-moiety that was created exceeded its ability to bind with charge-moieties and spin-moieties to form stable particles. This excess mass could form subatomic particles which are different from the set of particles that are observed today. This particle would be composed primarily of the mass-moiety. These particles could well be the particle of the Dark Matter.

It should be noted that this author does not believe that an individual mass-moiety or an individual charge-moiety will ever be observed experimentally. This is also the case with individual quarks and gluons.

XIV. FUNDAMENTAL PARTICLES

The issue at the moment to define the term "fundamental particle" and what is considered "fundamental".

Injecting huge quantities of energy into a particle through high speed collisions probably allows the fundamental particle to be elevated to an allowed high energy form in an eigenstate, that is interpreted as a new particle.

There are particles in the Standard Model, e.g., the tau lepton and the muon that fall into this category. It can be claimed that these two particles are just excited states of the electron by stating that the higher mass of these particles is the excess energy over that of an electron at rest. The "fundamental particles" that have been discovered in the past few decades could be what Dr. Richard Feynman called "resonances" [6]. Remember that the mean-lifetimes of almost all of these new "particles" is less than 10^{-20} seconds. During this time, a photon moves a distance of $3 * 10^{-12}$ meters! That is a very short time period. Perhaps, as Feynman points out, these are not particles at all.

All [7] subatomic particles of current wisdom can be broken into two categories: those with mean lifetimes greater than than 10^{-5}) seconds, (the electron, the proton, the neutron, the neutrinos, the photon and the anti-particles of members of this group) and the second group - with mean lifetimes shorter than 10^{-5} seconds.

It can be speculated that each member of the second group may be described as an excited state of one or several members of the first group.

If we were to watch the absorption of a photon by a proton, for that extremely short length of time when the photon has disappeared but there has not been sufficient time for the excited proton to decay into its final products, the huge energy of the photon is viewed as mass. This says that our camera which is watching this event would see (for a very short time) a particle with a much greater mass than an isolated proton.

The heavy particles of the second category can be explained in this way. The mass of the 'particles' is a storage vehicle for the excess energy of the collision, before the excited proton has a chance to decay.

[8] The Collision of Two Protons more fully explains some of the arguments given above.

XV. THE BONDING OF A PROTON AND A NEUTRON

One of the four forces employed by the The Standard Model is the Strong Force. It is said that this force that creates the bond of a proton and a neutron. The proton exhibits an infinite mean lifetime. But, the isolated neutron does not - it has a mean lifetime of 880 seconds. Yet, when a proton bonds with the neutron, the result is as stable as the proton, itself. The Strong force is given the credit for this bonding.

According to the Five Moiety Model, a proton is an admixture of a mass moiety, a charge moiety with a positive value, a spin moiety and perhaps other things. The same is true for the neutron except that the charge is a sum of two charge moieties, one with a positive value and one with a negative value. This means that there is no effective force existing between the proton and the neutron caused by charge. Both the proton and neutron have mass. So, it can be asserted that the total force between the two particles is due almost entirely by mass.

The shape of the potentials of the two masses, according to the discussion in paragraphs above, explains how the two particles can be bound.

This is the same action as the Strong Force of the Standard Model.

XVI. THE MAJOR DIFFERENCES BETWEEN THIS MODEL AND CURRENT WISDOM

The Standard Model deals only with the electromagnetic forces as well as strong and weak nuclear forces. It does not deal with the *fields* of the mass-moiety. The Standard Model does not include considerations of gravity. The Five Moiety Model does.

The Five Moiety Model constructs the entire universe out of only five building blocks, the moieties which are described above. Unlike the Five Moiety Model, the Standard Model claims many fundamental particles.

Einstein (and others) would consider space with fields but with no particles. In the Five Moiety Model, this is never a realistic situation. If a space has fields, there are companion particles, somewhere. In the Five Moiety Model, force is caused by a *field.* It is not caused by the exchange of two particles as is done in the Standard Model.

In the late 1960s, theoretical physicists ran into serious problems trying to calculate the "self energy" of an electron bathed in the field that it, itself, generated with its charge. Many things were tried in this calculation. The integrals which were derived were found to be infinite in value. Clearly, there was something wrong. Renormalization, second quantization, etc. were chosen to explain why the values were infinite, without really satisfying results. The Five Moiety Model states that the *fields* of the electron is an intrinsic part of the moieties that make up the electron. The *fields* and *particles* are indivisible. There is no "self-energy". The potentials at sub-atomic distances are not Newtonian.

XVII. A NEW PARADIGM

Research efforts in the future could be concerned with determining the properties of the *fields* and *particles* of the five moieties and determining the selection rules that determine the amounts of each moiety that comprise each particle. Every particle that has been observed is made up of an admixture of the five moieties. For instance, the neutrinos, as we know them, are each comprised of the neutrino moiety, plus a spin moiety, plus just a small trace of a mass moiety (there is no charge moiety present)

If we can now present the concept of a "unit" of a moiety, we can express the makeup of a particle as the sum of unit moieties multiplied by an occupation number. The occupation number expresses the measure of the 'amount' of a unit moiety that is present in the particle. The potential functions of mass and charge have been studied extensively and are very well understood. But this is true only over the classical range of distances. This document presents a starting point for specifying the nature of these functions at sub-atomic distances. Clearly improvements in this area are required in the future. Clearly, we know nothing about the potential of the neutrino moiety and very little of the potential function of the photon.

What must be understood is that the force experienced by a potential of one moiety is the same as it is in all particles. When experiments are conducted to determine the nature of a potential function of a moiety, then the results would apply to all moieties of the same type, no matter in what particle it is found.

Following the paths described above might well produce a new paradigm.

XVIII. ACKNOWLEDGMENTS

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[1] The following eleven equations can be found in any textbook covering classical electromagnetic theory. A summary may be found in O. D. Jefimenko, *Causality Electromagnetic Induction and Gravitation* (Electrit Scientific, Star City, 2000) pp. 101-105.

[2] O. D. Jefimenko, *Causality Electromagnetic Induction and Gravitation* (Electrit Scientific, Star City, 2000) pp. 101-105.

[3] Oliver Heaviside *Part I, The Electrician*, 31 281-282 (1893).

[4] Oliver Heaviside *Part II, The Electrician*, 31 359 (1893).

[5] Http://www.johnletcher.com/mygolfball.htm.

[6] Richard Feynman *Lectures on Physics* Volume 1 Chapter 23.

[7] Http://www.johnletcher.com/mytable.pdf.

[8] Http://www.johnletcher.com/myprotons.htm.