

# Revolutionary Ball Light and Matter Theory

by

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25/11/2018

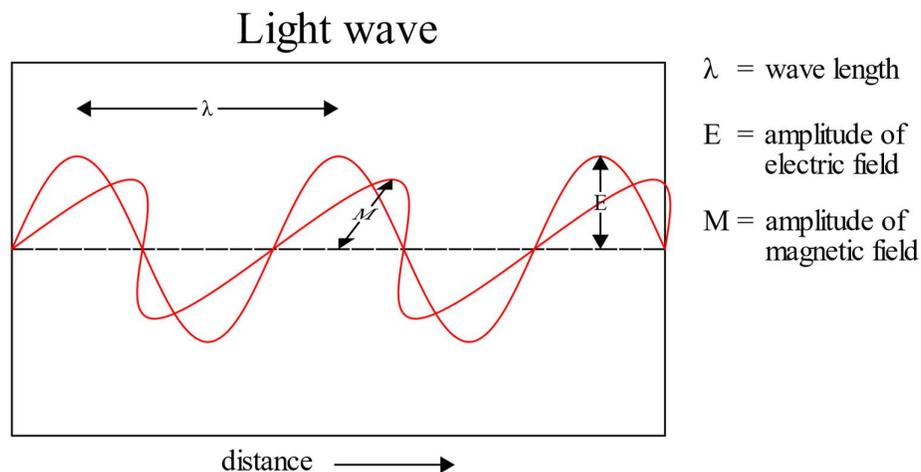
## Abstract

A model is provided for light and the structure of all matter which explains the quantisation of light and from which both the fine structure constant and Planck's constant are derived from properties of electromagnetism. This theory unites all forces of physics showing how mass is just electrical and magnetic field energy and quantum phenomena come from resonance states of electromagnetism. The implications of the theory are explained and include dark matter, the absence of antimatter, dark energy and black hole evaporation.

## Light, edisks and mdisks

Electromagnetic waves and classical electromagnetism are not the same thing as light. Light travels in straight lines, whereas electromagnetic waves spread out. Light is self-propagating and needs no medium.

The standard picture of light taught is like this:



This cannot be correct, because the energy has disappeared along the path. Both electric and magnetic waves store energy. What is happening in waves of electromagnetism, perhaps a bit harder to draw, is that with an increase of amplitude of E field you get a circulation of B field and vice versa. It does not travel as waves as shown in this above picture.

Rather than thinking of light as some sort of plane wave, we need to think instead of a rotation of an E field with constant acceleration of the E field vector into the centre. Let us call this disk of rotating electric field an **edisk**.

As with any accelerating electric field there is a circulating magnetic field orthogonal the rotating edisk. For short hand we will call this an **mdisk**.

In light therefore, we get a model of a constantly accelerating E field vector and a constantly accelerating B field vector. Both rotate such that the fields travel around their respective disks at the speed of light c with radius r and angular velocity  $\omega$ .

$$c = r\omega$$

For light this central acceleration with a single dipole vector of E field will only be possible if the ball of light is travelling. It spins around its edge like a rolling marble. There is constant acceleration into the middle and that means the centre of the ball of light will move at the speed of light. The edge on which it rolls will always be stationary. The edge on the opposite side will move at twice the speed of light relative to the surroundings through which it is passing.

Light could roll on any edge edisk or mdisk or somewhere in between, this accounts for the different kinds of light polarisation, planar and circular as well as so called super position of states, which is just rolling on somewhere between just an edisk edge and an mdisk edge.

A photon as a ball of light is essentially a resonance of electrical and magnetic fields.

### Resonance condition for trapping light in a particle

We can visualise the edisk and its pair of mdisks as a system of clockwork cogs rotating at the same frequency. In the case of light, these cogs are the same size and so the only rotation is rolling like a marble. Such a resonance can however come stop moving if the rotation can be made to happen internally.

If one of the cogs were smaller than the other then it would rotate faster and move about the other internally. To reproduce the same pattern on each extremes of the separation of this cog's teeth and the other cog, we have a limitation on the circumference of these cogs. The larger cog that is constrained in circumference speed is the edisk. The mdisk could take any size though. Let us name the radius of the edisk as  $r_e$  and the radius of the mdisk as  $r_m$ . Then the condition of a repeating pattern is given by

#### Equation 1 Mdisk Size Limitation

$$r_e = (2n + 1)r_m$$

The value of n is a positive integer. The state n=0 is the condition of a photon described above. The condition n=1 is then the electron or positron. Other values should provide the basis for predicting excited states of essentially the same elementary particles. Muons and Tauons and an infinite set further excited states exist.

The ground state therefore of any particle with its lowest possible energy state has the condition where  $n = 0$  that  $r_e = 3r_m$

### Explanation of Mass and the Derivation of $E=mc^2$

The edisk electrical field vectors rotate at the speed of light c such that its angular velocity  $\omega$  is

$$\omega = \frac{c}{r_e}$$

Mass is produced by a density of energy as described in general relativity, we will see an example here. The electric field stores energy as does the magnetic field. If the electrical field has the time dependent form  $E(t) = E \sin(\omega t)$ , then its energy comes from the energy stored in an electrical field and is  $U = \frac{\epsilon E^2}{2} V$  where E is an energy density and V is a volume. This means that the energy of the electrical field has a time dependent form of  $U(t) = \epsilon V E^2 \sin^2(\omega t) / 2$ . Using the double angle formula, this is  $U(t) = \epsilon V E^2 (1 + \cos(2\omega t)) / 4$ . The same form applies to the energy density of the magnetic field which is proportional to  $B^2$ . From this consideration, we would say that the angular speed of the energy density is given by

$$\Omega = 2\omega$$

If this energy density is not confined to the point of the electric field – and it is not if it moves twice as fast, then we should consider it as a disk of mass. The inertia I of a disk of mass m and radius r is given by

$$I = \frac{mr^2}{2}$$

The rotational kinetic energy is given by the formula

$$U_{rot} = \frac{I\Omega^2}{2}$$

Putting these together for a disc at  $r = r_e$  we get

$$U_{rot} = \frac{\left(\frac{mr^2}{2}\right)(2\omega)^2}{2} = mr^2\omega^2 = mc^2$$

In this way we can see that mass comes from the rotational kinetic energy of the edisk and mdisks.

This rotation of energy at twice the speed of light probably has a connection to the spin ½ symmetry of fermions, but this needs further thought and is not the subject of this discussion.

### The Electron/Positron Model

As we say earlier the mdisks have a radius one third that of the edisk. The edisk stays the same radius. Now let us consider how the energy is made up inside the electron from its electromagnetic properties.

#### Edisk Electrostatic Potential Energy

Let us start with the electrostatic potential of an edisk of charge Q with potential in volts V

##### Equation 2 Electrostatic Potential Energy

$$U_{es} = QV = \frac{Q^2}{4\pi\epsilon_0} \int_{\infty}^r \frac{1}{r_e^2} dr = \frac{Q^2}{4\pi\epsilon_0 r_e} = \frac{Q^2 \omega}{4\pi\epsilon_0 c} = \frac{Q^2 f}{2\epsilon_0 c}$$

This component on its own has the energy frequency ratio of  $4.8352769 \times 10^{-3}$  which as a fraction of Planck's constant is exactly  $\alpha$  the fine structure constant. So, this gives a physical explanation of the fine structure:

*The fine structure constant is the fraction of electromagnetic potential energy held by a charged particle due to its electrostatic potential.*

Using the calculation above it comes to 137.0359992690360000

### Edisk Magnetic Field Potential Energy

Now let us consider the energy stored in the static magnetic field created by the edisk. The edisk is a point charge  $Q$  rotating at speed  $c$ . This forms a current loop allowing us to calculate the magnetic field energy using the formula for a current loop of area  $A$  in field  $B$  and with current  $I$ :

$$U_{ms} = IAB$$

The area  $A$  is given by

$$A = \pi r_e^2$$

The current  $I$  is given by

$$I = \frac{cQ}{2\pi r_e}$$

The magnetic field of a current loop is given by

$$B = \frac{\mu_0 I}{2r_e}$$

Bringing these terms together we calculate the magnetic field energy of the edisk within the current loop:

$$\begin{aligned} U_{loop} &= A \frac{\mu_0 I^2}{2r_e} = \frac{\mu_0 I (\pi r_e^2)}{2r_e} = \frac{\mu_0 I^2 \pi r_e}{2} = \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} \\ &= \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c^2}{2r} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c \omega}{2} = \frac{\mu_0 Q^2 c \omega}{8\pi} = \frac{\mu_0 Q^2 c 2\pi f}{8\pi} = \frac{\mu_0 Q^2 c f}{4} \end{aligned}$$

This gives the energy of the magnetic field within the current loop. This magnetic field energy is also outside the current loop and ultimately the same flux going through the loop in one direction comes back past the outside of the loop. This makes the total energy stored in magnetic energy due to the edisk to

$$U_{ms} = 2U_{loop} = \frac{\mu_0 Q^2 c f}{2}$$

Using equation 2 and substituting for the permeability and permittivity of free space

$$c^2 = 1/\mu_0 \epsilon_0$$

we can write the expression for all the edisk energy as

### Equation 3 The edisk Potential Energy

$$U_e = \frac{Q^2 f}{2\epsilon_0 c} + \frac{\mu_0 Q^2 c f}{2} = \mu_0 Q^2 c f$$

This shows that magnetic field energy and electrostatic potential of the edisk balance nicely.

### Intra-Mdisk Magnetic Dipole Coupling Energy

For the mdisk we can consider the circulating magnetic field as a set of infinitesimal magnetic dipoles that attract each other according to the magnetic dipole-dipole interaction given by the following formula where  $M^2$  is the sum of all magnetic moment dot products around the circle of magnetic field:

$$U = \frac{3\mu_0 M^2}{4\pi r^3}$$

In a photon we know that magnetic and electric field energies match and that  $r_m$  is equal to  $r_e$  so we can simply state that the energy of the n=0 state all else being equal is proportional to  $1/r^3$  and so when we go from n=0 to n=1 states the radius is 1/3 so the dipole coupling energy will be  $3^3$  times larger.

In a photon (n=0 case) there is only one mdisk with a radius  $r_e$  at the centre of the edisk. In the n=1 case, there are two smaller mdisks.

Given these considerations we can just write down the magnetic dipole coupling energy for the force across the diameter of both mdisks as

### Equation 4 The Inter-mdisk Dipole Energy

$$U_{m(intra)} = 2 \times 3^3 U_e = 54U_e$$

### Inter-Mdisk interaction Dipole Coupling Energy

There is also a dipole coupling magnetic energy between the two mdisks. This will depend on the separation of the mdisks within the edisk. This attractive force between the mdisks balances with an electric dipole interaction force from two opposing dipoles of two E fields accelerating into the centre.

We take the charge on each charge of each dipole to be equal to half that of the electron charge such that each E field vector / dipole contributes half of the electron charge.

The force for a parallel axis electric dipole dipole interaction is given by

$$F_e = \frac{6Q^2 d^2}{16\pi\epsilon_0 r^4}$$

Where r is the separation of the centres and d is the dipole length.

The force of the mdisk dipole interaction for the same separation is

$$F_m = \frac{\mu_0 M^2}{4\pi r^4}$$

Setting these forces equal we get

$$\frac{6Q^2 d^2}{16\pi\epsilon_0 r^4} = \frac{\mu_0 M^2}{4\pi r^4}$$

$$\frac{24d^2}{16} = \frac{\epsilon_0 \mu_0 M^2}{Q^2}$$

$$\frac{3d^2}{2} = \frac{\epsilon_0 \mu_0 M^2}{Q^2}$$

We know that

$$U_e = \frac{Q^2 f}{\epsilon_0 c}$$

And that

$$U_m = \frac{3\mu_0 M^2}{4\pi r_m^3} = 27U_e$$

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So,

$$\frac{\epsilon_0 \mu_0 M^2}{Q^2} = \frac{4\pi r_m^3 3^2 f}{c} = \frac{3d^2}{2}$$

We can substitute the following:

$$c = r_e \omega = 6\pi r_m f$$

$$\frac{4\pi r_m^3 3^2 f}{6\pi r_m f} = \frac{3d^2}{2}$$

$$\frac{4\pi r_m^2 3}{2\pi} = \frac{3d^2}{2}$$

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$$d = 2r_m$$

The dipole length d is also the separation of the disks, so plugging in the formula for an interaction potential.

$$U_i = \frac{3\mu_0 M^2}{4\pi (2r_m)^3} = \frac{U_m}{8}$$

This is half of the energy, per mdisk in regards to its opposite number– the other half being in the electric dipole interaction potential. This means the total energy of interaction between both mdisks and the dipole interaction energy is

*Equation 5 The Intra-mdisk Electric and magnetic Dipole Energy*

$$U_i = \frac{U_m}{2}$$

## Total Electromagnetic Energy of the Electron

Adding all the components for the edisk energies we have the equation for the edisk energy (equation 3)

$$U_e = \mu_0 Q^2 c f$$

We add this to the mdisk energies to give us the total energy of the electron or the positron:

$$U_{total} = U_{m(intra)} + U_i + U_e$$

$$U_{total} = 54U_e + \frac{27U_e}{2} + U_e$$

Bringing these together we see that the total energy of the electron is given by:

$$U = \frac{137}{2} \mu_0 Q^2 c f$$

Which gives us the equation that defines Planck's constant as:

*Equation 7 The definition of Planck's constant*

$$h = \frac{137}{2} \mu_0 Q^2 c$$

## Neutrino model

From the above description we can recognise that the two dipoles inside the electron and their two mdisks are actually neutrinos.

A neutrino is thus an electric dipole with an mdisk. When it is not confined being half of an electron together with its mirror image, the anti-neutrino, then it will be free – and must – roll along its mdisk keeping its acceleration into its centre. It will, due to its lack of rotational kinetic energy of the magnetic field that is now straightened out it has no mass. However, if the neutrino is confined it gains considerable weight – ½ that of an electron/positron.

## Antimatter

From this model of the electron / positron it can be seen that matter is made up of pairing matter and antimatter. An electron is not matter and a positron antimatter. They are both made up from matter and antimatter orbiting one another. Matter and antimatter do not annihilate on contact. Quite the opposite they are the building blocks for all matter.

## Dark Energy

The first particles to form in space will be from photon / photon collisions, it is likely that there is an effect such that when photons of the right energy to create electrons or protons when colliding with them, will generally prefer to copy with the same chirality – i.e. the same type of elementary particle will get created. This will lead to seeding of different areas of space with a predominance of either electrons or protons. The effect of this is vast reaches of space which are otherwise empty is a force for expanding the universe which comes from these charges all repelling one another.

### Beyond the electron / positron

When there are symmetric collisions then the result is the generation of matter and antimatter partners. Electrons colliding with each other would produce electrons and positrons. Positrons would not however annihilate with the first electron it found. Generally, they would be attracted by electrical charges and orbit closer and closer until a bond is formed creating two new neutrinos. A bond between a positron and an electron would put the edisks of each as orthogonal but occupying the same place. In this way the particle created would move from being a magnetic dipole to being a magnetic quadrupole. This neutral particle could then – under sufficiently density of other particles pick up another electron or positron due to magnetic attraction turning it into a magnetic hexapole. Proceeding in this fashion we get heavier and heavier particles until the energy gained by merging puts too much magnetic repulsion. This would appear to happen when we merge two hexapoles together to reach a particle with 12 magnetic poles, though it could be more(?). At this point it can save energy by kicking out one of its electrons or positrons. This is the decay of a neutron into a proton. In the case of antimatter regions of space this would be the kicking out of a positron and becoming an etron - as I would call them – an anti-proton. The reason it would kick out an electron rather than a positron would be that the neutron had a collision with an electron. In such asymmetric collisions the chirality (matter or anti matter) of the impacting particle ensures that the ejected one matches.

In this way all matter is built up to the point of electrons and protons. Neutrons are therefore dodecapoles and as such they are hard balls with many strong magnetic fields. The bind together in a face centred cubic packing in crystal like structures to form nuclei with layers of protons separated by layers of neutrons to optimise binding energy versus electrostatic repulsion. This has been described in some detail by Norman Cook, but with this theory, it can be put on a precise mathematical basis.

All these nuclear and particle properties could be calculated precisely with this theory. As such it explains away the need to talk about quarks and the strong nuclear force. It is just simple magnetism.

### Dark Matter

In regions of space where matter has sufficient density to have formed into atoms such as hydrogen, then matter and antimatter regions can come into contact with one another. When this happens the atomic nuclei bind together, and no longer constrained by the repulsion of electrostatic potential can build arbitrarily large agglomerations of matter leading to neutron stars. This matter would be electrically neutral and so have no orbiting electrons or positrons as magnetism would be the only force in play. This is dark matter.

### Black Holes

As we have seen all matter comes from neutrinos and ends after a life as matter with a particular chirality involving light and limited size nuclei – it becomes dark matter. That dark matter ends up in black holes, or more accurately it gets flattened onto the surface of a black hole. The black hole turns these balls of electro magnetic waves back into the simple waves rather than particles and emits them back into space. Wave – as opposed to particles transmit energy at twice the speed of light and that is why they eventually evaporate.

### Conclusions

The implications of this theory are profound and answer questions that have puzzled Physicists for decades. I contend that this theory gives the mechanisms to be able to predict with remarkable

accuracy the masses of particles of all kinds. The model of the electron as a charge spinning at the speed of light has already been shown to provide the driving potential that for Bohmian Mechanics and the pilot wave (<https://arxiv.org/pdf/1409.8271.pdf>) interpretation of quantum phenomena. With this paper I have shown a model that describes the structure of the electron in detail and have derived both the fine structure constant and Planck's constant in doing so.

“We built the heavens with Our strength and it is We who expand it.  
We spread out the earth – how well We smoothed it out  
And we made everything in pairs. That you may ponder.

Qur'an 51:47

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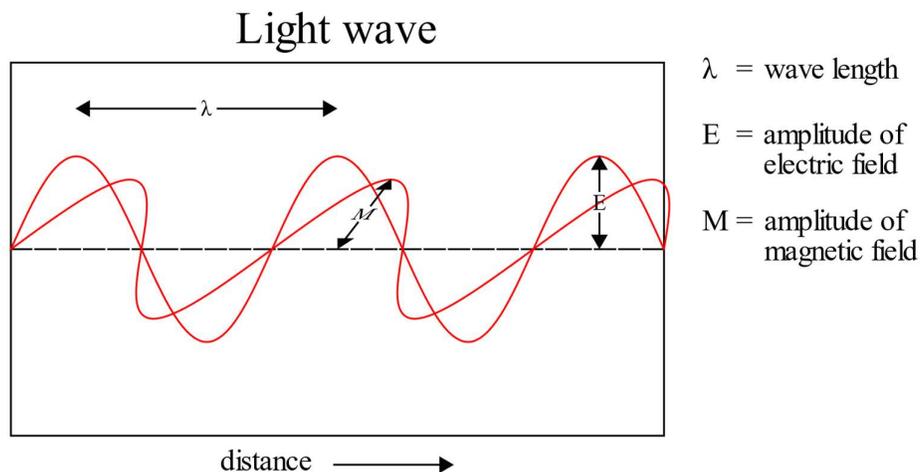
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The value of n is a positive integer. The state n=0 is the condition of a photon described above. The condition n=1 is then the electron or positron. Other values should provide the basis for predicting excited states of essentially the same elementary particles. Muons and Tauons and an infinite set further excited states exist.

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$$\frac{3d^2}{2} = \frac{\epsilon_0 \mu_0 M^2}{Q^2}$$

We know that

$$U_e = \frac{Q^2 f}{\epsilon_0 c}$$

And that

$$U_m = \frac{3\mu_0 M^2}{4\pi r_m^3} = 27U_e$$

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So,

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We can substitute the following:

$$c = r_e \omega = 6\pi r_m f$$

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The dipole length d is also the separation of the disks, so plugging in the formula for an interaction potential.

$$U_i = \frac{3\mu_0 M^2}{4\pi (2r_m)^3} = \frac{U_m}{8}$$

This is half of the energy, per mdisk in regards to its opposite number– the other half being in the electric dipole interaction potential. This means the total energy of interaction between both mdisks and the dipole interaction energy is

*Equation 5 The Intra-mdisk Electric and magnetic Dipole Energy*

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Adding all the components for the edisk energies we have the equation for the edisk energy (equation 3)

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We add this to the mdisk energies to give us the total energy of the electron or the positron:

$$U_{total} = U_{m(intra)} + U_i + U_e$$

$$U_{total} = 54U_e + \frac{27U_e}{2} + U_e$$

Bringing these together we see that the total energy of the electron is given by:

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Which gives us the equation that defines Planck's constant as:

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## Neutrino model

From the above description we can recognise that the two dipoles inside the electron and their two mdisks are actually neutrinos.

A neutrino is thus an electric dipole with an mdisk. When it is not confined being half of an electron together with its mirror image, the anti-neutrino, then it will be free – and must – roll along its mdisk keeping its acceleration into its centre. It will, due to its lack of rotational kinetic energy of the magnetic field that is now straightened out it has no mass. However, if the neutrino is confined it gains considerable weight – ½ that of an electron/positron.

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From this model of the electron / positron it can be seen that matter is made up of pairing matter and antimatter. An electron is not matter and a positron antimatter. They are both made up from matter and antimatter orbiting one another. Matter and antimatter do not annihilate on contact. Quite the opposite they are the building blocks for all matter.

## Dark Energy

The first particles to form in space will be from photon / photon collisions, it is likely that there is an effect such that when photons of the right energy to create electrons or protons when colliding with them, will generally prefer to copy with the same chirality – i.e. the same type of elementary particle will get created. This will lead to seeding of different areas of space with a predominance of either electrons or protons. The effect of this is vast reaches of space which are otherwise empty is a force for expanding the universe which comes from these charges all repelling one another.

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When there are symmetric collisions then the result is the generation of matter and antimatter partners. Electrons colliding with each other would produce electrons and positrons. Positrons would not however annihilate with the first electron it found. Generally, they would be attracted by electrical charges and orbit closer and closer until a bond is formed creating two new neutrinos. A bond between a positron and an electron would put the edisks of each as orthogonal but occupying the same place. In this way the particle created would move from being a magnetic dipole to being a magnetic quadrupole. This neutral particle could then – under sufficiently density of other particles pick up another electron or positron due to magnetic attraction turning it into a magnetic hexapole. Proceeding in this fashion we get heavier and heavier particles until the energy gained by merging puts too much magnetic repulsion. This would appear to happen when we merge two hexapoles together to reach a particle with 12 magnetic poles, though it could be more(?). At this point it can save energy by kicking out one of its electrons or positrons. This is the decay of a neutron into a proton. In the case of antimatter regions of space this would be the kicking out of a positron and becoming an etron - as I would call them – an anti-proton. The reason it would kick out an electron rather than a positron would be that the neutron had a collision with an electron. In such asymmetric collisions the chirality (matter or anti matter) of the impacting particle ensures that the ejected one matches.

In this way all matter is built up to the point of electrons and protons. Neutrons are therefore dodecapoles and as such they are hard balls with many strong magnetic fields. The bind together in a face centred cubic packing in crystal like structures to form nuclei with layers of protons separated by layers of neutrons to optimise binding energy versus electrostatic repulsion. This has been described in some detail by Norman Cook, but with this theory, it can be put on a precise mathematical basis.

All these nuclear and particle properties could be calculated precisely with this theory. As such it explains away the need to talk about quarks and the strong nuclear force. It is just simple magnetism.

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### Conclusions

The implications of this theory are profound and answer questions that have puzzled Physicists for decades. I contend that this theory gives the mechanisms to be able to predict with remarkable

accuracy the masses of particles of all kinds. The model of the electron as a charge spinning at the speed of light has already been shown to provide the driving potential that for Bohmian Mechanics and the pilot wave (<https://arxiv.org/pdf/1409.8271.pdf>) interpretation of quantum phenomena. With this paper I have shown a model that describes the structure of the electron in detail and have derived both the fine structure constant and Planck's constant in doing so.

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# Revolutionary Ball Light and Matter Theory

by

Mr Lamaan Ball MPhys

25/11/2018

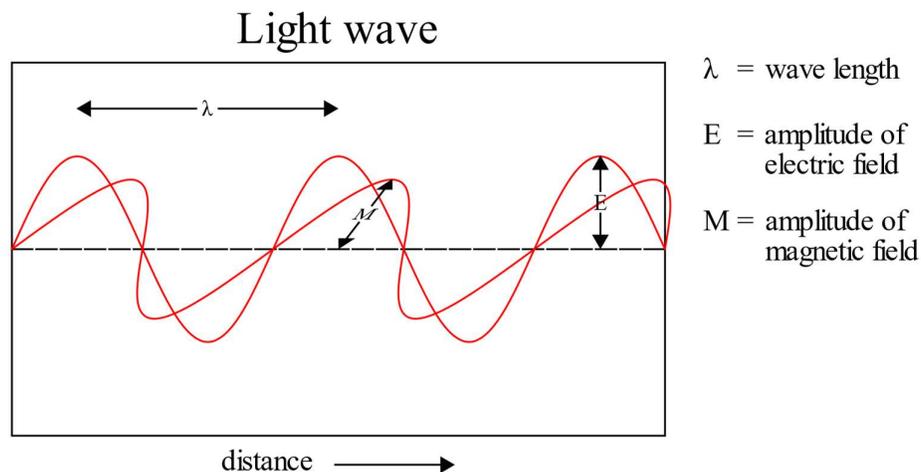
## Abstract

A model is provided for light and the structure of all matter which explains the quantisation of light and from which both the fine structure constant and Planck's constant are derived from properties of electromagnetism. This theory unites all forces of physics showing how mass is just electrical and magnetic field energy and quantum phenomena come from resonance states of electromagnetism. The implications of the theory are explained and include dark matter, the absence of antimatter, dark energy and black hole evaporation.

## Light, edisks and mdisks

Electromagnetic waves and classical electromagnetism are not the same thing as light. Light travels in straight lines, whereas electromagnetic waves spread out. Light is self-propagating and needs no medium.

The standard picture of light taught is like this:



This cannot be correct, because the energy has disappeared along the path. Both electric and magnetic waves store energy. What is happening in waves of electromagnetism, perhaps a bit harder to draw, is that with an increase of amplitude of E field you get a circulation of B field and vice versa. It does not travel as waves as shown in this above picture.

Rather than thinking of light as some sort of plane wave, we need to think instead of a rotation of an E field with constant acceleration of the E field vector into the centre. Let us call this disk of rotating electric field an **edisk**.

As with any accelerating electric field there is a circulating magnetic field orthogonal the rotating edisk. For short hand we will call this an **mdisk**.

In light therefore, we get a model of a constantly accelerating E field vector and a constantly accelerating B field vector. Both rotate such that the fields travel around their respective disks at the speed of light c with radius r and angular velocity  $\omega$ .

$$c = r\omega$$

For light this central acceleration with a single dipole vector of E field will only be possible if the ball of light is travelling. It spins around its edge like a rolling marble. There is constant acceleration into the middle and that means the centre of the ball of light will move at the speed of light. The edge on which it rolls will always be stationary. The edge on the opposite side will move at twice the speed of light relative to the surroundings through which it is passing.

Light could roll on any edge edisk or mdisk or somewhere in between, this accounts for the different kinds of light polarisation, planar and circular as well as so called super position of states, which is just rolling on somewhere between just an edisk edge and an mdisk edge.

A photon as a ball of light is essentially a resonance of electrical and magnetic fields.

### Resonance condition for trapping light in a particle

We can visualise the edisk and its pair of mdisks as a system of clockwork cogs rotating at the same frequency. In the case of light, these cogs are the same size and so the only rotation is rolling like a marble. Such a resonance can however come stop moving if the rotation can be made to happen internally.

If one of the cogs were smaller than the other then it would rotate faster and move about the other internally. To reproduce the same pattern on each extremes of the separation of this cog's teeth and the other cog, we have a limitation on the circumference of these cogs. The larger cog that is constrained in circumference speed is the edisk. The mdisk could take any size though. Let us name the radius of the edisk as  $r_e$  and the radius of the mdisk as  $r_m$ . Then the condition of a repeating pattern is given by

#### Equation 1 Mdisk Size Limitation

$$r_e = (2n + 1)r_m$$

The value of n is a positive integer. The state n=0 is the condition of a photon described above. The condition n=1 is then the electron or positron. Other values should provide the basis for predicting excited states of essentially the same elementary particles. Muons and Tauons and an infinite set further excited states exist.

The ground state therefore of any particle with its lowest possible energy state has the condition where  $n = 0$  that  $r_e = 3r_m$

### Explanation of Mass and the Derivation of $E=mc^2$

The edisk electrical field vectors rotate at the speed of light c such that its angular velocity  $\omega$  is

$$\omega = \frac{c}{r_e}$$

Mass is produced by a density of energy as described in general relativity, we will see an example here. The electric field stores energy as does the magnetic field. If the electrical field has the time dependent form  $E(t) = E \sin(\omega t)$ , then its energy comes from the energy stored in an electrical field and is  $U = \frac{\epsilon E^2}{2} V$  where E is an energy density and V is a volume. This means that the energy of the electrical field has a time dependent form of  $U(t) = \epsilon V E^2 \sin^2(\omega t) / 2$ . Using the double angle formula, this is  $U(t) = \epsilon V E^2 (1 + \cos(2\omega t)) / 4$ . The same form applies to the energy density of the magnetic field which is proportional to  $B^2$ . From this consideration, we would say that the angular speed of the energy density is given by

$$\Omega = 2\omega$$

If this energy density is not confined to the point of the electric field – and it is not if it moves twice as fast, then we should consider it as a disk of mass. The inertia I of a disk of mass m and radius r is given by

$$I = \frac{mr^2}{2}$$

The rotational kinetic energy is given by the formula

$$U_{rot} = \frac{I\Omega^2}{2}$$

Putting these together for a disc at  $r = r_e$  we get

$$U_{rot} = \frac{\left(\frac{mr^2}{2}\right)(2\omega)^2}{2} = mr^2\omega^2 = mc^2$$

In this way we can see that mass comes from the rotational kinetic energy of the edisk and mdisks.

This rotation of energy at twice the speed of light probably has a connection to the spin ½ symmetry of fermions, but this needs further thought and is not the subject of this discussion.

### The Electron/Positron Model

As we say earlier the mdisks have a radius one third that of the edisk. The edisk stays the same radius. Now let us consider how the energy is made up inside the electron from its electromagnetic properties.

#### Edisk Electrostatic Potential Energy

Let us start with the electrostatic potential of an edisk of charge Q with potential in volts V

##### Equation 2 Electrostatic Potential Energy

$$U_{es} = QV = \frac{Q^2}{4\pi\epsilon_0} \int_{\infty}^r \frac{1}{r_e^2} dr = \frac{Q^2}{4\pi\epsilon_0 r_e} = \frac{Q^2 \omega}{4\pi\epsilon_0 c} = \frac{Q^2 f}{2\epsilon_0 c}$$

This component on its own has the energy frequency ratio of  $4.8352769 \times 10^{-3}$  which as a fraction of Planck's constant is exactly  $\alpha$  the fine structure constant. So, this gives a physical explanation of the fine structure:

*The fine structure constant is the fraction of electromagnetic potential energy held by a charged particle due to its electrostatic potential.*

Using the calculation above it comes to 137.0359992690360000

#### Edisk Magnetic Field Potential Energy

Now let us consider the energy stored in the static magnetic field created by the edisk. The edisk is a point charge  $Q$  rotating at speed  $c$ . This forms a current loop allowing us to calculate the magnetic field energy using the formula for a current loop of area  $A$  in field  $B$  and with current  $I$ :

$$U_{ms} = IAB$$

The area  $A$  is given by

$$A = \pi r_e^2$$

The current  $I$  is given by

$$I = \frac{cQ}{2\pi r_e}$$

The magnetic field of a current loop is given by

$$B = \frac{\mu_0 I}{2r_e}$$

Bringing these terms together we calculate the magnetic field energy of the edisk within the current loop:

$$\begin{aligned} U_{loop} &= A \frac{\mu_0 I^2}{2r_e} = \frac{\mu_0 I (\pi r_e^2)}{2r_e} = \frac{\mu_0 I^2 \pi r_e}{2} = \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} \\ &= \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c^2}{2r} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c \omega}{2} = \frac{\mu_0 Q^2 c \omega}{8\pi} = \frac{\mu_0 Q^2 c 2\pi f}{8\pi} = \frac{\mu_0 Q^2 c f}{4} \end{aligned}$$

This gives the energy of the magnetic field within the current loop. This magnetic field energy is also outside the current loop and ultimately the same flux going through the loop in one direction comes back past the outside of the loop. This makes the total energy stored in magnetic energy due to the edisk to

$$U_{ms} = 2U_{loop} = \frac{\mu_0 Q^2 c f}{2}$$

Using equation 2 and substituting for the permeability and permittivity of free space

$$c^2 = 1/\mu_0 \epsilon_0$$

we can write the expression for all the edisk energy as

#### Equation 3 The edisk Potential Energy

$$U_e = \frac{Q^2 f}{2\epsilon_0 c} + \frac{\mu_0 Q^2 c f}{2} = \mu_0 Q^2 c f$$

This shows that magnetic field energy and electrostatic potential of the edisk balance nicely.

### Intra-Mdisk Magnetic Dipole Coupling Energy

For the mdisk we can consider the circulating magnetic field as a set of infinitesimal magnetic dipoles that attract each other according to the magnetic dipole-dipole interaction given by the following formula where  $M^2$  is the sum of all magnetic moment dot products around the circle of magnetic field:

$$U = \frac{3\mu_0 M^2}{4\pi r^3}$$

In a photon we know that magnetic and electric field energies match and that  $r_m$  is equal to  $r_e$  so we can simply state that the energy of the n=0 state all else being equal is proportional to  $1/r^3$  and so when we go from n=0 to n=1 states the radius is 1/3 so the dipole coupling energy will be  $3^3$  times larger.

In a photon (n=0 case) there is only one mdisk with a radius  $r_e$  at the centre of the edisk. In the n=1 case, there are two smaller mdisks.

Given these considerations we can just write down the magnetic dipole coupling energy for the force across the diameter of both mdisks as

#### Equation 4 The Inter-mdisk Dipole Energy

$$U_{m(intra)} = 2 \times 3^3 U_e = 54U_e$$

### Inter-Mdisk interaction Dipole Coupling Energy

There is also a dipole coupling magnetic energy between the two mdisks. This will depend on the separation of the mdisks within the edisk. This attractive force between the mdisks balances with an electric dipole interaction force from two opposing dipoles of two E fields accelerating into the centre.

We take the charge on each charge of each dipole to be equal to half that of the electron charge such that each E field vector / dipole contributes half of the electron charge.

The force for a parallel axis electric dipole dipole interaction is given by

$$F_e = \frac{6Q^2 d^2}{16\pi\epsilon_0 r^4}$$

Where r is the separation of the centres and d is the dipole length.

The force of the mdisk dipole interaction for the same separation is

$$F_m = \frac{\mu_0 M^2}{4\pi r^4}$$

Setting these forces equal we get

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So,

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We can substitute the following:

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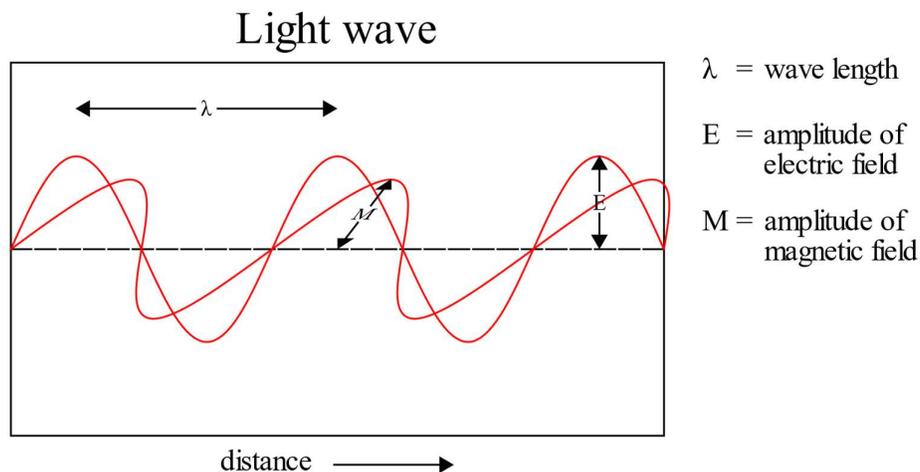
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The edisk electrical field vectors rotate at the speed of light c such that its angular velocity  $\omega$  is

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Mass is produced by a density of energy as described in general relativity, we will see an example here. The electric field stores energy as does the magnetic field. If the electrical field has the time dependent form  $E(t) = E \sin(\omega t)$ , then its energy comes from the energy stored in an electrical field and is  $U = \frac{\epsilon E^2}{2} V$  where E is an energy density and V is a volume. This means that the energy of the electrical field has a time dependent form of  $U(t) = \epsilon V E^2 \sin^2(\omega t) / 2$ . Using the double angle formula, this is  $U(t) = \epsilon V E^2 (1 + \cos(2\omega t)) / 4$ . The same form applies to the energy density of the magnetic field which is proportional to  $B^2$ . From this consideration, we would say that the angular speed of the energy density is given by

$$\Omega = 2\omega$$

If this energy density is not confined to the point of the electric field – and it is not if it moves twice as fast, then we should consider it as a disk of mass. The inertia I of a disk of mass m and radius r is given by

$$I = \frac{mr^2}{2}$$

The rotational kinetic energy is given by the formula

$$U_{rot} = \frac{I\Omega^2}{2}$$

Putting these together for a disc at  $r = r_e$  we get

$$U_{rot} = \frac{\left(\frac{mr^2}{2}\right)(2\omega)^2}{2} = mr^2\omega^2 = mc^2$$

In this way we can see that mass comes from the rotational kinetic energy of the edisk and mdisks.

This rotation of energy at twice the speed of light probably has a connection to the spin ½ symmetry of fermions, but this needs further thought and is not the subject of this discussion.

### The Electron/Positron Model

As we say earlier the mdisks have a radius one third that of the edisk. The edisk stays the same radius. Now let us consider how the energy is made up inside the electron from its electromagnetic properties.

#### Edisk Electrostatic Potential Energy

Let us start with the electrostatic potential of an edisk of charge Q with potential in volts V

##### Equation 2 Electrostatic Potential Energy

$$U_{es} = QV = \frac{Q^2}{4\pi\epsilon_0} \int_{\infty}^r \frac{1}{r_e^2} dr = \frac{Q^2}{4\pi\epsilon_0 r_e} = \frac{Q^2 \omega}{4\pi\epsilon_0 c} = \frac{Q^2 f}{2\epsilon_0 c}$$

This component on its own has the energy frequency ratio of  $4.8352769 \times 10^{-36}$  which as a fraction of Planck's constant is exactly  $\alpha$  the fine structure constant. So, this gives a physical explanation of the fine structure:

*The fine structure constant is the fraction of electromagnetic potential energy held by a charged particle due to its electrostatic potential.*

Using the calculation above it comes to 137.0359992690360000

#### Edisk Magnetic Field Potential Energy

Now let us consider the energy stored in the static magnetic field created by the edisk. The edisk is a point charge  $Q$  rotating at speed  $c$ . This forms a current loop allowing us to calculate the magnetic field energy using the formula for a current loop of area  $A$  in field  $B$  and with current  $I$ :

$$U_{ms} = IAB$$

The area  $A$  is given by

$$A = \pi r_e^2$$

The current  $I$  is given by

$$I = \frac{cQ}{2\pi r_e}$$

The magnetic field of a current loop is given by

$$B = \frac{\mu_0 I}{2r_e}$$

Bringing these terms together we calculate the magnetic field energy of the edisk within the current loop:

$$\begin{aligned} U_{loop} &= A \frac{\mu_0 I^2}{2r_e} = \frac{\mu_0 I (\pi r_e^2)}{2r_e} = \frac{\mu_0 I^2 \pi r_e}{2} = \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} \\ &= \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c^2}{2r} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c \omega}{2} = \frac{\mu_0 Q^2 c \omega}{8\pi} = \frac{\mu_0 Q^2 c 2\pi f}{8\pi} = \frac{\mu_0 Q^2 c f}{4} \end{aligned}$$

This gives the energy of the magnetic field within the current loop. This magnetic field energy is also outside the current loop and ultimately the same flux going through the loop in one direction comes back past the outside of the loop. This makes the total energy stored in magnetic energy due to the edisk to

$$U_{ms} = 2U_{loop} = \frac{\mu_0 Q^2 c f}{2}$$

Using equation 2 and substituting for the permeability and permittivity of free space

$$c^2 = 1/\mu_0 \epsilon_0$$

we can write the expression for all the edisk energy as

#### Equation 3 The edisk Potential Energy

$$U_e = \frac{Q^2 f}{2\epsilon_0 c} + \frac{\mu_0 Q^2 c f}{2} = \mu_0 Q^2 c f$$

This shows that magnetic field energy and electrostatic potential of the edisk balance nicely.

### Intra-Mdisk Magnetic Dipole Coupling Energy

For the mdisk we can consider the circulating magnetic field as a set of infinitesimal magnetic dipoles that attract each other according to the magnetic dipole-dipole interaction given by the following formula where  $M^2$  is the sum of all magnetic moment dot products around the circle of magnetic field:

$$U = \frac{3\mu_0 M^2}{4\pi r^3}$$

In a photon we know that magnetic and electric field energies match and that  $r_m$  is equal to  $r_e$  so we can simply state that the energy of the n=0 state all else being equal is proportional to  $1/r^3$  and so when we go from n=0 to n=1 states the radius is 1/3 so the dipole coupling energy will be  $3^3$  times larger.

In a photon (n=0 case) there is only one mdisk with a radius  $r_e$  at the centre of the edisk. In the n=1 case, there are two smaller mdisks.

Given these considerations we can just write down the magnetic dipole coupling energy for the force across the diameter of both mdisks as

### Equation 4 The Inter-mdisk Dipole Energy

$$U_{m(intra)} = 2 \times 3^3 U_e = 54U_e$$

### Inter-Mdisk interaction Dipole Coupling Energy

There is also a dipole coupling magnetic energy between the two mdisks. This will depend on the separation of the mdisks within the edisk. This attractive force between the mdisks balances with an electric dipole interaction force from two opposing dipoles of two E fields accelerating into the centre.

We take the charge on each charge of each dipole to be equal to half that of the electron charge such that each E field vector / dipole contributes half of the electron charge.

The force for a parallel axis electric dipole dipole interaction is given by

$$F_e = \frac{6Q^2 d^2}{16\pi\epsilon_0 r^4}$$

Where r is the separation of the centres and d is the dipole length.

The force of the mdisk dipole interaction for the same separation is

$$F_m = \frac{\mu_0 M^2}{4\pi r^4}$$

Setting these forces equal we get

$$\frac{6Q^2 d^2}{16\pi\epsilon_0 r^4} = \frac{\mu_0 M^2}{4\pi r^4}$$

$$\frac{24d^2}{16} = \frac{\epsilon_0 \mu_0 M^2}{Q^2}$$

$$\frac{3d^2}{2} = \frac{\epsilon_0 \mu_0 M^2}{Q^2}$$

We know that

$$U_e = \frac{Q^2 f}{\epsilon_0 c}$$

And that

$$U_m = \frac{3\mu_0 M^2}{4\pi r_m^3} = 27U_e$$

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So,

$$\frac{\epsilon_0 \mu_0 M^2}{Q^2} = \frac{4\pi r_m^3 3^2 f}{c} = \frac{3d^2}{2}$$

We can substitute the following:

$$c = r_e \omega = 6\pi r_m f$$

$$\frac{4\pi r_m^3 3^2 f}{6\pi r_m f} = \frac{3d^2}{2}$$

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$$4r_m^2 = d^2$$

$$4r_m^2 = d^2$$

$$d = 2r_m$$

The dipole length d is also the separation of the disks, so plugging in the formula for an interaction potential.

$$U_i = \frac{3\mu_0 M^2}{4\pi (2r_m)^3} = \frac{U_m}{8}$$

This is half of the energy, per mdisk in regards to its opposite number– the other half being in the electric dipole interaction potential. This means the total energy of interaction between both mdisks and the dipole interaction energy is

*Equation 5 The Intra-mdisk Electric and magnetic Dipole Energy*

$$U_i = \frac{U_m}{2}$$

## Total Electromagnetic Energy of the Electron

Adding all the components for the edisk energies we have the equation for the edisk energy (equation 3)

$$U_e = \mu_0 Q^2 c f$$

We add this to the mdisk energies to give us the total energy of the electron or the positron:

$$U_{total} = U_{m(intra)} + U_i + U_e$$

$$U_{total} = 54U_e + \frac{27U_e}{2} + U_e$$

Bringing these together we see that the total energy of the electron is given by:

$$U = \frac{137}{2} \mu_0 Q^2 c f$$

Which gives us the equation that defines Planck's constant as:

*Equation 7 The definition of Planck's constant*

$$h = \frac{137}{2} \mu_0 Q^2 c$$

## Neutrino model

From the above description we can recognise that the two dipoles inside the electron and their two mdisks are actually neutrinos.

A neutrino is thus an electric dipole with an mdisk. When it is not confined being half of an electron together with its mirror image, the anti-neutrino, then it will be free – and must – roll along its mdisk keeping its acceleration into its centre. It will, due to its lack of rotational kinetic energy of the magnetic field that is now straightened out it has no mass. However, if the neutrino is confined it gains considerable weight – ½ that of an electron/positron.

## Antimatter

From this model of the electron / positron it can be seen that matter is made up of pairing matter and antimatter. An electron is not matter and a positron antimatter. They are both made up from matter and antimatter orbiting one another. Matter and antimatter do not annihilate on contact. Quite the opposite they are the building blocks for all matter.

## Dark Energy

The first particles to form in space will be from photon / photon collisions, it is likely that there is an effect such that when photons of the right energy to create electrons or protons when colliding with them, will generally prefer to copy with the same chirality – i.e. the same type of elementary particle will get created. This will lead to seeding of different areas of space with a predominance of either electrons or protons. The effect of this is vast reaches of space which are otherwise empty is a force for expanding the universe which comes from these charges all repelling one another.

### Beyond the electron / positron

When there are symmetric collisions then the result is the generation of matter and antimatter partners. Electrons colliding with each other would produce electrons and positrons. Positrons would not however annihilate with the first electron it found. Generally, they would be attracted by electrical charges and orbit closer and closer until a bond is formed creating two new neutrinos. A bond between a positron and an electron would put the edisks of each as orthogonal but occupying the same place. In this way the particle created would move from being a magnetic dipole to being a magnetic quadrupole. This neutral particle could then – under sufficiently density of other particles pick up another electron or positron due to magnetic attraction turning it into a magnetic hexapole. Proceeding in this fashion we get heavier and heavier particles until the energy gained by merging puts too much magnetic repulsion. This would appear to happen when we merge two hexapoles together to reach a particle with 12 magnetic poles, though it could be more(?). At this point it can save energy by kicking out one of its electrons or positrons. This is the decay of a neutron into a proton. In the case of antimatter regions of space this would be the kicking out of a positron and becoming an etron - as I would call them – an anti-proton. The reason it would kick out an electron rather than a positron would be that the neutron had a collision with an electron. In such asymmetric collisions the chirality (matter or anti matter) of the impacting particle ensures that the ejected one matches.

In this way all matter is built up to the point of electrons and protons. Neutrons are therefore dodecapoles and as such they are hard balls with many strong magnetic fields. The bind together in a face centred cubic packing in crystal like structures to form nuclei with layers of protons separated by layers of neutrons to optimise binding energy versus electrostatic repulsion. This has been described in some detail by Norman Cook, but with this theory, it can be put on a precise mathematical basis.

All these nuclear and particle properties could be calculated precisely with this theory. As such it explains away the need to talk about quarks and the strong nuclear force. It is just simple magnetism.

### Dark Matter

In regions of space where matter has sufficient density to have formed into atoms such as hydrogen, then matter and antimatter regions can come into contact with one another. When this happens the atomic nuclei bind together, and no longer constrained by the repulsion of electrostatic potential can build arbitrarily large agglomerations of matter leading to neutron stars. This matter would be electrically neutral and so have no orbiting electrons or positrons as magnetism would be the only force in play. This is dark matter.

### Black Holes

As we have seen all matter comes from neutrinos and ends after a life as matter with a particular chirality involving light and limited size nuclei – it becomes dark matter. That dark matter ends up in black holes, or more accurately it gets flattened onto the surface of a black hole. The black hole turns these balls of electro magnetic waves back into the simple waves rather than particles and emits them back into space. Wave – as opposed to particles transmit energy at twice the speed of light and that is why they eventually evaporate.

### Conclusions

The implications of this theory are profound and answer questions that have puzzled Physicists for decades. I contend that this theory gives the mechanisms to be able to predict with remarkable

accuracy the masses of particles of all kinds. The model of the electron as a charge spinning at the speed of light has already been shown to provide the driving potential that for Bohmian Mechanics and the pilot wave (<https://arxiv.org/pdf/1409.8271.pdf>) interpretation of quantum phenomena. With this paper I have shown a model that describes the structure of the electron in detail and have derived both the fine structure constant and Planck's constant in doing so.

“We built the heavens with Our strength and it is We who expand it.  
We spread out the earth – how well We smoothed it out  
And we made everything in pairs. That you may ponder.

Qur'an 51:47

# Revolutionary Ball Light and Matter Theory

by

Mr Lamaan Ball MPhys

25/11/2018

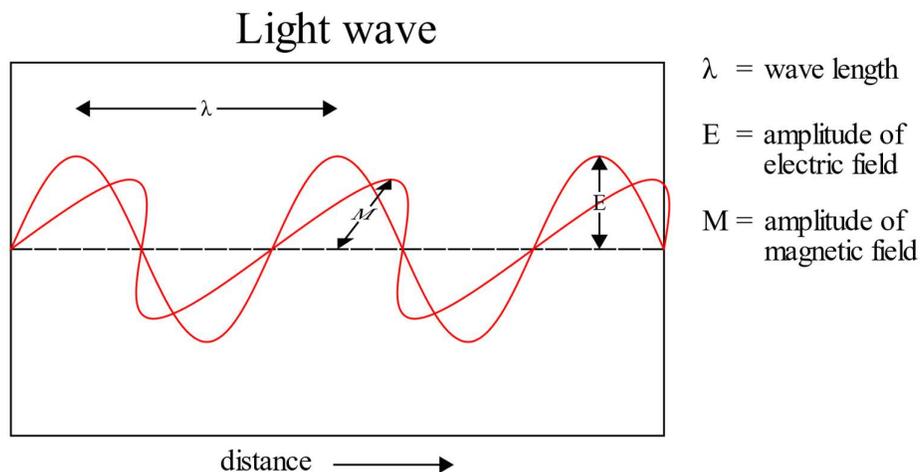
## Abstract

A model is provided for light and the structure of all matter which explains the quantisation of light and from which both the fine structure constant and Planck's constant are derived from properties of electromagnetism. This theory unites all forces of physics showing how mass is just electrical and magnetic field energy and quantum phenomena come from resonance states of electromagnetism. The implications of the theory are explained and include dark matter, the absence of antimatter, dark energy and black hole evaporation.

## Light, edisks and mdisks

Electromagnetic waves and classical electromagnetism are not the same thing as light. Light travels in straight lines, whereas electromagnetic waves spread out. Light is self-propagating and needs no medium.

The standard picture of light taught is like this:



This cannot be correct, because the energy has disappeared along the path. Both electric and magnetic waves store energy. What is happening in waves of electromagnetism, perhaps a bit harder to draw, is that with an increase of amplitude of E field you get a circulation of B field and vice versa. It does not travel as waves as shown in this above picture.

Rather than thinking of light as some sort of plane wave, we need to think instead of a rotation of an E field with constant acceleration of the E field vector into the centre. Let us call this disk of rotating electric field an **edisk**.

As with any accelerating electric field there is a circulating magnetic field orthogonal the rotating edisk. For short hand we will call this an **mdisk**.

In light therefore, we get a model of a constantly accelerating E field vector and a constantly accelerating B field vector. Both rotate such that the fields travel around their respective disks at the speed of light c with radius r and angular velocity  $\omega$ .

$$c = r\omega$$

For light this central acceleration with a single dipole vector of E field will only be possible if the ball of light is travelling. It spins around its edge like a rolling marble. There is constant acceleration into the middle and that means the centre of the ball of light will move at the speed of light. The edge on which it rolls will always be stationary. The edge on the opposite side will move at twice the speed of light relative to the surroundings through which it is passing.

Light could roll on any edge edisk or mdisk or somewhere in between, this accounts for the different kinds of light polarisation, planar and circular as well as so called super position of states, which is just rolling on somewhere between just an edisk edge and an mdisk edge.

A photon as a ball of light is essentially a resonance of electrical and magnetic fields.

### Resonance condition for trapping light in a particle

We can visualise the edisk and its pair of mdisks as a system of clockwork cogs rotating at the same frequency. In the case of light, these cogs are the same size and so the only rotation is rolling like a marble. Such a resonance can however come stop moving if the rotation can be made to happen internally.

If one of the cogs were smaller than the other then it would rotate faster and move about the other internally. To reproduce the same pattern on each extremes of the separation of this cog's teeth and the other cog, we have a limitation on the circumference of these cogs. The larger cog that is constrained in circumference speed is the edisk. The mdisk could take any size though. Let us name the radius of the edisk as  $r_e$  and the radius of the mdisk as  $r_m$ . Then the condition of a repeating pattern is given by

#### Equation 1 Mdisk Size Limitation

$$r_e = (2n + 1)r_m$$

The value of n is a positive integer. The state n=0 is the condition of a photon described above. The condition n=1 is then the electron or positron. Other values should provide the basis for predicting excited states of essentially the same elementary particles. Muons and Tauons and an infinite set further excited states exist.

The ground state therefore of any particle with its lowest possible energy state has the condition where  $n = 0$  that  $r_e = 3r_m$

### Explanation of Mass and the Derivation of $E=mc^2$

The edisk electrical field vectors rotate at the speed of light c such that its angular velocity  $\omega$  is

$$\omega = \frac{c}{r_e}$$

Mass is produced by a density of energy as described in general relativity, we will see an example here. The electric field stores energy as does the magnetic field. If the electrical field has the time dependent form  $E(t) = E\sin(\omega t)$ , then its energy comes from the energy stored in an electrical field and is  $U = \frac{\epsilon E^2}{2}V$  where E is an energy density and V is a volume. This means that the energy of the electrical field has a time dependent form of  $U(t) = \epsilon V E^2 \sin^2(\omega t)/2$ . Using the double angle formula, this is  $U(t) = \epsilon V E^2 (1 + \cos(2\omega t))/4$ . The same form applies to the energy density of the magnetic field which is proportional to  $B^2$ . From this consideration, we would say that the angular speed of the energy density is given by

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The rotational kinetic energy is given by the formula

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Putting these together for a disc at  $r = r_e$  we get

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This rotation of energy at twice the speed of light probably has a connection to the spin ½ symmetry of fermions, but this needs further thought and is not the subject of this discussion.

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Let us start with the electrostatic potential of an edisk of charge Q with potential in volts V

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*The fine structure constant is the fraction of electromagnetic potential energy held by a charged particle due to its electrostatic potential.*

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The area  $A$  is given by

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The magnetic field of a current loop is given by

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Bringing these terms together we calculate the magnetic field energy of the edisk within the current loop:

$$\begin{aligned} U_{loop} &= A \frac{\mu_0 I^2}{2r_e} = \frac{\mu_0 I (\pi r_e^2)}{2r_e} = \frac{\mu_0 I^2 \pi r_e}{2} = \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} \\ &= \left( \frac{cQ}{2\pi r} \right)^2 \frac{\mu_0 \pi r}{2} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c^2}{2r} = \left( \frac{Q}{2\pi} \right)^2 \frac{\mu_0 \pi c \omega}{2} = \frac{\mu_0 Q^2 c \omega}{8\pi} = \frac{\mu_0 Q^2 c 2\pi f}{8\pi} = \frac{\mu_0 Q^2 c f}{4} \end{aligned}$$

This gives the energy of the magnetic field within the current loop. This magnetic field energy is also outside the current loop and ultimately the same flux going through the loop in one direction comes back past the outside of the loop. This makes the total energy stored in magnetic energy due to the edisk to

$$U_{ms} = 2U_{loop} = \frac{\mu_0 Q^2 c f}{2}$$

Using equation 2 and substituting for the permeability and permittivity of free space

$$c^2 = 1/\mu_0 \epsilon_0$$

we can write the expression for all the edisk energy as

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$$U_e = \frac{Q^2 f}{2\epsilon_0 c} + \frac{\mu_0 Q^2 c f}{2} = \mu_0 Q^2 c f$$

This shows that magnetic field energy and electrostatic potential of the edisk balance nicely.

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For the mdisk we can consider the circulating magnetic field as a set of infinitesimal magnetic dipoles that attract each other according to the magnetic dipole-dipole interaction given by the following formula where  $M^2$  is the sum of all magnetic moment dot products around the circle of magnetic field:

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We know that

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And that

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So,

$$\frac{\epsilon_0 \mu_0 M^2}{Q^2} = \frac{4\pi r_m^3 3^2 f}{c} = \frac{3d^2}{2}$$

We can substitute the following:

$$c = r_e \omega = 6\pi r_m f$$

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We add this to the mdisk energies to give us the total energy of the electron or the positron:

$$U_{total} = U_{m(intra)} + U_i + U_e$$

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Which gives us the equation that defines Planck's constant as:

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## Dark Energy

The first particles to form in space will be from photon / photon collisions, it is likely that there is an effect such that when photons of the right energy to create electrons or protons when colliding with them, will generally prefer to copy with the same chirality – i.e. the same type of elementary particle will get created. This will lead to seeding of different areas of space with a predominance of either electrons or protons. The effect of this is vast reaches of space which are otherwise empty is a force for expanding the universe which comes from these charges all repelling one another.

### Beyond the electron / positron

When there are symmetric collisions then the result is the generation of matter and antimatter partners. Electrons colliding with each other would produce electrons and positrons. Positrons would not however annihilate with the first electron it found. Generally, they would be attracted by electrical charges and orbit closer and closer until a bond is formed creating two new neutrinos. A bond between a positron and an electron would put the edisks of each as orthogonal but occupying the same place. In this way the particle created would move from being a magnetic dipole to being a magnetic quadrupole. This neutral particle could then – under sufficiently density of other particles pick up another electron or positron due to magnetic attraction turning it into a magnetic hexapole. Proceeding in this fashion we get heavier and heavier particles until the energy gained by merging puts too much magnetic repulsion. This would appear to happen when we merge two hexapoles together to reach a particle with 12 magnetic poles, though it could be more(?). At this point it can save energy by kicking out one of its electrons or positrons. This is the decay of a neutron into a proton. In the case of antimatter regions of space this would be the kicking out of a positron and becoming an etron - as I would call them – an anti-proton. The reason it would kick out an electron rather than a positron would be that the neutron had a collision with an electron. In such asymmetric collisions the chirality (matter or anti matter) of the impacting particle ensures that the ejected one matches.

In this way all matter is built up to the point of electrons and protons. Neutrons are therefore dodecapoles and as such they are hard balls with many strong magnetic fields. The bind together in a face centred cubic packing in crystal like structures to form nuclei with layers of protons separated by layers of neutrons to optimise binding energy versus electrostatic repulsion. This has been described in some detail by Norman Cook, but with this theory, it can be put on a precise mathematical basis.

All these nuclear and particle properties could be calculated precisely with this theory. As such it explains away the need to talk about quarks and the strong nuclear force. It is just simple magnetism.

### Dark Matter

In regions of space where matter has sufficient density to have formed into atoms such as hydrogen, then matter and antimatter regions can come into contact with one another. When this happens the atomic nuclei bind together, and no longer constrained by the repulsion of electrostatic potential can build arbitrarily large agglomerations of matter leading to neutron stars. This matter would be electrically neutral and so have no orbiting electrons or positrons as magnetism would be the only force in play. This is dark matter.

### Black Holes

As we have seen all matter comes from neutrinos and ends after a life as matter with a particular chirality involving light and limited size nuclei – it becomes dark matter. That dark matter ends up in black holes, or more accurately it gets flattened onto the surface of a black hole. The black hole turns these balls of electro magnetic waves back into the simple waves rather than particles and emits them back into space. Wave – as opposed to particles transmit energy at twice the speed of light and that is why they eventually evaporate.

### Conclusions

The implications of this theory are profound and answer questions that have puzzled Physicists for decades. I contend that this theory gives the mechanisms to be able to predict with remarkable

accuracy the masses of particles of all kinds. The model of the electron as a charge spinning at the speed of light has already been shown to provide the driving potential that for Bohmian Mechanics and the pilot wave (<https://arxiv.org/pdf/1409.8271.pdf>) interpretation of quantum phenomena. With this paper I have shown a model that describes the structure of the electron in detail and have derived both the fine structure constant and Planck's constant in doing so.

“We built the heavens with Our strength and it is We who expand it.  
We spread out the earth – how well We smoothed it out  
And we made everything in pairs. That you may ponder.

Qur'an 51:47