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The Link between Electric Current and Magnetic Field

(The Epicycle Theory of the Atom)

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Abstract. It is proposed that the orbital electrons of an atom should be replaced by a much more complicated interaction of rotating electron pairs and rotating electron-positron dipole pairs. This scenario may better explain both magnetic spin moment and electric current inside atomic and molecular matter. Rotating dipoles can act as a source of stored kinetic energy by virtue of magnetization and linear polarization, and the associated solenoidal bonding can provide a link from the orbital electrons through to the magnetic field beyond.

The link between electric current and magnetic fields will be explored by reviewing Maxwell's cogwheel/idle wheel mechanism in terms of mutually orbiting pairs.

It will then be speculated that a magnetic field acts like a rotationally elastic sponge that soaks up the large scale vorticity of Descartes' universe.

The Double Helix Theory of the Magnetic Field

I. We saw in 'The Double Helix Theory of the Magnetic Field',

http://www.wbabin.net/science/tombe.pdf

how rotating electron-positron dipoles could be arranged in a double helix fashion to account for the magnetic field. A rotating electron-positron

dipole consists of an electron and a positron undergoing a mutual central force orbit such that the rotation axis is perpendicular to a line joining the electron to the positron. If we stack these dipoles on top of each other along their axes of rotation with the electrons placed approximately above the positrons and angularly synchronized in a twisted rope ladder fashion, we will effectively have a helical spring. These helical springs account for the Coulomb tension that runs through magnetic **H** lines of force, and **H** is a measure of the vorticity of the rotating aether within these dipoles. If the rope ladder untwists, the tension will increase because the electrons will come closer to the positrons above and below them. See Figure 1 below,

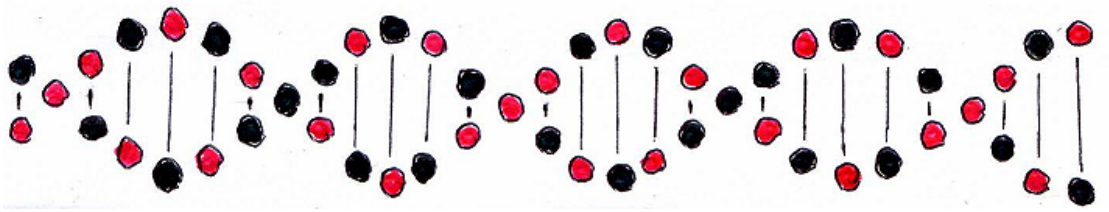

Figure 1. A close-up view of a single magnetic line of force. The electrons are shown in red and the positrons are shown in black. The double helix is rotating about its axis with a prodigious angular speed and the rotation axis represents the magnetic field vector H. The diagram is not to scale as the relative dimensions remain unknown.

The dipoles in adjacent **H** field lines will be aligned in their mutual equatorial planes and the mutual tangential velocities existing between these adjacent dipoles will cause a centrifugal repulsion to act laterally between **H** lines. This centrifugal repulsion accounts for both ferromagnetic and electromagnetic repulsion.

II. We saw in 'Gravitation and the Gyroscopic Force',

http://www.wbabin.net/science/tombe5.pdf

how four fundamental forces can be derived either hydrodynamically or by differentiating the displacement vector in the inertial frame of reference. These four fundamental forces are,

(a) The inverse square law force corresponding to irrotational radial fluid flow. This is the Coulomb force and it underlies linear polarization in a dielectric material.

(b) Centrifugal repulsion. This is the force that defies Coulomb's law in orbital dynamics, and which is responsible for magnetic

repulsion, and which plays a major role in atomic and molecular stability.

(c) The gyroscopic Coriolis force **F** = q**v**X**B**, is active in electromagnetism. Since rotating electron-positron dipoles are essentially miniature gyroscopes, the gyroscopic force also provides the torque that aligns the electric sea into the double helix pattern.

(d) The angular force $\partial\mathbf{A}/\partial t$ plays a role in electromagnetic induction by creating an angular displacement current in the electron-positron dipoles. **A** is the momentum of the aether.

III. In "Charge, Spin, and 'Charge to Mass' Ratio",

http://www.wbabin.net/science/tombe10.pdf

it was discussed how the centrifugal force and the Coriolis force are actually just two aspects of the same thing. They are respectfully the radial and the tangential components of the convective force that is induced when a particle cuts at right angles across aether flow.

IV. In 'Gravity Reversal and Atomic Bonding',

http://www.wbabin.net/science/tombe6.pdf

it was discussed how negative charge is fundamentally mutually attractive. It follows from this that mutual bonding between negatively charged electrons is possible. An arrangement of mutually orbiting electron pairs inside atomic and molecular matter would be better able to explain the magnetic spin moment associated with electrons, and it would better explain the bonding mechanism between atomic electrons and the wider electron-positron sea. It would enable the atomic electrons to be linked into the magnetic field solenoidally.

The Epicycle Theory of the Atom

V. It will now be proposed that it is not actually electrons alone that are orbiting the nucleus of an atom, but that there exists a much more complex picture which can be viewed in terms of rotating electron pairs orbiting the nucleus and interacting with surrounding rotating electron-positron dipoles.

A rotating electron-positron dipole is negatively charged and it has got all the properties of both an electric dipole and a magnetic dipole. It can be linearly polarized by the Coulomb force, and it can be aligned and magnetized by the gyroscopic force and the angular $\partial\mathbf{A}/\partial t$ force. The circumferential velocity of these rotating dipoles can account for the centrifugal and Coriolis magnetic force of repulsion. It could truthfully be said that the rotating electron-positron dipole is the fundamental building block of Ampère's circuital law. It is the DNA of Ampère's circuital law. It is a miniature Ampère's circuital law.

A pair of mutually orbiting electrons would be many orders of magnitude more negatively charged than the electron positron dipole which is essentially only gravitationally charged. A pair of negative electrons cannot be linearly polarized and it is this factor which makes the electron-positron dipole such a vital ingredient inside matter.

Replacing a cloud of electrons in atomic and molecular matter with a cloud of mutually orbiting pairs has the advantage of blending the luminiferous medium with the electrons inside atomic and molecular matter, and allowing certain phenomena to be explained simply in terms of linear polarization, magnetization, or EM wave behaviour. The luminiferous electric sea permeates deep inside atomic and molecular matter and so we will have a complex interaction of electrons and positrons. As we move closer to the atomic nuclei, the rotating electron-positron dipoles will give way to pure mutually orbiting electron pairs, or maybe even to one single electron in the case of the Hydrogen atom.

This arrangement would account for the existence of magnetic spin moment, since orbiting pairs are miniature bar magnets, and it would provide a direct link between atomic orbits and electromagnetic radiation. Electric current in a wire might be a flow of rotating pairs with their axes aligned into solenoidal rings inside the wire in sympathy with the surrounding magnetic field beyond the wire. This would mean that they could push each other translationally along the wire with centrifugal repulsion in their equatorial planes. On the other hand, electric current may be as basic as pure aether flow with the electron-positron dipole arrangement determining whether a material is a conductor, semi-conductor, or insulator. One of Maxwell's derivations of Ampère's circuital law did not require any particles at all.

An electron-positron dipole will be polarized by the electric field of an atomic nucleus. This might help to explain why dipoles which are close

to atomic nuclei, and hence being strongly polarized, are more vulnerable to being split apart by gamma rays.

Electric Current and Magnetic Fields

VI. In part II of his 1861 paper 'On Physical Lines of Force',

http://vacuum-physics.com/Maxwell/maxwell_oplf.pdf

James Clerk-Maxwell attempted to explain the mechanical connection between electric current and magnetic fields. He considered that the electric current was somehow gripping the molecular vortices of the magnetic field and causing them to rotate. He used a cogwheel analogy in which electrical particles acted as idle wheels.

Maxwell was never able to complete this picture. He was never able to demonstrate the torque mechanism precisely. He got as far as establishing that,

(a) The molecular vortices repel each other in the equatorial plane as a result of centrifugal force. He established this fact from hydrodynamics in part I of his paper.
(b) The vortex cells need to be surrounded by electrical particles in order to justify their continuing existence.
(c) The angular $\partial\mathbf{A}/\partial t$ force is involved in the torque mechanism.

We will now try to reconcile the particle dynamics with the hydrodynamics.

Consider once again the rotating electron-positron dipole in which the electron is undergoing a mutual central force orbit with a positron. If the electron constitutes an aethereal sink and the positron constitutes an aethereal source, then as the aether crosses over from the positron to the electron, it will be rotating. This means that the aether will be spiralling out of the positron and spiralling into the electron. The electron, the positron, and the composite dipole will all constitute vortices.

This vorticity means that Kepler's law of areal velocity will not apply to electron-positron dipoles. (A similar argument will hold for two mutually orbiting sinks as in the case of a pair of negative electrons). The orbits of these dipoles have been described in other articles as Keplerian orbits for

ease of visualization. However they are actually more complicated than Keplerian orbits as they also involve the Lorentz force.

A Keplerian orbit, as in the case of the planets of the Solar System, is a very special case of a more general kind of motion. The Keplerian orbit is essentially a two body problem involving a balance between the inward radial inverse square law force, and the outward radial centrifugal force.

It will be discussed in section **VII** how Kepler's law of areal velocity is actually caused by the presence of the electric sea of rotating-electron positron dipoles. It follows therefore that the dipoles themselves will not be restricted by the constraint that is inherent in Kepler's areal velocity law. The constraint imposed by Kepler's areal velocity law is the fact that only radial forces are involved. This constraint in turn leads to the Law of Conservation of Energy, and so it cannot be said that the presence of a dense sea of electrons and positrons will in anyway cause friction and hence interfere with the Keplerian motion of the planets. The electric sea is in actual fact part of the cause of why the planets move exactly as they do.

In the electric sea, the electron positron dipoles will be subjected to both the tangential Coriolis $\mathbf{v}\mathrm{X}\mathbf{B}$ force and the tangential angular $\partial\mathbf{A}/\partial t$ force that together constitute the Lorentz force. The dipoles will also exist in a state of centrifugal/Coriolis pressure in their equatorial planes that is absent in planetary orbital theory.

Centrifugal force occurs radially outwards between any two particles that possess a mutual tangential speed. In the simple Keplerian solution, this leads to circular, elliptical, parabolic, or hyperbolic motion. In the case of negligible gravity, the hyperbolic solution that we observe in everyday situations in the Cartesian reference frame appears as a straight line which we call 'Inertia'.

When two rotating electron-positron dipoles, both spinning in the same direction are placed side by side in their equatorial planes, the individual electrons and positrons within one dipole will possess enormous mutual tangential speeds with respect to the individual electrons and positrons within the other dipole. We will have a four body problem. Since the motions of the individual electrons and positrons are constrained to move in a circle, this means that the two dipoles will repel each other. The reason is that due to this constraint, pairs of single particles taken one from each of the two dipoles are not free to follow the natural conic path that would be prescribed by their associated mutual two body problem as

considered in isolation. There is also the issue of a compression building up in the aether between the two dipoles.

Due to the vorticity involved, the situation will be asymmetric and the mutual repulsion between these two dipoles will be caused by a combination of both centrifugal force and Coriolis force. If one of these dipoles is subjected to an angular acceleration $\partial\mathbf{A}/\partial t$ as in the dynamic case of electromagnetic induction, we know that this will have the effect of causing the other dipole to angularly accelerate in sympathy in the same direction. Energy can be transferred between the dipoles since neither Kepler's law of areal velocity nor the law of conservation of energy apply to the situation.

This energy transfer can be explained by the fact that the angular acceleration of the first dipole has the effect of increasing the repulsion between the two dipoles, and at an angle. Due to the asymmetric vorticity and the fact that the Coriolis force is augmenting the centrifugal force, this repulsion is at such an angle as to give a reactive back kick on the other dipole. This back kick leads to the torque that causes the other dipole to angularly accelerate in the same direction. Kepler's law of areal velocity does not apply, and the transfer of energy will be governed by Lenz's Law.

Electromagnetic radiation would appear to consist of a propagated oscillating transverse vorticity **H** and an oscillating predominantly longitudinal centrifugal/Coriolis pressure.

We now need to explain how the electric current in the wire starts the process off in the first place. We know that the process only begins when the current in the wire is accelerating. It takes translational acceleration of electric current to increase a magnetic field. If this translational acceleration is to create a back kick and a torque on the neighbouring electron positron dipoles, then we would expect that the entire system would have to be under high pressure and linked to the cogwheel mechanism. This would suggest that the particles of electric current are also mutually orbiting pairs in a state of translational motion and aligned solenoidally in sympathy with the magnetic field. It would seem that electric current constitutes an arrangement of high pressure wheels skidding along the inside of a wire. The equatorial planes of these wheels would spread out radially from a cross section looking down the inside of the wire, and the axial planes of these wheels would form solenoidal rings and intersect with the radial lines in spider's web fashion.

The mutual circumferential velocities that exist between adjacent aethereal vortices in the equatorial plane is in the order of nearly thrice the speed of light, hence making the sea of vortices, and hence the magnetic field, into a very high pressure solid in the equatorial plane. The drift velocities of electric particles in a wire would not be high enough to account for electromagnetic induction if electric current were to only constitute free electrons. Rotating pairs are needed to get the necessary mutual tangential speeds and hence the necessary aether pressure.

The Barnett Effect and the Earth's Magnetic Field

VII. We must now enquire as to why we don't appear to observe any high degree of mutual repulsion between spinning objects on the large scale.

The answer lies in Kepler's law of areal velocity. Kepler's law of areal velocity tells us that there is no large scale vorticity. This fact is hardly surprising in view of the fact that space is permeated with tiny vortices. It would be very difficult to imagine how any large scale vorticity could fit around this tiny vortex scenario. The sea of tiny vortices acts like a rotationally elastic sponge and soaks up all the large scale vorticity. What this effectively means is that all 'would be' large scale vorticity becomes manifested in the form of a magnetic field. Descartes' vortex theory of gravity contradicted Kepler's laws for the simple reason that it implied tangential effects on the motion of the planets that would have contradicted the Law of Conservation of Energy. The tangential effects implied by Descartes' vortex universe are mathematically identical to the Lorentz force. Descartes had failed to see how a sea of tiny vortices would split the fundamental forces into a zero curl theory of gravity and a non-zero curl theory of electromagnetism.

When two magnets are repelling each other, the magnetic field lines spread away from each other. This represents the fact that the hydrostatic pressure in the vortex sea, due to centrifugal and Coriolis repulsion, is leaking out sideways between the magnets and reducing the direct head on effect.

In the case of two large gyroscopes both spinning in the same direction, the direct mutual repulsion is spread out sideways far and wide. In order for spinning objects on the large scale to have any noticeable magnetic effect, the angular velocity would have to be very high indeed, or there

would have to be a concentrated interaction between their atomic matter and the sea of aether vortices, or both. We would expect that there might be a considerable degree of slippage between the atomic matter of the gyroscopes and the electric sea contained within them, but we would need very high tangential speeds before these gyroscopes could begin to compete with the effect that is generated between two electron positron dipoles.

In ferromagnetic materials, in which the concentration of aether vortices is higher than in any other materials, a small but definite magnetic field was indeed detected in 1915 by S. J. Barnett. Barnett detected this effect when he spun ferromagnetic materials to angular speeds of around 3,000rpm [1].

The Difference between the B Field and the H Field

VIII. The difference between the magnetic flux density vector **B** and the magnetic field vector **H** can be traced back historically to Maxwell's 1855 paper ‘On Faraday’s Lines of Force’. The picture becomes quite clear in his concept of a sea of molecular vortices. See his original 1861 paper 'On Physical Lines of Force’ at,

http://vacuum-physics.com/Maxwell/maxwell_oplf.pdf

Within that context, **H** represented pure vorticity (spin), whereas **B** was a weighted vorticity that was weighted for the density of the vortex sea. Maxwell considered magnetic permeability μ to be a measure of the density of the vortex sea. Hence the relationship,

Magnetic Induction Current

$$\mathbf{B} = \mu\mathbf{H} \qquad (1)$$

was essentially an angular analogy to the linear electric current relationship,

Electric Convection Current

$$\mathbf{J} = \rho\mathbf{v} \qquad (2)$$

where ρ is electric charge density.

B was seen as a kind of magnetic current of vortices aligned in their axial planes, with **H** being closely related to the circumferential velocity of the vortices. **B** is effectively a magnetic flux density.

The electric current equation can be viewed as a convective current of electric charge that involves linear motion. By analogy, the magnetic equation is an inductive current involving spin. There is no linear motion in the inductive current along the direction of the **B** vector. The magnetic inductive current represents physical lines of force. In particular, it represents lines of microscopic fine-grain inverse square law force.

Negative Atomic Nuclei

IX. If we replace the electron cloud of atomic and molecular matter with a dielectric sea, we might then ask if an array of atomic or molecular nuclei might not also be dielectric. Rutherford claims to have shown us that atomic nuclei are positively charged, however his experiment might only have demonstrated that some atomic nuclei are positively charged. It might also have demonstrated centrifugal repulsion between rotating objects.

The Diameter of the Electron-Positron Dipoles

X. It was once suggested in 'The Double Helix Theory of the Magnetic Field' that the diameter of the electron-positron dipoles might be in the order of femtometers. That estimation was based on the assumption that these dipoles are undergoing unpressurized Keplerian orbits. Due to the large centrifugal/Coriolis pressure involved, these dipoles are being compressed and as such it becomes very difficult to be able to calculate the exact diameter. The diameter would actually have to be alot smaller than that calculated using the uncompressed Kepler's laws. In addition to this difficulty, for reasons discussed in "Charge, Spin, and 'Charge to Mass' Ratio" it is quite possible that we should be using Newton's law of gravitation in the formula as opposed to Coulomb's law of electrostatics. And although gravity is normally much weaker than electrostatics, we don't actually know if it will be weaker in the case of an electron being attracted to a positron.

Electrostatic force is normally measured on the basis that the intervening medium is the electric sea of electrons and positrons. However, in the case of an electron in orbit around a positron in the bound state, the intervening medium will be pure space (aether). The electric permittivity of pure space will be many orders of magnitude smaller than that of the electric sea since pure space contains no leakage sinks. This may have the effect of bringing the magnitude of the attractive force back into line with what it would have been had we just assumed the attractive force to be determined by standard electrostatic theory.

At the end of the day, we have got no means by which to accurately calculate the diameter of an electron positron dipole. The only thing that we can say for certain is that its diameter is on a scale that is many orders of magnitude smaller than the atomic and molecular scale.

[1] Barnett S. J., *"Magnetization by Rotation"* Physical Review 6/4 (1915) 239 - 270