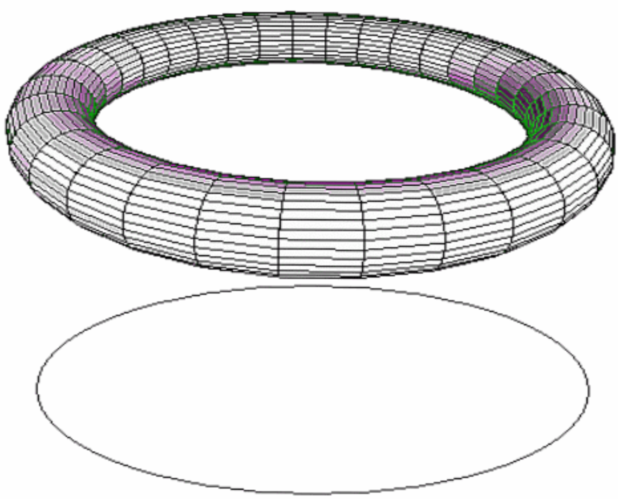
the general science journal

Ring Electrons



john.erich.ebner@gmail.com
http://blackholeformulas.com

Abstract

The cover shows a ring electron, a hollow torus made out of a flux tube. The tube is very much smaller than the ring so the pretty drawing on the top is not to scale. The line drawing of the ellipse on the bottom is much closer to scale.

The radius of the ring is r_{ring} and the radius of the tube is r_{tube}. The ratio of $r_{ring}/r_{tube} = \pi/\alpha = 430.511$. This ratio is like a one inch diameter garden hose with a length of 225 feet making a ring with a diameter of 72 feet. When you can see all of the ring it looks like a line drawing of an ellipse not a hollow torus.

The ring proton might also have this same ring/tube ratio but it must be much smaller. A ring proton at this scale would be a dot smaller than a fourth the width of the line.

A charge may travel around the ring like water in a hose or be confined to a cross sectional ring or surface or both.

Does charge have volume or does it only have surface? In the ring electron, there is a flux of charge, a current, flowing around a very skinny circular flux tube at the speed of light.

Since this current must flow without loss for the electron to endure, the electron is a superconductor.

We don't expect to see the electron laying on the ground like a hula hoop. We expect to see the ring spinning sphere-like. The smaller the ring the easier it spins.

Authors Note

This document was written with Latex `http://latex-project.org/ftp.html` and TexStudio `http://texstudio.sourceforge.net/`, both of which are excellent, open-source and free. The PDF pages it produces can be read in two page view and printed two pages at a time in landscape to save paper or make a booklet.

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1 Introduction

The electron and proton have mass, charge, angular momentum and magnetic moment which can be tied together with the dynamic structure of a ring.

They are tiny machines which have energy in orbit like Bohr's planetary atoms [1], helical electromagnetic waves [2] and the Cosmos [3]. The cover was drawn with the awesome and free k3dsurf [4].

Electrons have a charge and a magnetic field. Moving charge is a current which produces a magnetic field so we may say the charge orbits in the electron producing its magnetic field. Does the charge loop because of the magnetic field or does the looping charge cause a magnetic field? We do know a charge and magnetic moment coexist in the electron. The electron has an angular momentum and magnetic moment which require the energy equivalent of mass to orbit at a certain radius, which we use, so it is unlikely to be a point particle. The geometry of a ring electron can accommodate the electrodynamics necessary, for charge moving at the speed of light, to be restrained by its magnetic field. Bergman's and Wesley's 1990 ring electron paper [5], ring protons and dual ring electron-proton neutrons are at this site [6] worth exploring.

2 Ratio of electrostatic to gravitational forces

$$me\cdot c^2 = \frac{ce^2}{4\pi\epsilon_0 r_c} \; and \; r_c = \frac{ce^2}{4\pi\epsilon_0\cdot me\cdot c^2} = 2.82E\neg 15 \; m \tag{2.1}$$

The rest energy of the electron equals the energy of its charge when the radius is r_c. Where r_c is the classical radius of the electron, me is the mass of the electron, ϵ_0 is the permittivity of space, c is the speed of light. As the radius of the electron is reduced below r_c, the energy exceeds that contained in its charge. This seems to me unlikely event. How does something contain more than $me\cdot c^2$ of energy?

$$Fc = \frac{ce^2}{4\pi\epsilon_0 r^2} \tag{2.2}$$

Fc is the electrostatic repulsive force between two electrons with a charge of ce at a separation of r meters but

$$me\cdot c^2\cdot r_c = \frac{ce^2}{4\pi\epsilon_0} \tag{2.3}$$

so

$$Fc = \frac{me \cdot c^2 \cdot r_c}{r^2} \tag{2.4}$$

$$Fg = \frac{G \cdot me^2}{r^2} \tag{2.5}$$

This is the gravitational force between two electrons at a separation of r meters. G is the gravitational constant.

$$\frac{Fc}{Fg} = \frac{c^2 \cdot r_c}{G \cdot me} = 4.16E42 \tag{2.6}$$

This is the huge ratio of electrostatic repulsive forces to gravitational attractive forces between two electrons.

$$Fc = Fg \tag{2.7}$$

We can write the electrostatic repulsion of the charge of the electrons equals the gravitational attraction of the electrons.

$$\frac{me \cdot c^2 \cdot r_{bh}}{r^2} = \frac{G \cdot me^2}{r^2} \tag{2.8}$$

$$c^2 \cdot r_{bh} = G \cdot me \tag{2.9}$$

This is the blackhole formula with radius = r_{bh} and mass = me.

$$r_{bh} = \frac{G \cdot me}{c^2} = 6.76E\neg 58\ m \tag{2.10}$$

r_{bh} is the radius of the black hole where light will orbit, using the mass of the electron and the black hole formula [3]. The rest energy of the electric charge is packed into far too small a sphere. $r_c = r_{bh} \cdot 4.16E42$. The energy packed into the volume of r_{bh} would be 4.16E42 time the energy of the charge or of $me \cdot c^2$.

$$me \cdot c^2 = \frac{ce^2}{4\pi r_{bh} \cdot 4.16E42} \tag{2.11}$$

This radius is far too small for the electron to have angular momentum or spin but this radius times the ratio of the electrostatic to gravitational forces, equation (2.6), equals r_c.

$$r_c = r_{bh} \cdot 4.16E42 = r_{bh} \cdot \frac{c^2 \cdot r_c}{G \cdot me} = \frac{G \cdot me}{c^2} \cdot \frac{c^2 \cdot r_c}{G \cdot me} \tag{2.12}$$

The ring electron can be described as having energy in orbit like a black hole but based on 4.16E42 times stronger electromagnetic not gravitational forces holding the energy equivalent of mass in orbit. One might call them electromagnetic black holes. For an alternate approach see Don J. Stevens [9] or [10].

3 Planck's law

$$energy = h_p \cdot frequency \tag{3.1}$$

Planck's constant is $h_p = 6.6260755E\neg 34\ kg \cdot m^2$

$$me \cdot c^2 = h_p \cdot frequency = 8.1871044E\neg 14\ \frac{kg \cdot m^2}{s^2} \tag{3.2}$$

the energy of the electron.

$$me \cdot c^2 = \frac{h_p \cdot c}{wavelength} \tag{3.3}$$

substituted for frequency.

$$Compton's\ wavelength = \frac{h_p \cdot c}{me \cdot c^2} = \frac{h_p}{me \cdot c} \tag{3.4}$$

isolated wavelength.

$$r = \frac{wavelength}{2\pi} = \frac{h_p}{2\pi \cdot me \cdot c} = \frac{r_c}{\alpha} = 3.86E\neg 13\ m \tag{3.5}$$

since

$$h_p = 2\pi \cdot me \cdot c \cdot \frac{r_c}{\alpha} \tag{3.6}$$

Planck's law implies the radius of the electron is $r_{ring} = \frac{r_c}{\alpha}$

4 Electron magnetic moment

The magnetic moment, mm, is current·area, the current flowing around a loop times the area enclosed by the loop.

The electron must have a shape. Current·area suggests the electron is a disk. We seek current as a ring and magnetic field as something like a disk.

$$mm = current \cdot area \tag{4.1}$$

$$mm = charge \cdot frequency \cdot area \tag{4.2}$$

substituted for current.

$$mm = charge \cdot \frac{velocity}{circumference} \cdot area \tag{4.3}$$

substituted for frequency.

$$mm = charge \cdot \frac{velocity}{2\pi r} \pi r^2 = .5 \cdot q \cdot v \cdot r \tag{4.4}$$

collected terms.

$$mm = .5 \cdot ce \cdot c \cdot r_{ring} = \frac{me \cdot c^2}{2 \cdot B} \tag{4.5}$$

where r_{ring} is the radius of the ring electron.

$$mm = .5 \cdot ce \cdot c \cdot r_{ring} = \frac{h_p}{4\pi} \frac{ce}{me} \tag{4.6}$$

equate with $\frac{h_p}{4\pi} \frac{ce}{me}$ the magnetic moment of the electron. The ce terms cancel and me is transposed.

$$angular\ momentum = .5 \cdot kg \cdot v \cdot r = .5 \cdot me \cdot c \cdot r_{ring} = \frac{h_p}{4\pi} \tag{4.7}$$

collected terms. This is the same equation we see in the angular momentum. The incongruity between the magnetic moment and the angular momentum has been resolved in a simplistic even humorus way. Is this a too easy result? Are these simplistic solutions hiding a more complex underlying reality? The incongruity between two things being resolved in an odd way is one definition of a joke. We see a similar almost too simple pattern in the appendix, with

$$\epsilon_0 \cdot \mu_0 = \frac{1}{c^2}\ and\ z_0 = \frac{1}{\epsilon_0 \cdot c} = c \cdot \mu_0\ ohms \tag{4.8}$$

$$r_{ring} = \frac{hp}{2\pi \cdot me \cdot c} = \frac{r_c}{\alpha} \tag{4.9}$$

isolated r_{ring} where

$$hp = \frac{2\pi \cdot me \cdot c \cdot r_c}{\alpha} = \frac{kg \cdot m^2}{s} \tag{4.10}$$

$$magnetic\ moment = mm = .5 \cdot q \cdot v \cdot r_{ring} = .5 \cdot ce \cdot c \cdot \frac{r_c}{\alpha} \quad (4.11)$$

The magnetic moment implies that the radius of the electron is

$$r_{ring} = r_{re} = \frac{r_c}{\alpha} \quad (4.12)$$

5 Proton magnetic moment

$$magnetic\ moment\ proton = mm_p = .5 \cdot charge \cdot velocity \cdot radius \quad (5.1)$$

$$mm_p = .5 \cdot ce \cdot c \cdot r_{rp} = \frac{h_p}{4\pi} \frac{ce}{mp} \quad (5.2)$$

Spin is constant in both the electron and proton at $\frac{h_p}{4\pi}$. The magnetic moment is spin times the charge divided by the mass. The magnetic moment decreases with increasing mass.

$$mm_p = .5 \cdot mp \cdot c \cdot r_{rp} = \frac{h_p}{4\pi} \quad (5.3)$$

collected terms.

$$r_{rp} = \frac{h_p}{2\pi \cdot mp \cdot c} \quad (5.4)$$

isolated the radius of the ring proton.

$$r_{rp} = \frac{2\pi \cdot me \cdot c \cdot r_c}{2\pi \cdot mp \cdot c \cdot \alpha} = \frac{me}{mp} \cdot \frac{r_c}{\alpha} = \frac{me}{mp} \cdot r_{re} \quad (5.5)$$

The radius of the ring proton = $2.10E\neg 16\ m$ which is mp/me, 1836.15, times smaller than the ring electron. The radius of the tube of the ring proton is $4.88E\neg 19\ m$.

6 Proton magnetic field

$$B_{rp} = \frac{mp \cdot c^2}{ce \cdot c \cdot rp} \quad (6.1)$$

the huge magnetic field of the proton from the proton magnetic moment.

$$B_{rp} = B_{re} \cdot \frac{mp}{me^2} = \frac{mp \cdot c \cdot \alpha}{ce \cdot r_c} \cdot \frac{me}{mp} = 1.488E16 \frac{kg}{A \cdot s^2} \tag{6.2}$$

a magnetic field this big would disrupt orbits in the atom were it not concealed in a loop.

7 Bohr magneton or electron magnetic moment

$$mm = .5 \cdot charge \cdot velocity \cdot radius \tag{7.1}$$

$$.5 \cdot ce \cdot v \cdot r_{ring} = \frac{.5 \cdot ce \cdot c \cdot r_c}{\alpha} = 9.27E\neg 24\ A \cdot m^2 \tag{7.2}$$

The accepted value of the magnetic moment,

$$mm = 9.284770E\neg 24\ A \cdot m^2\ is\ about\ (1 + \frac{1}{862})\ or\ (1 + \frac{\alpha}{2\pi}) \tag{7.3}$$

times bigger than the Bohr magneton. Where do all those decimal places come from? We paint with a broad brush omitting small corrections. Small corrections imply perfect knowledge. We will see that α/π is the ratio of the radii of the ring electron.

8 Electron angular momentum or spin

The electron angular momentum, am_e, or spin, is mass current·area, the mass flowing around a loop times the area enclosed by the loop. This implies that the electron is a disk as noted above.

$$am_e = mass \cdot frequency \cdot area \tag{8.1}$$

substituted for mass current.

$$am_e = mass \cdot \frac{velocity}{circumference} \cdot area \tag{8.2}$$

substituted for frequency.

$$am_e = me \cdot \frac{c}{2\pi r} \cdot \pi r^2 = .5 \cdot me \cdot c \cdot r \tag{8.3}$$

collected terms. Equate with $\frac{h_p}{4\pi}$ the spin of the electron.

$$am_e = .5 \cdot me \cdot c \cdot r_{ring} = \frac{h_p}{4\pi} \tag{8.4}$$

This is the same equation we found in the magnetic moment.

$$r_{ring} = \frac{hp}{2\pi \cdot me \cdot c} = \frac{r_c}{\alpha} = r_c \cdot 137.036 = 3.86E\neg 13\ m \tag{8.5}$$

Isolated r_{ring}. The angular momentum implies that the radius of the electron is $r_{ring} = \frac{r_c}{\alpha}$.

9 Electron spin

Spin is constant at $\frac{h_p}{4\pi}$. We can write

$$h_p = 2\pi \cdot me \cdot c \cdot r_{ring} \tag{9.1}$$

If the relativistic mass of me increases as the radius of r_{ring} decreases then the spin at $\frac{h_p}{4\pi}$ stays constant. The magnetic moment however $\frac{h_p}{4\pi}\frac{ce}{me}$ decreases with increasing mass.

Planck's law, the spin and the magnet moment of the electron imply that the radius of the electron is $r_{ring} = r_c/\alpha$ and that the circumference is,

$$Compton's\ wavelength = \frac{2\pi r_c}{\alpha} = \frac{h_p}{me \cdot c} \tag{9.2}$$

If me increases while r_{ring} decreases then the angular momentum may stay constant. If the mass, me, and therefore the rest energy increases then the radius of the electron r_{ring} must decrease. The electron ring must show a very small radius at high energy in a particle accelerator. The ring electron spins sphere-like. The sphere has void center. The tube of the electron is small and difficult to detect. The electron tube is $\frac{\pi}{\alpha} = 430.511\ times\ smaller$ than the ring. The radii are ever smaller at higher energy. Small but not a point. This is not evidence that the electron is a point particle. A point particle must incorporate infinite magnetic pinch pressure, force/area, to restrain the infinite electrostatic pressure of repulsion, energy/volume, due to the charge of the electron being confined to the infinitely small volume of a point. This makes a point particle electron infinitely improbable. We abhor infinities. The gigantic ring currents and magnetic fields we calculate also strain credibility. However, so much energy in such a small volume has to come from somewhere.

10 The g-factor

This is a quote from Wiki [7] "The spin of a charged particle is associated with a magnetic dipole moment with a g-factor differing from 1. This is incompatible with classical physics, assuming that the charge and mass of the particle are distributed evenly in spheres of equal radius."

Of course, from the name of this paper, one might astutely infer we are not taking the electron as a sphere.

11 The electron is not a sphere

Is the electron a disk or a ring or what?
Angular momentum = I $\cdot\,\omega$
I is the moment of inertia and ω is the angular velocity.

$$\frac{h_p}{4\pi} = I\cdot\omega \tag{11.1}$$

Substitute for the angular momentum of the electron.
ω = v/r = c/r and the velocity is v = c in the electron. Substitute for ω.

$$\frac{h_p}{4\pi} = \frac{I\cdot c}{r} \tag{11.2}$$

Isolate r.

$$r = \frac{I\cdot 4\pi c}{h_p} \tag{11.3}$$

Substitute for the moment of inertia of a

$$disk : I = \frac{m\cdot r^2}{2}$$

$$r = \frac{m\cdot r^2\cdot 4\pi c}{2\cdot h_p} \; or \; r = \frac{h_p}{2\pi\cdot m\cdot c} \tag{11.4}$$

$$r = \frac{h_p}{2\pi\cdot me\cdot c} = \frac{r_c}{\alpha} = 3.86E\neg 13\ m \tag{11.5}$$

This is the radius for a disk with the correct angular momentum.

I speculate, the ambiguity in the shape of the electron, in its moment of inertia, might be resolved in favor of the disk shaped electron. We have toroidal currents along the circumference of the ring of the electron and poloidal magnetic flux through the area of the ring of the electron. Both of which have energy and therefore mass. It would be hard to say the mass is only confined to the ring. The mass might be said to be confined to something like a disk which includes the ring.

12 Poincare stress and energy density

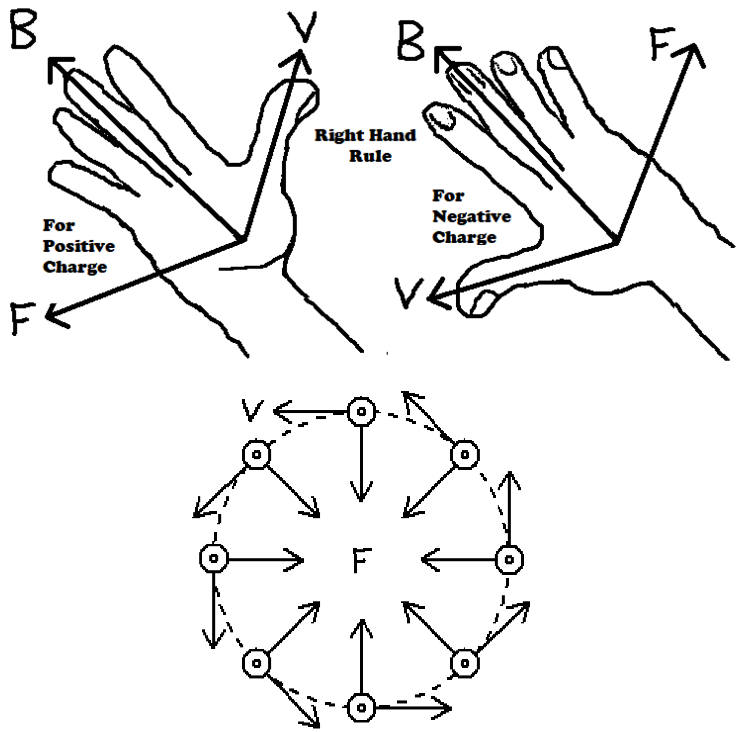

Figure 1: Right Hand Rule for charges
An orbiting negative charge generates a vertical magnetic field, pointing up, and a center seeking centripetal force.

Lorentz equation for magnetic force:

$$\overrightarrow{F_b} = q \cdot \overrightarrow{v} \times \overrightarrow{B} = \textit{ seen here as } = q \cdot c \cdot B \tag{12.1}$$

The product of charge and velocity(with respect to B) are perpendicular to B. Only a moving charge is effected by a magnetic field. The static magnetic field of the electron is generated by the moving charge in orbit. The vector B rotates around the axis of $q \cdot v$ so we use it twice. Once for the radius of the torus and once for the radius of the tube of the torus.

"Poincare stress" has to be present to prevent the electric charge of an electron from flying apart due to the Coulomb repulsion". See Paul Marmet [11]

$$q \cdot E = q \cdot c \cdot B \tag{12.2}$$

$q \cdot E$ is a radial force like centrifugal force. $q \cdot c \cdot B$ is a center seeking centripetal force somewhat like gravity.

The electrostatic force of repulsion of the charge equals the magnetic pinch force of attraction of the charge when the charge moves at the speed of light. This $q \cdot v \cdot B$ force is what keeps charge in orbit in the electromagnetic wave, cyclotron, tokamak and ring electron and what causes the spiral of charged particles in the magnetic field of a bubble chamber as the particles loose velocity. $q \cdot v \cdot B$ acts like a central force to keep the charge and its energy equivalent of mass in orbit. We are comfortable with the central force of gravity holding the planets in orbit. This central force is more obscure. There is no central object to provide a central force. There is only $q \cdot v \cdot B$. The direction of the moving charge is changed by B. How does this work? We know how it acts sometimes. We seek a metaphor to describe this peculiar force.

$$E = c \cdot B \; in \; \frac{kg \cdot m}{A \cdot s^3} \tag{12.3}$$

Cancelled q, units are volts per meter, force per charge.

$$E^2 = B^2 \cdot c^2 \tag{12.4}$$

Squared.

$$E^2 = B^2 \cdot \frac{1}{\mu_0 \cdot \epsilon_0} \tag{12.5}$$

Substituted $c^2 = 1/(\mu_0 \cdot \epsilon_0)$

$$E^2 \cdot e0 = \frac{B^2}{\mu_0} = 1.55E25 \frac{kg}{m \cdot s^2} \tag{12.6}$$

The energy density or pressure of the E and B fields are equal.

$$\frac{force}{area} = \frac{energy}{volume} = \frac{kg}{m\cdot s^2} = pressure = Pascals \tag{12.7}$$

$$\frac{kg\cdot m}{s^2}\frac{1}{m^2} = \frac{kg\cdot m^2}{s^2}\frac{1}{m^3} = \frac{kg}{m\cdot s^2} \tag{12.8}$$

This is the magnetic pinch pressure equals the electrostatic pressure of repulsion. This magnetic pinch pressure restrains the charge to the thin ring of the electron like a hose restrains water.

13 Moving E generates B

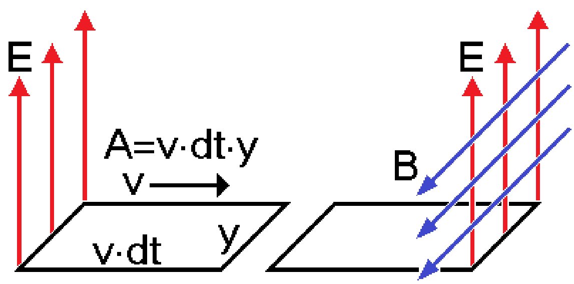

Figure 2: Moving E field generates B

A is the area of square $v\cdot dt\cdot y$. The transition from E to B takes dt time in figure (2).

13.1 Rectangular area

$$\phi_E = E\cdot A = E\cdot y\cdot v \tag{13.1}$$

$$d\phi_E = E\cdot y\cdot v\cdot dt \tag{13.2}$$

$$\frac{d\phi_E}{dt} = E\cdot y\cdot v \tag{13.3}$$

$$\oint_C \overrightarrow{B} \circ \overrightarrow{dl} = \mu_0\epsilon_0\frac{d\phi_E}{dt} \tag{13.4}$$

$$B\cdot y = \mu_0\epsilon_0\cdot E\cdot y\cdot v \tag{13.5}$$

$$B = \mu_0\epsilon_0\cdot E\cdot v \tag{13.6}$$

$$E = \frac{B}{\mu_0\epsilon_0\cdot v} = \frac{c^2}{v}B \tag{13.7}$$

$$E = c\cdot B \qquad If\ v = c: \tag{13.8}$$

13.2 Circular area

$$\phi = E\cdot A = E\cdot \pi r^2 \tag{13.9}$$

$$d\phi_E = E\cdot \pi r^2\cdot dt \tag{13.10}$$

$$\frac{d\phi_E}{dt} = E\cdot 2\pi r \tag{13.11}$$

$$\oint_C \overrightarrow{B} \circ \overrightarrow{dl} = \mu_0\epsilon_0\frac{d\phi_E}{dt} \tag{13.12}$$

$$B \cdot 2\pi r = \mu_0\epsilon_0\cdot E\cdot 2\pi r \tag{13.13}$$

$$B = \mu_0\epsilon_0\cdot E \quad or \quad B = (constant)\cdot E \tag{13.14}$$

$$E = \frac{B}{\mu_0\epsilon_0\cdot v} = \frac{c^2}{v}B \tag{13.15}$$

$$E = c\cdot B \qquad when\ v = c \tag{13.16}$$

14 Moving B generates E

A is the area of square $v\cdot dt\cdot y$. The transition from B to E takes dt time in figure (3).

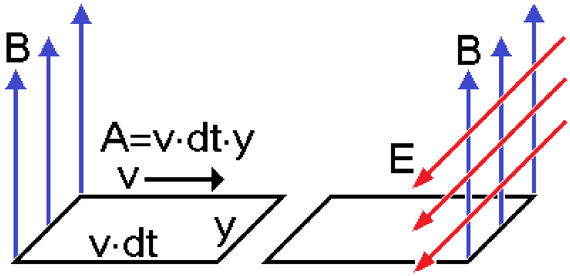

Figure 3: Moving B field generates E

14.1 Rectangular area

$$\Phi_B = B \cdot A = B \cdot y \cdot v \tag{14.1}$$

$$d\Phi_B = B \cdot y \cdot v \cdot dt \tag{14.2}$$

$$\frac{d\Phi_B}{dt} = B \cdot y \cdot v \tag{14.3}$$

$$\oint_C \overrightarrow{E} \circ \overrightarrow{dl} = \neg \frac{d\Phi_B}{dt} \tag{14.4}$$

$$E \cdot y = B \cdot y \cdot v \tag{14.5}$$

$$E = c \cdot B \qquad If \ v = c \tag{14.6}$$

14.2 Circular area

$$\Phi_B = B \cdot A = B \cdot \pi r^2 \tag{14.7}$$

$$d\Phi_B = B \cdot \pi r^2 \cdot dt \tag{14.8}$$

$$\frac{d\Phi_B}{dt} = B \cdot 2\pi r \tag{14.9}$$

$$\oint_C \overrightarrow{B} \circ \overrightarrow{dl} = \frac{d\Phi_B}{dt} \tag{14.10}$$

$$B \cdot 2\pi r = E \cdot 2\pi r \tag{14.11}$$

$$E = c \cdot B \tag{14.12}$$

15 Electron energy

$$force\cdot radius = energy \tag{15.1}$$

in an orbiting system.

$$q\cdot v\cdot B\cdot r_{ring} = me\cdot c^2 \tag{15.2}$$

energy of the orbiting electron where v is velocity c and r_{ring} is radius.

16 Cyclotron formula and the magnetic field

$$q\cdot c\cdot B = ce\cdot c\cdot B = \frac{me\cdot c^2}{r_{ring}} \tag{16.1}$$

the cyclotron formula with

$$centrifugal\ force = \frac{mass\cdot v^2}{r_{ring}}$$

The $q\cdot c\cdot B$ force holds the mass energy of the electron charge in orbit.

$$B_{re} = \frac{me\cdot c^2}{ce\cdot c\cdot r_{ring}} = \frac{me\cdot c\cdot \alpha}{ce\cdot r_c} = 4.41E9\frac{kg}{A\cdot s^2} \tag{16.2}$$

Isolated B with q = ce. Four billion Teslas. This is the huge magnetic field calculated from the mass and the magnetic moment. A magnetic field this big would disrupt orbits of atoms were the magnetic field not contained within a loop. See the Beaty video [8]. This is the B at r_{ring} which holds the charge in orbit. This same value of B is next used at r_{tube}. It is used with the current and Ampere's law to define the radius of the tube. The huge magnetic field of the electron is derived from the well measured
mm = electron magnetic moment.

$$mm = .5\cdot charge\cdot velocity\cdot radius = magnetic\ moment \tag{16.3}$$

$$mm = .5\cdot ce\cdot c\cdot r_{ring} = \frac{.5\cdot ce\cdot c\cdot r_c}{\alpha} = \frac{ce\cdot h_p}{4\pi\cdot me} \tag{16.4}$$

$$2\cdot mm\cdot B = 2\cdot .5\cdot ce\cdot c\cdot r_{ring}\cdot \frac{me\cdot c}{ce\cdot r_{ring}} = me\cdot c^2 \tag{16.5}$$

$$2\cdot mm\cdot B = me\cdot c^2 \tag{16.6}$$

the magnetic potential energy is the rest mass energy.

$$2\cdot mm\cdot B = h_p\cdot frequency \tag{16.7}$$

This is the electron spin resonance formula. The amount of rotational work is the torque times the angle to rotate the electron from alignment with the magnetic field to alignment plus 180 degrees which is a spin flip.

$$\frac{me\cdot c^2}{h_p} = 1.236E20\frac{1}{s} \tag{16.8}$$

the frequency of the ring electron.

$$\frac{me\cdot c^2\cdot \alpha^2}{h_p} = 6.58E15\frac{1}{s} \tag{16.9}$$

the frequency of the Bohr atom.

17 Toroidal electron current

$$amps = current = charge\cdot frequency = charge\cdot \frac{velocity}{circumference}$$

$$amps = \frac{ce\cdot c}{2\pi r_{ring}} = \frac{ce\cdot c\cdot \alpha}{2\pi r_c} = \frac{ce^2\cdot c^2}{4\pi\cdot mm} = 19.8\ A \tag{17.1}$$

18 Amperes law

The poloidal magnetic field around the tube of the electron is associated with the toroidal current along the ring of the electron.

$$\frac{2\pi r_{tube}\cdot B}{\mu_0} = amps \tag{18.1}$$

The loop around $r_{tube}\ times\ \frac{B}{\mu_0}$ equals the toroidal current.

$$r_{tube} = \ radius\ of\ the\ tube\ = \frac{amps}{B}\frac{\mu_0}{2\pi}$$

$$r_{tube} = \frac{ce\cdot c}{2\pi r_{ring}}\cdot \frac{ce\cdot r_{ring}}{me\cdot c}\cdot \frac{\mu_0}{2\pi} = \frac{ce^2}{2\pi\cdot me}\cdot \frac{\mu_0}{2\pi}$$

$$r_{tube} = \frac{ce^2}{4\pi^2 \cdot me \cdot \epsilon_0 \cdot c^2} = \frac{r_c}{\pi} = 8.97E - 16\ m \tag{18.2}$$

$$r_{ring} = \frac{hp}{2\pi \cdot me \cdot c} = \frac{r_c}{\alpha} = 3.86E - 13\ m \tag{18.3}$$

$$r_{tube} = \frac{\alpha}{\pi} \cdot r_{ring} = \frac{\alpha}{\pi} \cdot \frac{r_c}{\alpha} = \frac{r_c}{\pi} = \frac{r_{ring}}{430.511} \tag{18.4}$$

The ratio

$$\frac{r_{ring}}{r_{tube}} = \frac{\pi}{\alpha} = 430.511 \tag{18.5}$$

stays constant with increasing rest energy so that the relative proportions of the electron stay the same with decreasing size of the electron at higher electron masses.

Figure 4: Right Hand Rule

When you grab a ring with your right hand, the thumb points in the toroidal direction along the ring while the fingers curl through the area of the ring in the perpendicular poloidal direction around the tube. Poloidal flux, which occurs through an area, and perpendicular toroidal looping around, which occurs along a circumference, are always associated. A flux or current has magnitude and direction. It has a rate of change, d/dt, if its direction changes, even if its magnitude, area or circumference do not change. The flux of red E and green B, seen below, are as real as a mudslide. If they are real, what are they? We know their units. The mathematical interaction of units tells us something about the consistancy of our world model but one might mistake superficial knowledge of units for the deep knowledge of reality.

19 Ampere's and Faraday's laws

The red E electric field has units of

$$E = \frac{volts}{meter} = \frac{kg \cdot m}{A \cdot s^3} = \frac{kg \cdot m}{s^2} \frac{1}{A \cdot s} \tag{19.1}$$

$$E = \frac{force}{q}, force\ per\ charge\ or\ force\ per\ (amp \cdot second) \tag{19.2}$$

$$force = q \cdot E \tag{19.3}$$

q = $A \cdot s$ is charge. The green B magnetic field has units of

$$\frac{Weber's}{m^2} = Teslas = \frac{kg}{A \cdot s^2} \tag{19.4}$$

$$charge \cdot velocity = \frac{amps \cdot seconds \cdot meters}{second} = amps \cdot meters. \tag{19.5}$$

$$force = B \cdot q \cdot v = \frac{B \cdot A \cdot s \cdot m}{s} = B \cdot A \cdot m \tag{19.6}$$

v is velocity. This $B \cdot q \cdot$ v force is what keeps charge in orbit in the electromagnetic wave, cyclotron, tokamak and ring electron.

$$B \cdot q \cdot v = \frac{kg \cdot v^2}{r} = centripetal force\ in\ \frac{kg \cdot m}{s^2} \tag{19.7}$$

r is the orbital radius. $B \cdot q \cdot v$ acts like a central force to keep the charge and its energy equivalent of mass in orbit with the magnetic pinch force.

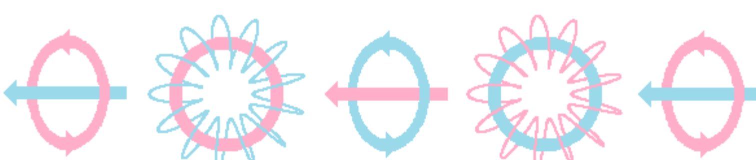

Figure 5: Electrons using Faraday's and Ampere's Laws

First on the left in figure (5), Faraday's law/($c\cdot u0$): The red ring is the moving electron charge which is a toroidal electron current in amps. The green arrow is the magnetic flux.

$$\frac{d(B\pi r^2)}{dt}\frac{1}{c\cdot\mu_0} = \frac{2\pi r\cdot E}{c\cdot\mu_0} = amps \tag{19.8}$$

Faraday's law/($c\cdot u0$). The poloidal green flux of B/($c\cdot u0$) times the area of the ring equals the toroidal red E/($c\cdot u0$) times the circumference of the ring. Red exerts a torque around green.

Second: The poloidal green flux which was shown as a green arrow is now shown as a green poloidal looping around the red torroidal current. The green flux is still out of the ring like the north pole of a magnet. We will use the cyclotron formula to calculate the poloidal green flux of B.

Third, Ampere's law:

$$\epsilon_0\cdot\frac{d(E\pi r^2)}{dt} = \frac{2\pi r\cdot B}{\mu_0} = amps \tag{19.9}$$

Maxwell's changing red poloidal displacement current times the area of the tube equals the toroidal green current times the circumference of the tube. Green exerts a torque around red. This is a cross section through the second figure. It shows a single green loop of the poloidal flux around the tube and a piece of the red ring is now shown as a red arrow. In this cross section, showing the tube of the electron, the former red toroidal is now red poloidal and the former green poloidal is now green toroidal. This perpendicular transformation, in going to a cross section, changes our viewpoint from Faraday to Ampere.

Fourth: The poloidal red flux which was shown as a red arrow is now shown as a red poloidal looping around a green torroidal current. The red flux is still out of the cross section of the tube. The red flux is the toroidal electron current along the ring of the electron.

They are something like a wave guide. For figure (6), go to the citation to enlarge.

On the left in figure (6): A green helix on a pink torus [12]. The pink electron current is surrounded by a green magnetic helix. As the distance between the green loops becomes infinitesmal, the green helix becomes a green tube, the green totally encloses the pink like a hose encloses water.

On the right in figure (6): A red helix on on a green helix on a pink torus of current [13]. This is the view when all three layers are stacked up. The green magnetic helix is surrounded by a red helical

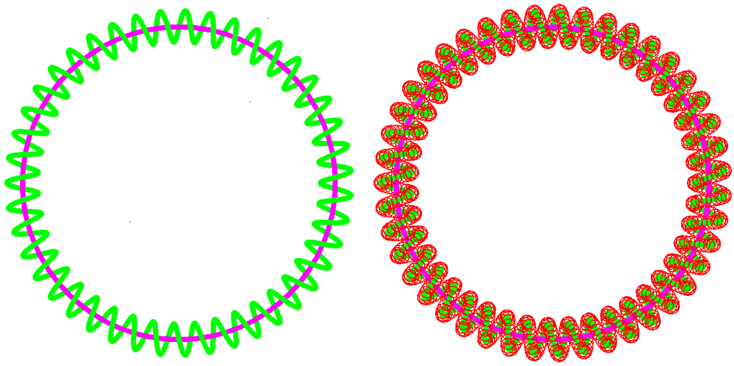

Figure 6: Another view of ring electrons

current layer. The red loops separation become infinitesimal in a different way than the green loops separation become infinitesimal.

As the distance between the red loops becomes infinitesimal, the field between the neighbor loops cancel where they are in opposite directions. The loops at the center of the tube, the pink current inside the green layer, reinforce each other where these loops are pointing in the same direction. The loops on the outside of the tube, outside of the green layer, reinforce each other, where they are pointing in the same direction. The residual field is the original electron current which is here shown as pink in the center of the tube, a green magnetic layer which is not shown and a current on the outside of the torus flowing in a direction opposite to the current in the center of the torus.

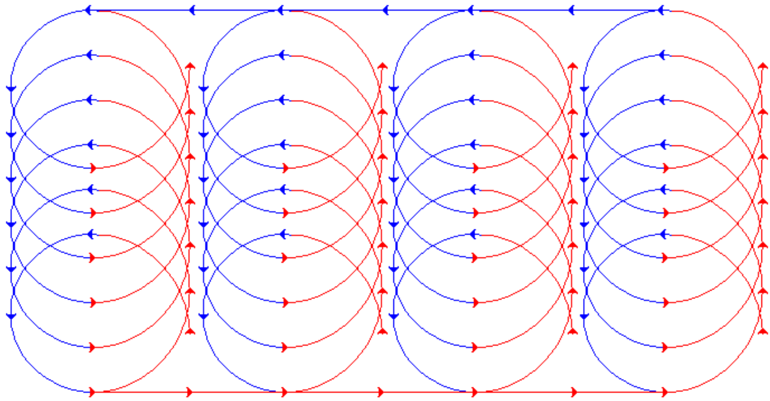

Figure 7: Helical loops cancel when oppositely directed and add when commonly directed. These helical current loops wrap around the green magnetic field which wraps around the torus. The red side of the loops and the blue side of the loops go in different directions, so they have a tendency to cancel when they are close together. Where the loops point in a common direction they have a tendency to add like the blue line at the top, which touches the torus, and the red line at the bottom, which is a little farther out from the torus, but oppositely directed.

20 Appendix

Ring electron torus surface area:

$$2\pi r_{ring} \cdot 2\pi r_{tube} = 1.367E - 26\ m^2 \tag{20.1}$$

Surface charge density:

$$\frac{Ce}{2\pi r_{ring} \cdot 2\pi r_{tube}} = 11.716E6\ \frac{A \cdot s}{m^2} \tag{20.2}$$

Ring electron torus volume:

$$2\pi r_{ring} \cdot \pi r_{tube}^2 = \frac{2\pi \cdot r_c}{\alpha} \frac{\pi \cdot r_c^2}{\pi^2} = \frac{2 \cdot r_c^3}{\alpha} = 6.1328E\neg 42\ m^3 \tag{20.3}$$

Charge volume density:

$$\frac{Ce \cdot \alpha}{2 \cdot rc^3} = 2.61246E22\ \frac{A \cdot s}{m^3} \tag{20.4}$$

Ring electron density:

$$\frac{me \cdot \alpha}{2 \cdot r_c^3} = 1.4853E11\ \frac{kg}{m^3} \tag{20.5}$$

Nuclear density is much larger at $10E21\ \frac{kg}{m^3}$.

Ring electron energy density using only the volume of the ring:

$$\frac{me\cdot c^2\cdot\alpha}{2\cdot r_c^3} = 1.3349E28\ \frac{kg}{m\cdot s^2} \tag{20.6}$$

This is 861.0224 times the energy density of B^2/μ_0 *or* $E^2\epsilon_0$.

$$\frac{B^2}{\mu_0} = \frac{me^2\cdot c^2\cdot\alpha^2}{ce^2\cdot r_c^2\cdot\mu_0} \tag{20.7}$$

$$\frac{me\cdot c^2\cdot\alpha}{2\cdot r_c^3}\frac{\mu_0}{B^2} = 861.0224 \tag{20.8}$$

$$\frac{me\cdot c^2\cdot\alpha}{2\cdot r_c^3}\frac{ce^2\cdot r_c^2\cdot\mu_0}{me^2\cdot c^2\cdot\alpha^2} = \tag{20.9}$$

$$\frac{1}{2\cdot r_c}\frac{ce^2\cdot\mu_0}{me\cdot\alpha} = 861.0224 = \frac{2\pi}{\alpha} \tag{20.10}$$

$$\frac{ce^2}{2\cdot r_c\cdot me\cdot c^2\cdot\epsilon_0\cdot\alpha} = 861.0224 = \frac{2\pi}{\alpha} \tag{20.11}$$

since

$$r_c = \frac{ce^2}{4\pi\epsilon_0\cdot me\cdot c^2} \tag{20.12}$$

21 Constants

me = mass of the electron = 9.109E-31 kg
ce = charge of the electron = 1.602E-19 $A \cdot s$
$\epsilon_0 = permittivity\ of\ free\ space = \frac{1E7}{4\pi c^2}\ \frac{A^2 \cdot s^2}{kg \cdot m}$
$\mu_0 = permeability\ of\ free\ space = \frac{4\pi}{1E7}\ \frac{kg \cdot m}{A^2 \cdot s^2}$
$\epsilon_0 \cdot \mu_0 = \frac{1}{c^2}$
$z_0 = impedance of space = \frac{1}{\epsilon_0 \cdot c} = c \cdot \mu_0 = 376.73\ \frac{kg \cdot m^2}{A^2 \cdot s^3} = ohms$
$\frac{4\pi}{\mu_0} = \frac{\epsilon_0}{4\pi c^2} = \frac{ce^2}{me \cdot r_c} = 1E7\ \frac{A^2 \cdot s^2}{kg \cdot m}$
$r_c = \frac{ce^2}{4\pi\epsilon_0 \cdot me \cdot c^2} = 2.82E - 15\ m$
The rest energy $me \cdot c^2$ equals the energy associated with the charge of the electron of ce and a radius of r_c, the classical radius of the electron:
$me \cdot c^2 = \frac{ce^2}{4\pi\epsilon_0 r_c}$
If the rest energy increases then r_c decreases.
frequency·wavelength = c
$me \cdot c^2 = hp \cdot frequency = \frac{h_p \cdot c}{wavelength}$
$\alpha = fine\ structure\ constant = .007297\ or\ \frac{1}{137.036}$
$h_p = Planck's\ constant = \frac{2\pi \cdot me \cdot c \cdot r_c}{\alpha} = 6.626E\neg 34\ \frac{kg \cdot m^2}{s}$
Compton's wavelength = hp/(me·c) = 2.426E-12 m
the circumference of the ring electron.

$$h_p \cdot \alpha = 2\pi \cdot me \cdot c \cdot r_c = \frac{ce^2}{2c\epsilon_0} \tag{21.1}$$

Any symbolic definition of h_p uses α and any symbolic definition of α uses h_p. This gives us at least two definitions each of both h_p and α. Combinations of the above three terms are seen. Electron spin comes from the first and second while r_c comes from the first and second or the second and third.

$$me \cdot c^2 \cdot r_c = \frac{ce^2}{4\pi\epsilon_0} = 2.307E\neg 28\ \frac{kg \cdot m^3}{s^2} \tag{21.2}$$

for comparison with,

$$1.41E\neg 28\ \frac{m^3}{kg \cdot s^3} = \frac{c^3}{M_c} = \frac{G}{age} \tag{21.3}$$

M_c is the mass of the cosmos about 1.91E53 kg.
G about $6.67E\neg 11\ \frac{m^3}{kg \cdot s^2}$ is the gravitational constant.
Age is the age of the cosmos about 15 billion years = 4.74E17 s. [3], Are these small and similar numbers a clue linking the force between electrons and the cosmological constants or is this merely numerology ?

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