DC Induction, a Means for Harnessing Quantum Energy
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1. Introduction.

This paper examines the force-field needed to extract energy from the spinning/orbiting motion of electrons responsible for magnetism, that energy being continually replenished by the active vacuum. Methods for creating this field are discussed.

2. The Solenoid equivalent for a Permanent Magnet

Permanent magnets are often characterised by an effective surface current. This current is imagined to flow around the surface of the magnet and to be responsible for the magnetic field of the magnet, Figure 1.

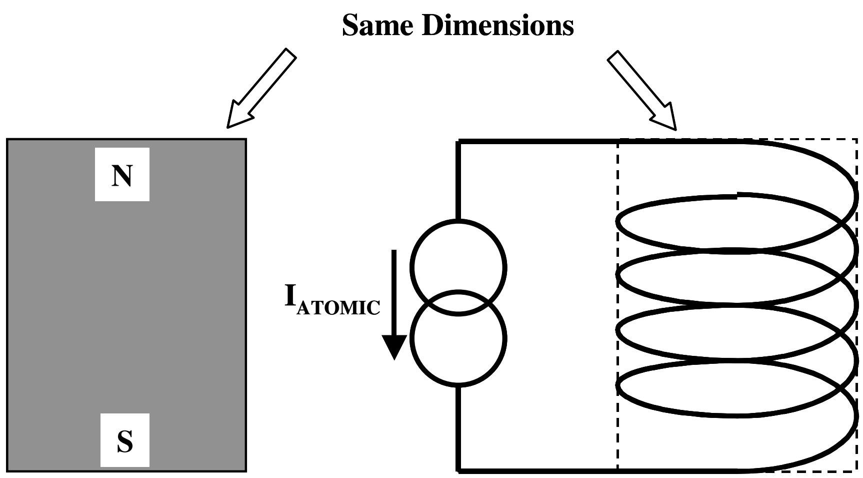

Figure 1. Magnet and its Equivalent Solenoid

Of course no such current exists, the field actually emanates from a vast number of spinning or orbiting electrons. However the surface current analogy is useful for predicting performance of some magnetic circuits, effectively the magnet is replaced with an air cored solenoid of identical dimensions. This imaginary solenoid is then energised by a current source which is continuously supplied by Nature, I_{ATOMIC} in Figure 1. It is therefore pertinent to ask the question, what is needed to load this current source so that energy is continuously drawn? The answer is of course to have a continuous (DC) voltage induced into the solenoid. If this voltage is of the correct polarity, energy is taken from the current source (if of the opposite polarity energy is given up to the current source).

That an induced voltage *can* extract such *quantum energy* is already an established fact, albeit hidden in EM theory and practise. Take a simple magnetic circuit consisting of a high permeability core with an air gap. Place two identical coils on that core. When we pass DC current through one coil we initially extract energy from the power source to "charge" its inductance: thereafter the continuous current drain extracts energy only to feed the copper losses, which we shall ignore. That initial quantity of energy (which we can call one unit) is effectively all stored in the air gap, and was drawn while the flux build-up induced a voltage to load the current source. Now apply an identical current to the second coil. The flux in the air gap is doubled in value, but energy is proportional to flux squared, so the energy stored there is now *four* units. However the charging of the second inductor takes only one unit of energy from its power source, *so where has that extra two units come from*? The answer is in that extra flux build-up creating voltage in the *first* coil to impose a second load impulse on its power source. If we now replace the first coil with a permanent magnet having equivalent surface current, we find that we start with one unit of energy in the gap supplied by Nature. By inputting just one unit of energy via the second coil we get two additional units of energy in the gap *supplied by Nature*. This is the basis of an OU reluctance motor described by Aspden, but the flaw in his argument becomes apparent when you examine the complete system (not just the air gap) over a full cycle. The machine has to return to its start conditions, where we find that the free energy extracted all gets fed back to the quantum world. What is needed for continual extraction of energy from the first coil/PM is *not* cycles of alternating voltage, but a continuous DC induction.

3. DC Voltage Induction into a Coil?

It is accepted wisdom in electromagnetic theory that DC induction into a coil is impossible. This view is based on the premise that induction involves a time rate of change of magnetic flux through the coil; essentially a DC voltage induction would require a magnetic field which rises continuously to infinity. However it should be noted that there is an interim step between the changing magnetic field (**B**) and the voltage induction. Induction involves a force on the conduction electrons, and by definition a force on an electric charge is an electric (**E**) field. The changing **B** field appears to *create* an **E** field, and it is the **E** field which drives the electrons. This **E** field is non-conservative. Unlike the conservative Coulomb field, here a closed integral does not yield zero, it yields a certain value, the *volts per turn*. Note that when dealing with alternating fields the phase relationship between the **B** field and its *created* **E** field is 90°.

What is generally overlooked in the perceived wisdom is the established fact that this quadrature phase relationship between **B** and **E** is not a universal requirement. Take EM radiation as an example. EM radiation in the far field involves **B** and **E** fields which are *in phase*. At the wave crests, both **B** and **E** are at a maximum value; d**B**/dt is zero, *but **E** is at a maximum*. Taken to the low frequency limit of DC, this can allow a static **E** field to coexist with a static **B** field.

Most scientists will quote one Maxwell equation as evidence that an **E** field is linked to a changing **B** field:-

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \qquad (1)$$

This tells us that if **B** is changing with time then there is an **E** field which has curl, i.e. **E** changes with distance. *It does not tell us that if the **B** field is static then **E** is zero.* When we look at this in relation to EM radiation, we find that **E** and **H** are in phase, having the ratio Z_0 (the impedance of free space), hence

$$\frac{\mathbf{E}}{\mathbf{B}} = \frac{Z_0}{\mu_0} = Z_0 c \qquad (2).$$

Therefore we can rewrite (1) to be

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{E}}{\partial t} \cdot \frac{1}{c} \qquad (3).$$

The only component of the Curl function is $(dE_x/dz)\mathbf{j}$, where z is the radiation direction, x is the polarisation direction and **j** is the unit vector along the y direction, then since

$\frac{\mu_0}{Z_0} = \frac{1}{c}$ and $c = \frac{\partial z}{\partial t}$ we get

$$\frac{\partial E_x}{\partial z} \cdot \frac{\partial z}{\partial t} = \frac{-\partial E_x}{\partial t} \qquad (4).$$

In this case the Maxwell equation (1) simply tells us the obvious, that if at a fixed point in space **B** (or **E**) is changing with time, then when we look back along the approaching radiation, we will see the **E** (or **B**) waveform changing with distance. *The changing **B** does not create the **E**, **B** and **E** both exist together in synchronism.* It will now be shown how a *local* static **E** field can be created.

4. Electron Acceleration

It is established physics that an accelerating charge radiates EM. In its most basic form, a point charge Q traveling at velocity **v** produces around it an **A** field related to **v**.

$$\mathbf{A} = \frac{\mu_0 Q \mathbf{v}}{4\pi r} \qquad (5)$$

Everywhere, **A** points in the velocity direction, and the magnitude of **A** varies with inverse distance r. Most texts dealing with accelerating charge start with an elementary dipole consisting of two opposite-polarity charges $+Q$ and $-Q$ separated by a small distance **l**, thus forming an electric dipole of moment $\mathbf{p}=Q\mathbf{l}$. Then if one charge is stationary while the other moves at velocity **v**, $Q\mathbf{v}=d\mathbf{p}/dt$ and (5) becomes

$$\mathbf{A} = \frac{\mu_0}{4\pi r}\frac{d\mathbf{p}}{dt} \qquad (6)$$

If the velocity is changing with time, then the changing **A** field produces an electric field component given by

$$\mathbf{E}_A = -\frac{d\mathbf{A}}{dt} = -\frac{\mu_0 Q}{4\pi r} \cdot \frac{d\mathbf{v}}{dt} = \frac{\mu_0}{4\pi r}\frac{d^2\mathbf{p}}{dt^2} \qquad (7)$$

where the subscript $_A$ denotes the vector potential derivation of this component. Everywhere, $\mathbf{E}_A$ points in the opposite direction to the acceleration, and the magnitude of $\mathbf{E}_A$ varies with inverse distance r. The moving charge also has around it a scalar potential ϕ,

$$\varphi = -\frac{1}{4\pi\varepsilon_0} div\left(\frac{\mathbf{p}}{r}\right) \qquad (8)$$

which produces another electric field component from its gradient

$$\mathbf{E}_{\varphi} = -grad(\varphi) \qquad (9).$$

When we perform the spatial differentiation $grad(div[\phi])$ we have to take account of the propagation delay (by using *retarded* potentials emanating from the charge at an earlier position), so this math function is affected by charge velocity and acceleration. The sum of the two electric field vectors (7) and (9) then yields the classical dipole radiation characteristics, both near and far field. This approach has been followed rigorously since the days of Hertz, but almost invariably concentrates on *oscillating* charge where acceleration and deceleration take place within the confines of the dipole length. There seems to be no consideration given to acceleration which takes place in one small region of space, with deceleration taking place in another small region of space. We study that problem here.

We are interested in the near field, and particularly a near field which is non-conservative (i.e. we want an integral around a closed path to yield a non-zero answer). It is well known that any field which is the gradient of a scalar function is conservative, so we can ignore (9). This leaves only (7), the vector potential derived $\mathbf{E}_A$ for consideration.

For an electron, which has negative charge, the **A** field and the **E** field (we have dropped the suffix $_A$) are reversed, thus **A** points in the opposite direction to the velocity and **E** points in the acceleration direction, Figures 2 and 3.

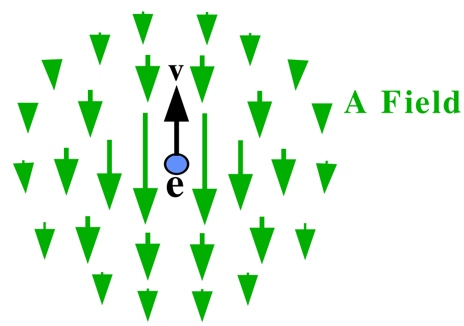

Figure 2. A Field around a moving electron

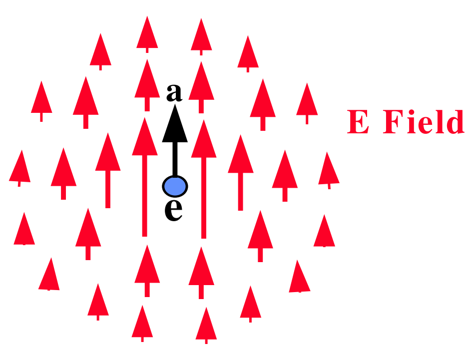

Figure 3. E Field around an Accelerating Electron

This **E** field is of interest because it has unusual properties. *Because of it's* **A** *field derivation it is non-conservative, an integration round a closed circuit does not* *necessarily yield zero voltage*. Also we can't describe it by the familiar field line concept, where field amplitude is indicated by the line spacing. That protocol has historical connotations (remember the old *lines per square centimeter*?), but is still used universally to describe fields. It adequately does so when the fields are conservative, where the fields can be described by the gradient of a scalar function, but the radiative field we are discussing does not fall into that category. All the **E** field lines from the electron acceleration point in the same direction, the lines are all parallel. If we wish to display field strength by line spacing, we would have lines which begin and end in space, which is nonsense. In Figure 3 the field strength is denoted by the length of the arrows.

Consider a closed loop close to an electron which suddenly receives an acceleration impulse, as shown in Figure 4. If we take the **E** field component tangential to the loop at different points (e.g. denoted by the black dots) we get a chart of the form shown. The closed integral of this component is non-zero, the **E** field induces voltage into that loop.

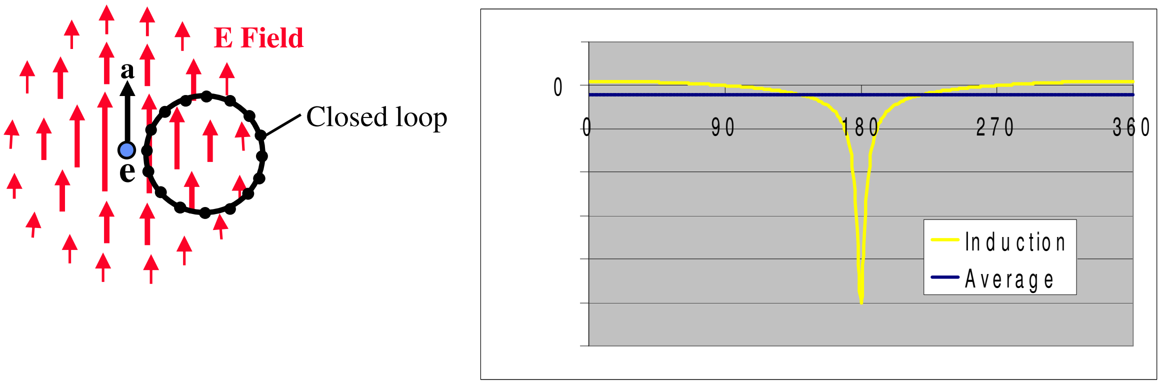

Figure 4. Induction in a Closed Loop.

The graph in Figure 4 was derived using equation (7) in a spreadsheet. For a single electron which changes velocity over a small distance compared to the dimensions of the loop, the voltage is a unidirectional impulse.

5. Mechanical Acceleration

Now consider an electron traveling along the stationary conductor towards the rotating slip-ring of Figures 5 or 6. This electron is part of any current flowing in the slip-ring circuit. It travels along that conductor, then along the brush, at trivial drift velocity, but when it leaves the brush tip to enter the rotating slip-ring, it is suddenly accelerated to non-trivial velocity. That acceleration takes place over a small distance, say the diameter of the brush tip. Inside the moving conductor the electron now travels at trivial drift velocity relative to the moving conductor. The sudden acceleration up to slip-ring velocity produces an electric field impulse. The accelerations of the many electrons which make up a significant current flow create many such unidirectional impulses, *which appear as a constant DC field in the vicinity of the brush tip*. It can be shown that the averaging of the many impulses gives the **E** field as

$$\mathbf{E} = \frac{\mu_0 I \cdot \Delta v}{4\pi r} \qquad (10)$$

where Δv is the change of velocity over the small acceleration region. Since $\Delta v = v_{\mathrm{slipring}} - v_{\mathrm{drift}}$ and v_{drift} is tiny, we get

$$\mathbf{E} \approx \frac{\mu_0 I \cdot v_{slipring}}{4\pi r} \qquad (11)$$

Thus for a slip ring with surface velocity 10m/s and a current of 100A we get an **E** field at1mm from the brush tip of 0.1V/m. Although this is a relatively small field value, it is enough to induce measurable DC voltage into a practical multi-turn coil. *To the Author's knowledge this DC induction has not been discovered before*. Quasi-static DC induction is known when flux through a coil changes at a constant rate, but this is time limited, true DC would require the flux to reach an infinite value. *Here we have another form of DC induction which does not have that infinity*. This is depicted in Figure 5.

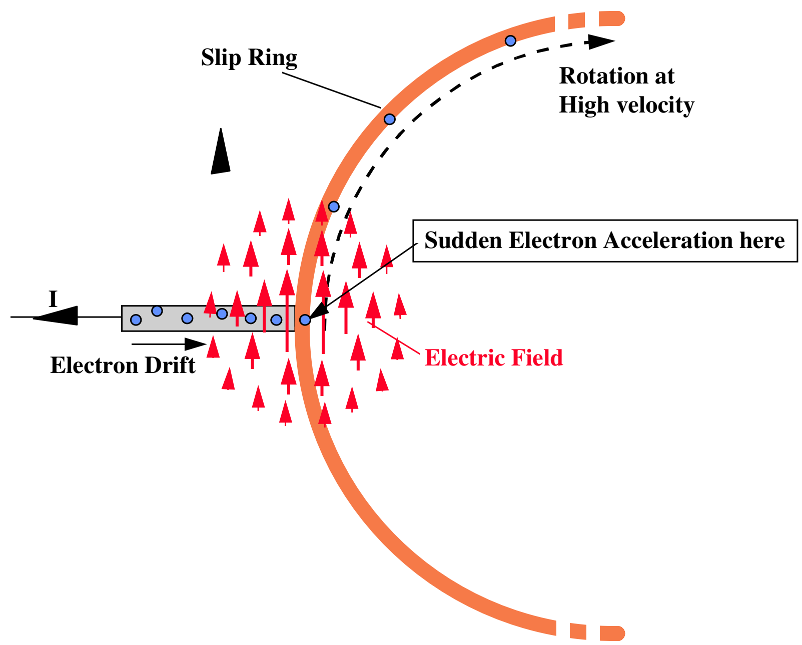

Figure 5. E Field from Slip-Ring

*This **E** field, although static, does not obey the normal rules of electrostatics.*

At the opposite side of the loop, conduction electrons leaving the slip-ring at the brush contact endure a deceleration, which creates a DC electric field near *that* brush tip, Figure 6.

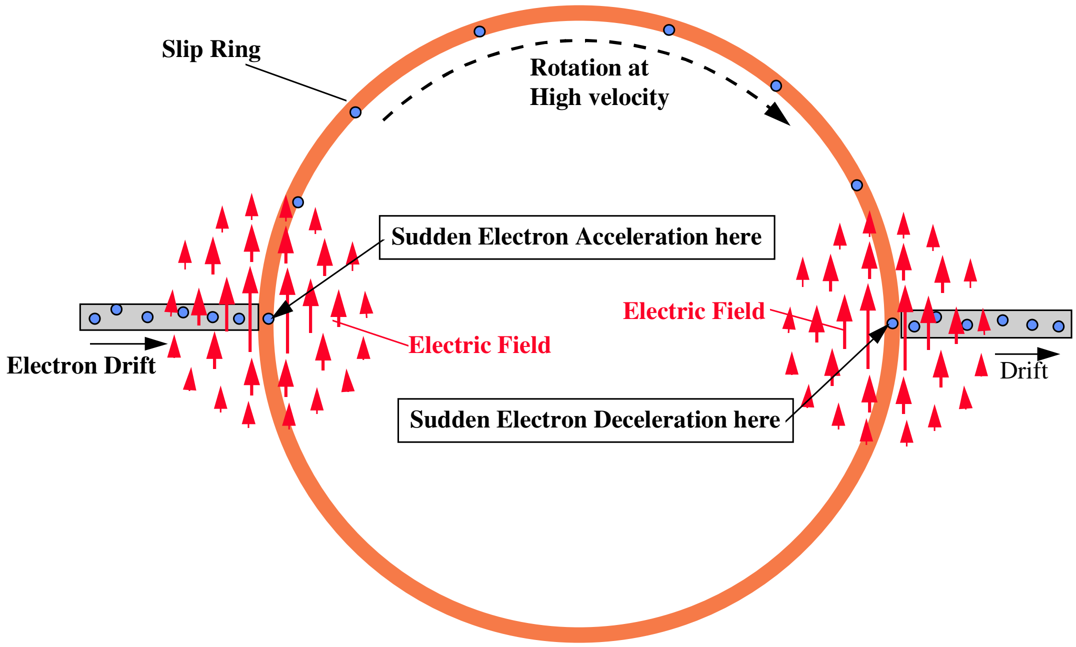

Figure 5. Complete Slip-Ring

Note that in the two field regions the fields point in the same direction. If we now place two stationary coils within the slip ring, one close to each brush contact, *we have a DC-DC transformer*, Figure 7.

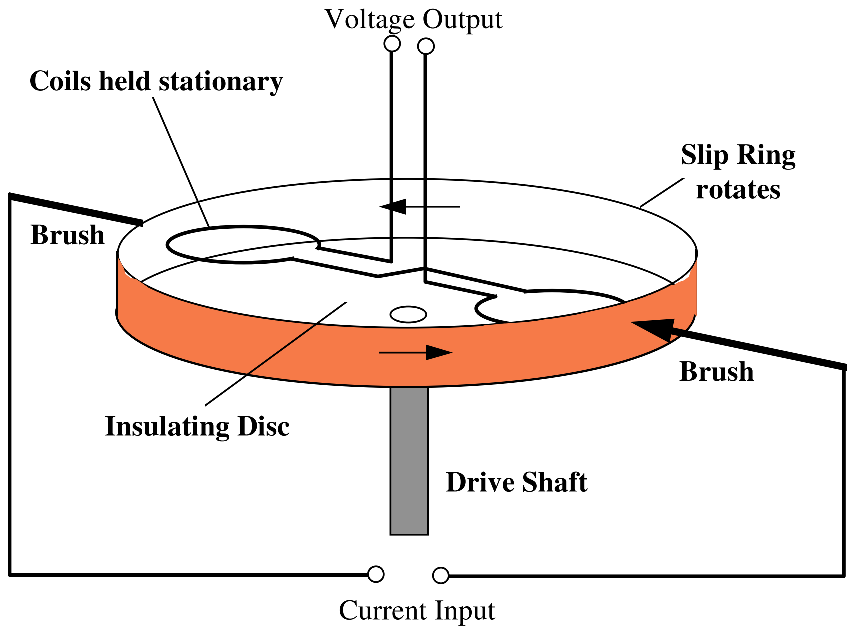

Figure 7. DC-DC Transformer

This transformer is current driven, so operates at low impedance. Current driven across the slip-ring creates the local static **E** fields described earlier, which induce DC voltage into the two coils (these coils are shown here as single turns, but of course they can be multi-turn). That voltage drives a current through the load. Current flow in the coils then creates **B** and **A** fields, the **A** field being the important one. The conduction electrons in the slip ring, transported at high velocity through the non-uniform **A** field, endure longitudinal induction which loads the input current generator with voltage. Hence there is no power gain in this transformer, a load is reflected from output to input, the system is truly reciprocal. Note the mechanical rotation of the slip ring is merely the transport for the conduction electrons, it does not add energy to the system. The only loads on the drive shaft are windage and the friction loads of the bearings and brushes.

Now consider the source for the non-uniform **A** field, through which those electrons are transported, as magnets. Magnets replace the coils of Figure 7. It is often convenient to represent magnets by their equivalent surface current, i.e. to imagine that their permanent field is created by current flowing around the curved surface. Of course the source of this perpetual current is atomic in origin, so we can place an atomic current generator in series with this surface loop. Now when we consider the **E** fields from the brush tips, it is seen that these induce a constant voltage into those surface loops. *There is a load placed on the atomic current generator*. In both **E** field regions the direction is such as to load the local surface current driver, thus taking power from both disc magnets. It may be noted that the high values for equivalent surface current in magnets enable significant power extraction at the low induced voltages from the **E** fields.

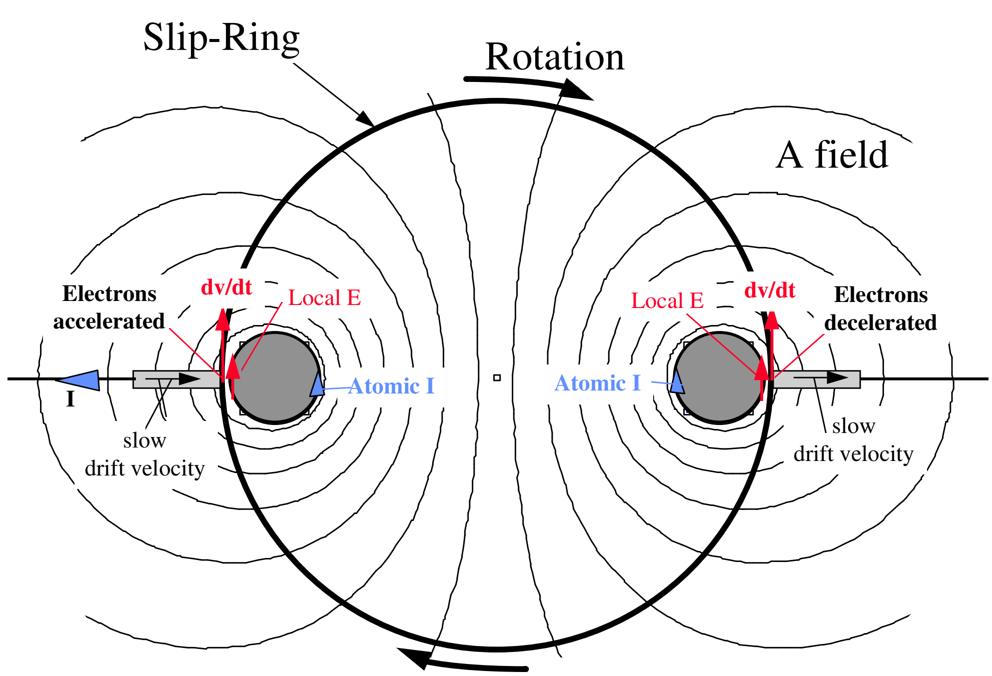

Figure 8. OU Homopolar Generator

This homopolar generator is a variation of the Distinti paradox and is also a generator version of the Marinov Motor. The generated energy comes, not from the drive shaft, but from the quantum dynamos in the permanent magnets. The manner in which that energy is extracted has been exposed.

6. Solid State Acceleration.

There are non-mechanical structures where a continual stream of electrons is accelerated in one region of space and decelerated in another. These can also be expected to exhibit the static **E** field radiation close to the acceleration regions. One example is the electron beam generator in cathode ray tubes. A more interesting example is the junction between a normal conductor and a superconductor. Electron velocity inside a superconductor is certainly non-trivial, so across the junction significant acceleration takes place. Figure 9 depicts a system which should exhibit negative resistance characteristics, thus being a solid state OU generator. A ring magnet surrounds each junction, magnetized so that the DC **E** field from each junction loads the quantum dynamos. This produces a pair of opposing **A** fields along the super-conducting section, where the high speed electrons gain energy from the highly non-uniform **A** field.

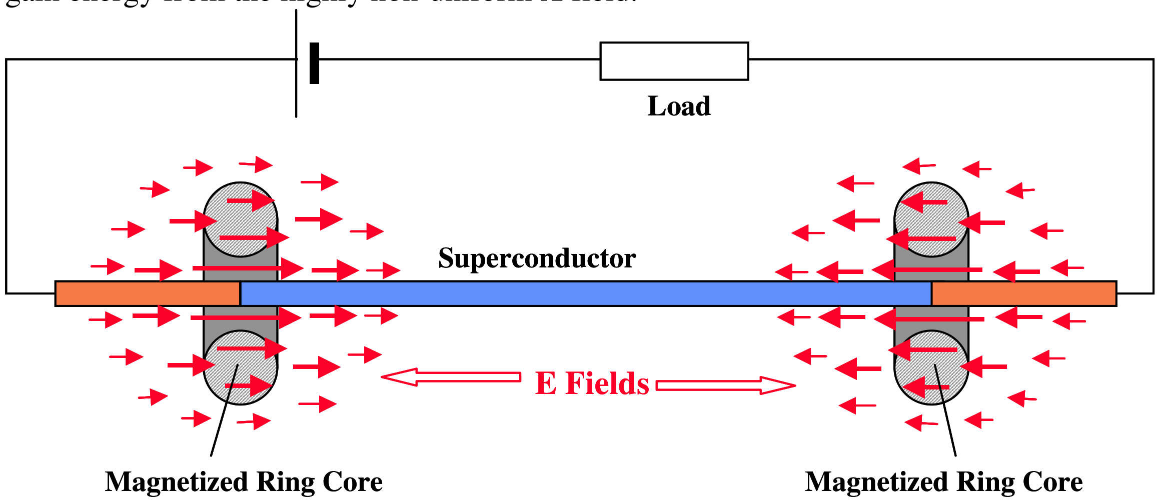

Figure 9. Solid State OU generator.