Means for Harnessing Quantum Energy from Magnets

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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. This is seen to involve two types of voltage induction, one being a radiative electric field and the other longitudinal induction from charge movement through a non-uniform vector magnetic potential field; methods for creating these 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.

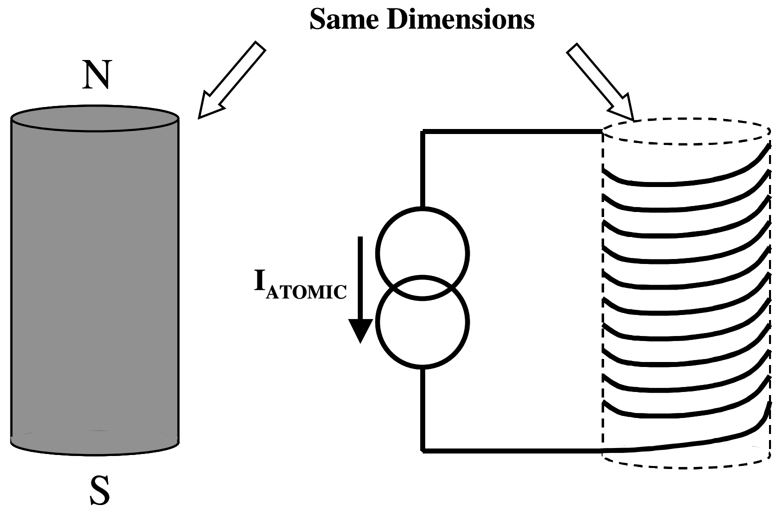
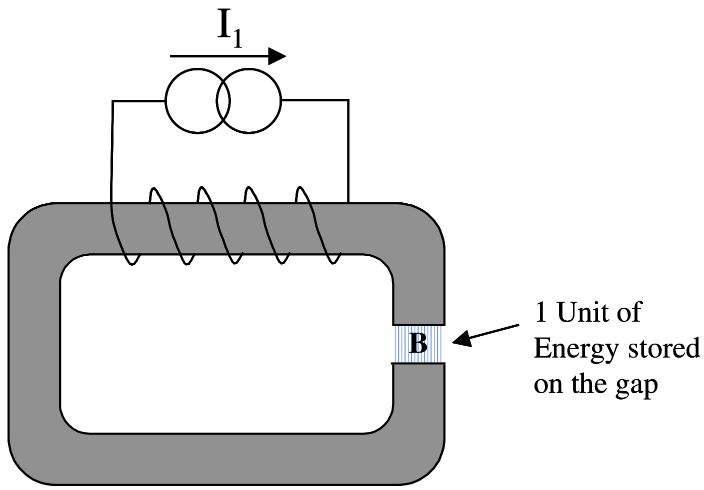


Figure 1. Permanent Magnet and its Equivalent Solenoid

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, Figure 1. This imaginary solenoid is considered energised by a current source where the current is effectively 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 drawn, that energy then also being supplied by Nature? The answer is of course to have a 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.

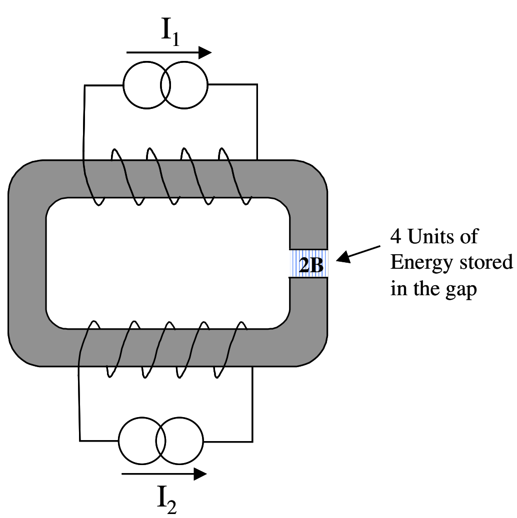
That an induced voltage *can* extract such *quantum energy* is already an established fact, albeit hidden in EM theory and practise. Take a simple magnetic circuit consisting of a high permeability core with an air gap. Energise a coil on that core, Figure 2.



Source I_1 supplies the 1 Unit of Energy during the current and flux build-up. Power flow is current*induced-voltage.

Figure 2. Magnetic Energy Supplied by One Coil

When we pass DC current I_1 through that coil we initially extract energy from its 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 the same current I_2 to a second identical coil, Figure 3.



Source I_2 supplies 1 Unit of Energy during its current (and the additional flux) build-up. Source I_1 supplies 2 units of Energy by the induced voltage acting on its already established current.

Figure 3. Magnetic Energy Supplied by two Coils

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 I_1=I_{ATOMIC}, Figure 4, we find that the initial, single, unit of energy is supplied by the magnet, by its electron circulations, the *quantum dynamos*.

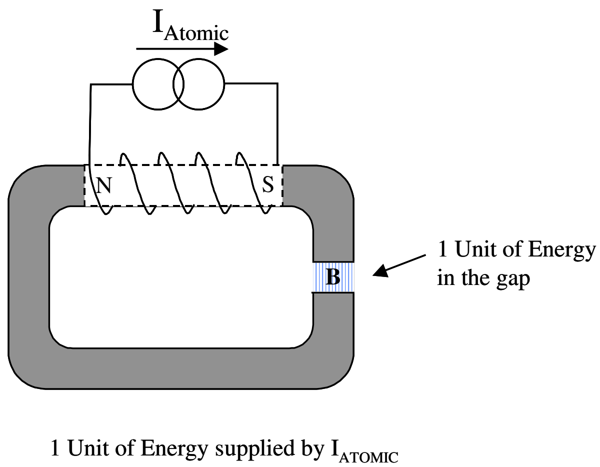


Figure 4. Magnetic Energy Supplied by a Permanent Magnet

Now when we have the second coil in place, Figure 5, carrying current so as to also provide to the gap one unit of energy, we get the two additional units of energy in the gap *supplied by the Magnet*

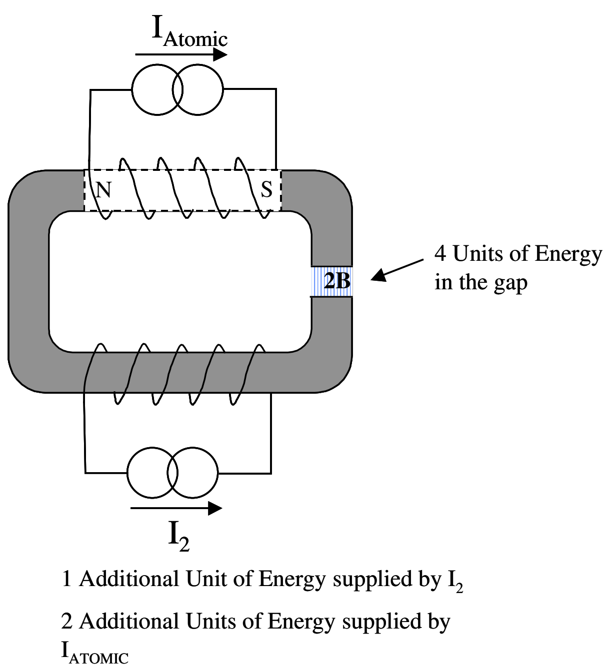


Figure 5. Magnetic Energy Supplied by a Permanent Magnet and a Coil

This is the basis of an OU reluctance motor described by Aspden, who argued correctly that the gap's 4 units of energy could be extracted mechanically by allowing a permeable rotor to be pulled into the gap. He imagined the current supplied to the coil being reduced in value during this gap closure so as to keep the flux constant, thus drawing no extra energy from source I_2. Then I_2 can be turned off, and the gap reopened, requiring just one unit of mechanical energy to do that. Thus, for an input of one unit of electrical energy, three units of mechanical work would be achieved. However the flaw in his argument becomes apparent when you examine the *complete* system (not just the air gap) over a full cycle. This must include the effective air gap of the magnet (which Aspden ignored) and the energy supplied from source I_2 to *that* gap. After the active gap is closed, giving up its 4 units of energy as mechanical output, it is not possible to regain all of the energy put into the magnet air gap, and that "lost" energy accounts for Aspden's apparent OU.

The value in the above exercise is the demonstration that voltage induction into an actual coil, which is responsible for extracting energy from its current source, has the same effect on the imaginary coil of the PM, and energy *is* extracted from the PM.

A changing B field creates a circulatory E field, which induces voltage V into a coil so as to load its current source I, Figure 6. Power=V·I.

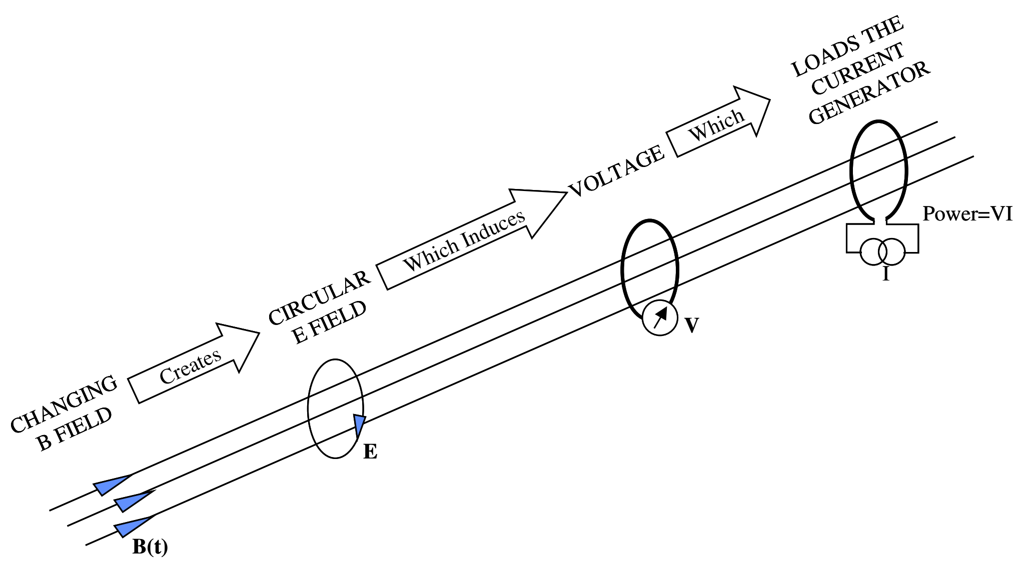


Figure 6. Voltage Induction loads a Current Generator

The same goes for a permanent magnet, the circulatory E field created by the changing B field does genuinely load the quantum dynamos, Figure 7. Power=$V \cdot I_{ATOMIC}$.

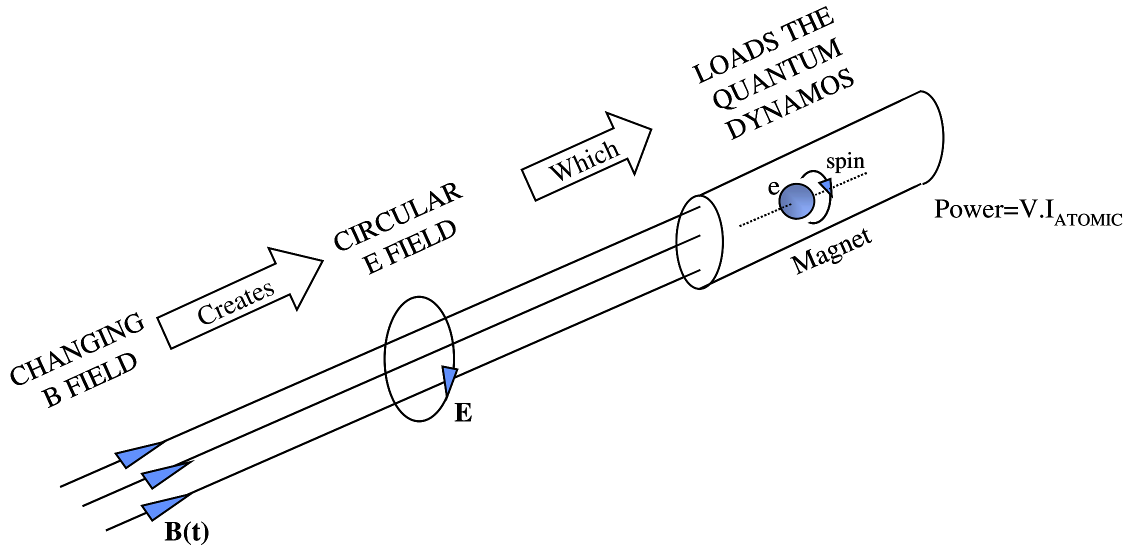


Figure 7. Voltage Induction loads the Atomic Currents

We see that it is a very simple matter to extract energy from a PM over one part of a machine cycle. The problem comes when we return the machine to its starting conditions, the flux change has to reverse, the drag on the quantum dynamos becomes a boost and all the "free" energy gained gets fed back to the quantum world. What is needed for continual extraction of energy from the PM is *not* induced cycles of alternating voltage, but a continuous DC induction. Achieving this by flux change requires the impossibility of flux increasing infinitely. We need voltage induction that is not based on flux change, Figure 8.

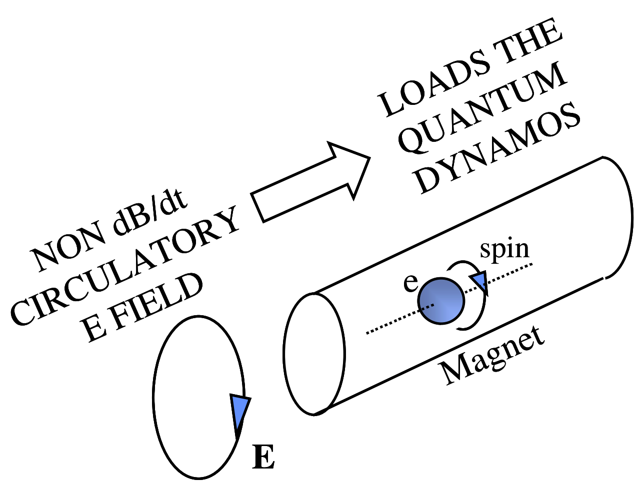


Figure 8. The needed Induction Field

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 comes from 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 apparently *created* **E** field is 90°.

What is generally overlooked in the perceived wisdom is the established fact that this quadrature phase relationship between co-located **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* (in phase with respect to time, but they are in space quadrature). 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 at right angles to itself. *It does not tell us that if the **B** field is static then **E** is zero.* When we look at (1) in relation to far-field EM radiation, we find that **E** and **H** are in phase, having the ratio Z_0 (the impedance of free space), hence

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

Therefore we can rewrite (1) to be

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

The only component of the Curl function is $\frac{\partial E_x}{\partial z}\mathbf{j}$, where z is the radiation direction, x is the polarisation direction and **j** is the unit vector along the y direction, then since $c = \frac{\partial z}{\partial t}$ we get

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

In this far-field case the Maxwell equation (1) simply tells us the obvious, that if at a fixed point in space **B** and **E** are changing with time, then when we look back along the approaching radiation, we will see both the **E** and **B** waveforms changing with distance. *The changing **B** does not create the **E**, **B** and **E** both exist together in synchronism.* Figure 9 illustrates this, showing a radiated sine wave, with an observation point P_1. At this point in space and time, this is the peak of the sine wave where dB/dt is zero, and so is dE/dt. If we look along the propagation (z) direction we see that the Curl components dB/dz and dE/dz are both zero.

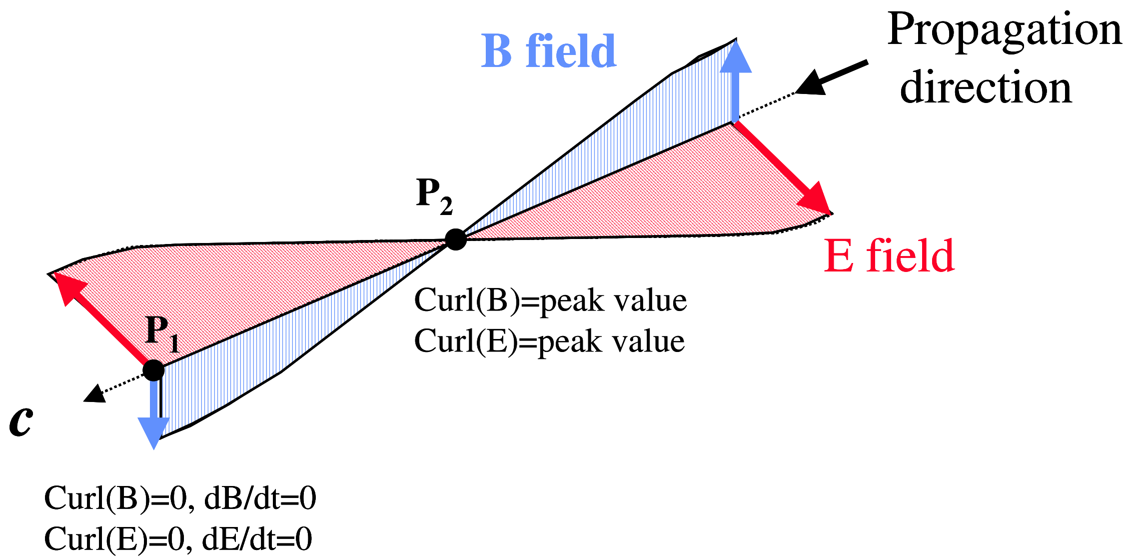


Figure 9

The Curl function is cyclic with respect to time. If we look at a different point in space (or time), say point P_2 at the sine wave zero crossing, then Curl **B** and Curl **E** each have maximum values, as do the time differentials dB/dt and dE/dt. It is obvious that time differentials must be accompanied by space differentials, that dE/dt must accompany dE/dz and dB/dt must accompany dB/dz; equation (1) neatly expresses this, the Z_0 impedance relationship *and* the space quadrature between **B** and **E** all in one simple expression. But to reiterate, **E** and **B** *can* coexist as quasi-static fields where there is no dB/dt or dE/dt present, as at point P_1.

It is worth noting that in this radiation field, voltage induction into a closed loop does relate to change of flux through that loop. A loop placed across the B field at position P_1 will not receive voltage at that point in time. This is easily seen by considering a rectangular loop where induction occurs only on the leading/trailing edges. Voltage induction requires that there is a difference between the leading and trailing E fields, i.e. Curl E is not zero, and if that is so then dB/dt also is not zero.

The far-field radiation shown has a *wave impedance* E/H of Z_0, 377 ohms. In the *near-field*, i.e. close to the radiation source, wave impedance becomes complex and deviates widely from Z_0. It can be very low or very high, depending on the type of radiator, and its value changes with distance. It will now be shown how *local* static but highly non-uniform radiation **E** and **B** fields can be created, where the two fields change value with distance because of different range dependencies. The non-uniform **E** field drives DC induction voltage into a coil *without* dB/dt being present.

4. Electron Acceleration

It is established physics that a linearly 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**.

$$\mathbf{A} = \frac{\mu_0 Q \mathbf{v}}{4\pi r} \tag{5}$$

Everywhere, **A** points in the velocity direction, and the magnitude of **A** varies with inverse distance r. If the charge is accelerating along **v**, then **A** is changing with time yielding an **E** field

$$\mathbf{E} = -\frac{d\mathbf{A}}{dt} = -\frac{\mu_0 Q}{4\pi r}\frac{d\mathbf{v}}{dt}. \tag{6}$$

For an electron, which has negative charge, the **A** field and the **E** field are reversed, thus **A** points in the opposite direction to the velocity and **E** points in the acceleration direction, Figures 10 and 11.

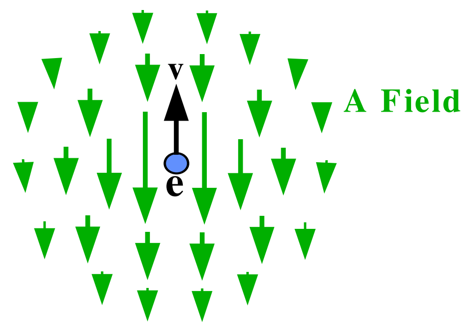


Figure 10. A Field around a moving electron

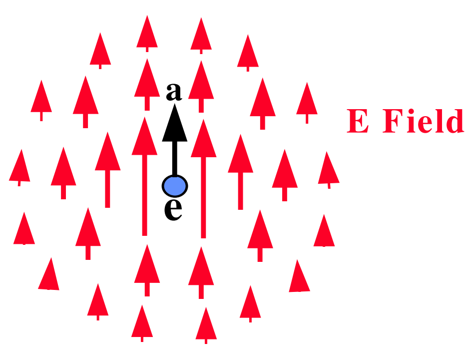
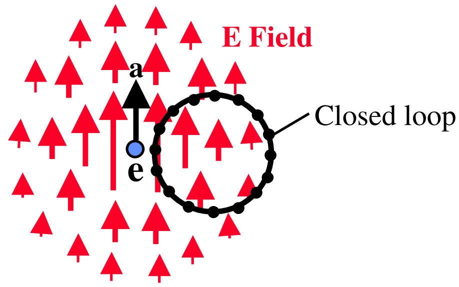


Figure 11. E Field around an Accelerating Electron

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 11 the field strength is denoted by the length of the arrows.

Consider a closed loop close to an electron *e* which suddenly receives an acceleration impulse, as shown in Figure 12. If we take the **E** field component tangential to the loop at different points (e.g. denoted by the black dots), starting at the position furthest from the electron, 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.*



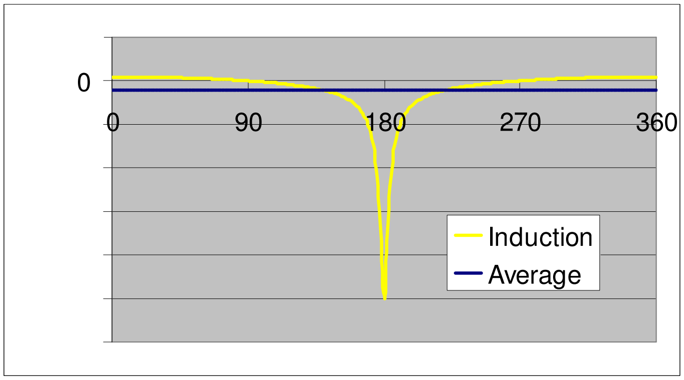


Figure 12. Induction around a Closed Loop.

The graph in Figure 12 was derived using equation (6) 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 time-impulse.

Now consider a stream of electrons arriving at the acceleration region at low velocity, and leaving at high velocity, Figure 13.

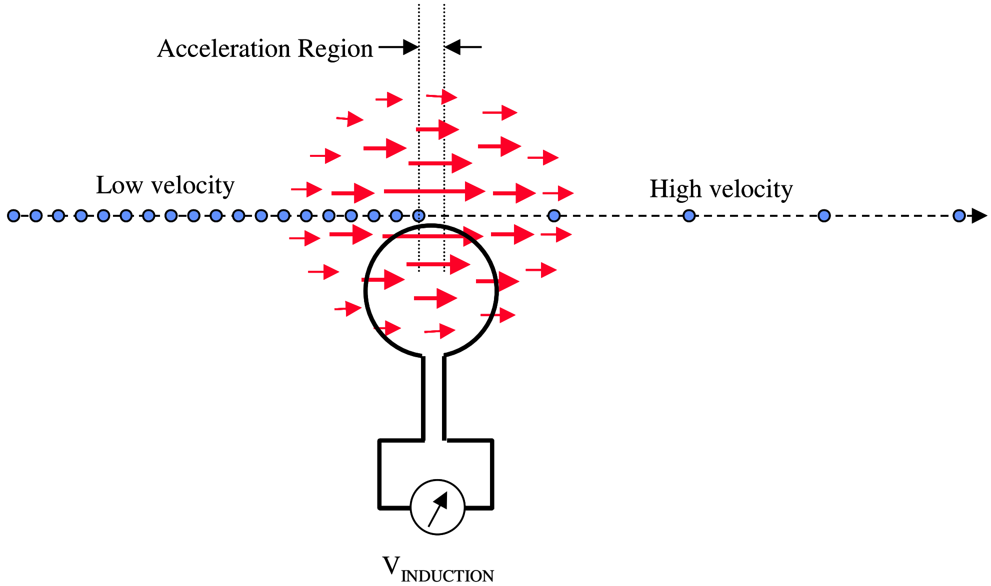


Figure 13. Electron Stream with Acceleration Region

This beam of electrons gives rise to a stream of unidirectional **E** field impulses, which time-integrate to a constant (static) level. *A coil placed in that field as shown will receive DC voltage induction*. Note that the current in the beam is everywhere constant, even though the velocity changes. Hence the circular **B** field from that current is also constant, and so too is the longitudinal **A** field. This poses a dilemma, since there is now no d**A**/dt to "create" the **E** field. In essence, when we look near the acceleration region, the increase in **A** or **B** (which are both proportional to velocity) that would come from the increase in velocity is negated by the reduction in charge density, hence a reduction in the impulse frequency. However this does not apply to the **E** field impulses, which are proportional to the acceleration. If this DC induction is shown to exist, it will demonstrate that the equations for induction **E**=-d**A**/dt and V=-dΦ/dt do not have universal applicability, and should be qualified in some way.

5. Mechanical Acceleration

Now consider an electron traveling along a stationary conductor towards the rotating slip-ring of Figure 14. 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, and 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*.

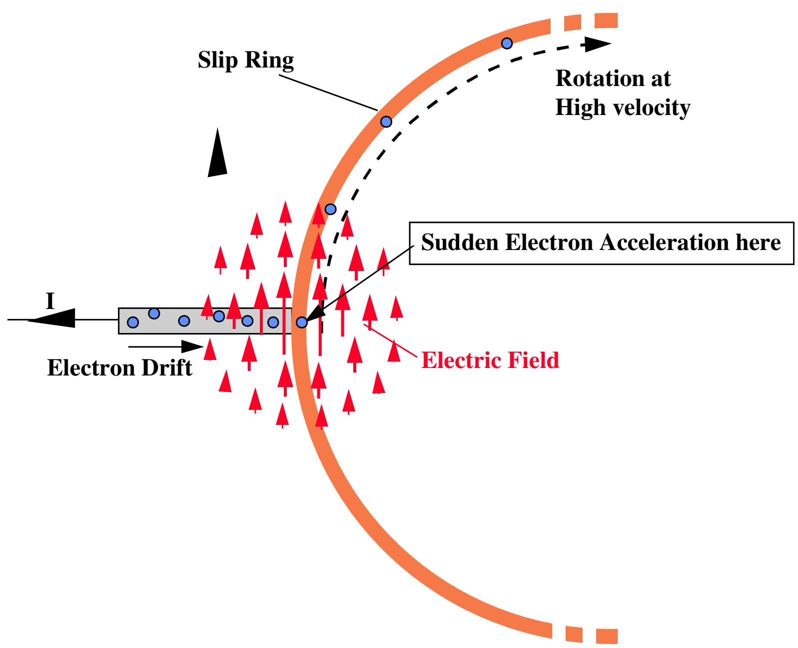


Figure 14. E Field from Slip-Ring

It can be shown that the averaging of the many impulses gives the **E** field at a distance large compared to the acceleration region as

$$\mathbf{E} = \frac{\mu_0 I \cdot \Delta v}{4\pi r} \qquad (7)$$

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

$$\mathbf{E} \approx \frac{\mu_0 I \cdot v_{slipring}}{4\pi r} \qquad (8)$$

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. 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 15.

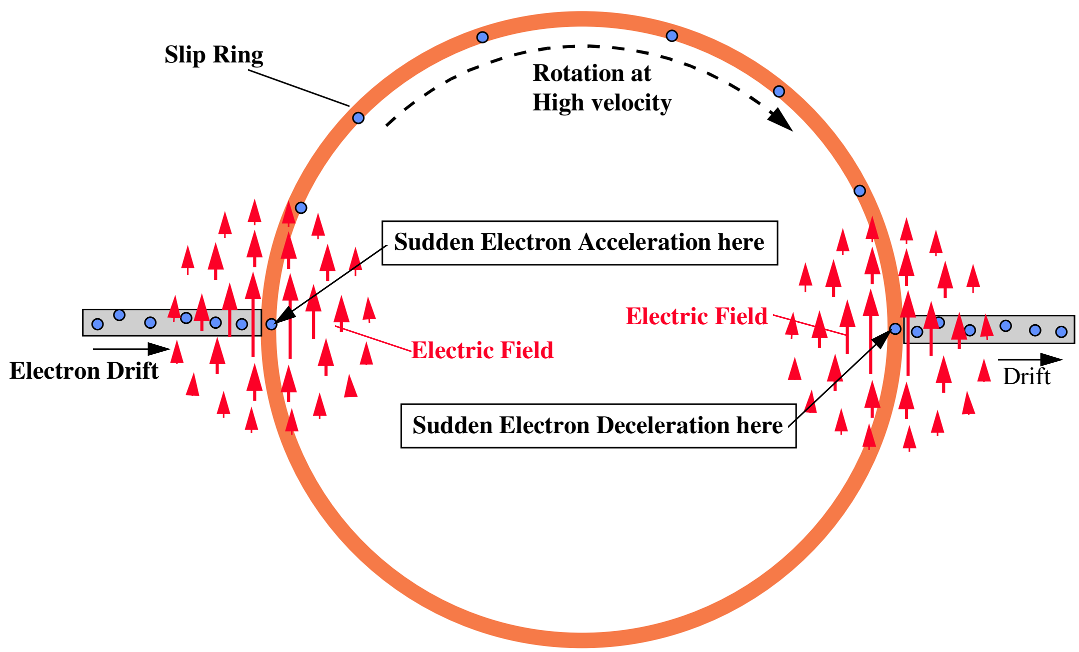


Figure 15. Complete Slip-Ring

If we now place two stationary coils within the slip ring, one close to each brush contact, *we have a DC-DC transducer or transformer*, Figure 16.

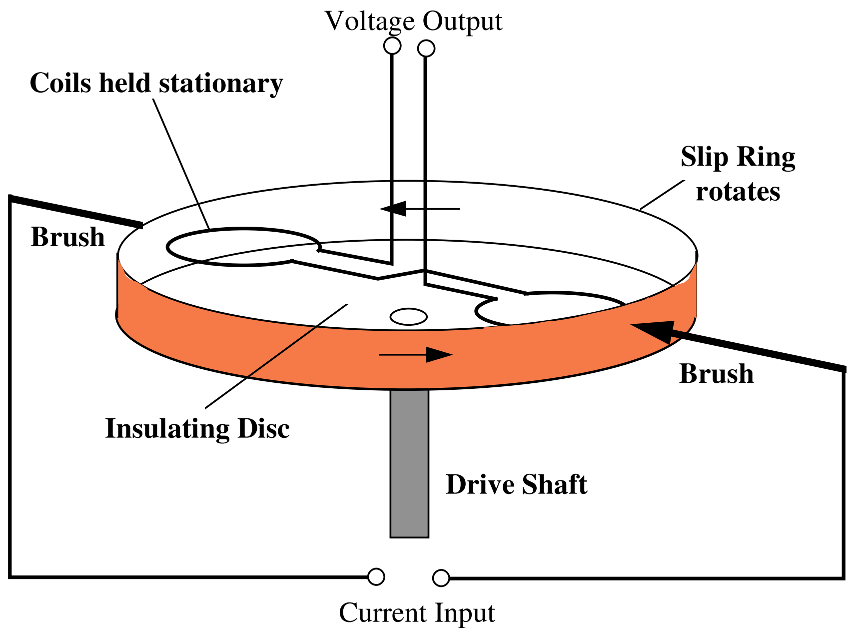


Figure 16. DC-DC Transformer

This transformer is current driven, so operates at low input 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). Now what happens when that voltage drives a current through a load? Current flow in the coils creates a static **B** and an **A** field, the **A** field being the important one. The conduction electrons in the slip ring are transported at high velocity through the static but non-uniform **A** field, and it will now be shown that they endure longitudinal induction which loads the input current generator with voltage, thus taking power from it.

6. Longitudinal Induction

Consider a unit charge moving in the *x* direction in a non-uniform vector magnetic potential field **A** where the changing **A** component of interest is A_x, Figure 17.

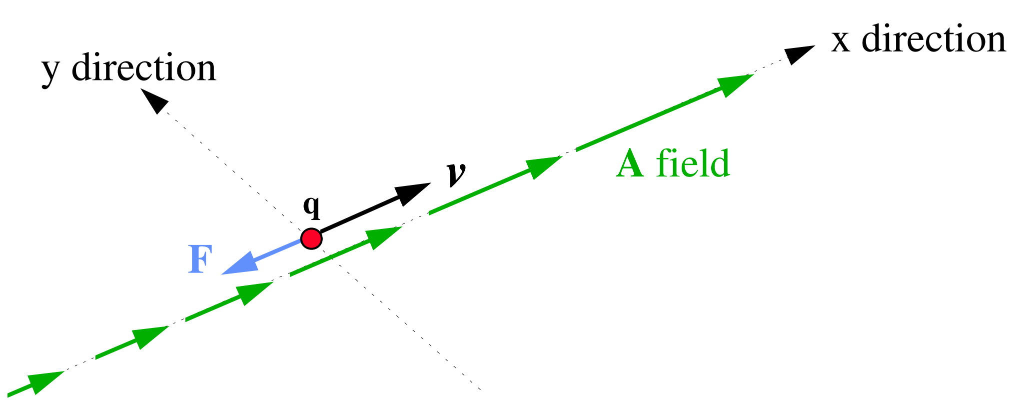


Figure 17. Longitudinal Force

Denoting the x component of the field as A_x, we can express its partial derivative with respect to time as

$$\frac{\delta A_x}{\delta t} = \frac{\delta A_x}{\delta x} \cdot \frac{\delta x}{\delta t} \qquad (9)$$

where $\delta x/\delta t$ will be recognized as the speed v.

There is evidence that if $\delta A_x/\delta x$ occurs because the vector **A** changes amplitude with distance (i.e. it is not a constant value vector which simply changes angle), then (9) gives rise to a force along the x direction

$$F_x = -qE_x = -qv\frac{\delta A_x}{\delta x} \qquad (10)$$

The factor $\delta A_x/\delta x$ is one component of the Divergence of the vector **A**. The field has no Curl, there is no **B** field present.

*This non-**B** longitudinal induction is virtually unknown, it does not appear in EM texts and is not taught, yet it holds the key to explain many effects which are presently unexplained or simply considered anomalous.*

Consider now charge-movement which comes from physical displacement of the conductor. Because the induction is along the velocity direction, the conductor must point in that direction. This situation is shown in Figure 18.

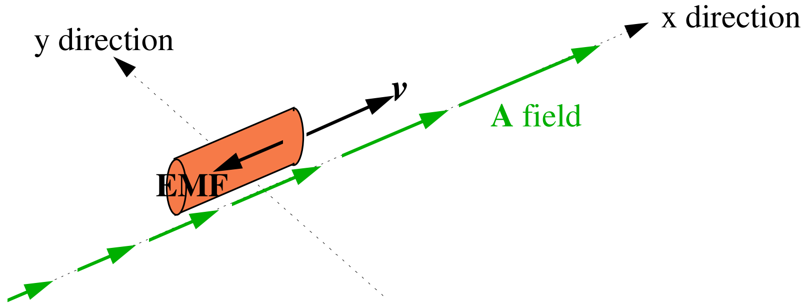


Figure 18. Conductor Element moving along x direction.

Thus if we take a thin wire element pointing along the x direction *and moving in that direction*, each free electron in the conductor will endure a longitudinal force, there will be an emf induced in that element. An example of this induction is found in the Distinti Paradox2, except there the conductor is stationary (in the form of a ring) while the **A** field source (two PM's) revolve within it. The total E-field along the conductor length is given by the integral

$$V = \int E.dl = v\int \frac{\delta A_x}{\delta x} = v.\Delta A \qquad (11)$$

where ΔA is the change in A_x over the active length of the moving conductor.

We can now turn our attention to the DC-DC Transformer of Figure 16 to analyse its performance.

7. DC-DC Transformer Analysis

Figure 19 shows the **A** field generated by input current flowing though the two coils. Conduction electrons in the slip ring are transported through this non-uniform field, thus enduring a force (10) shown as an induction electric field $\mathbf{E}_A$

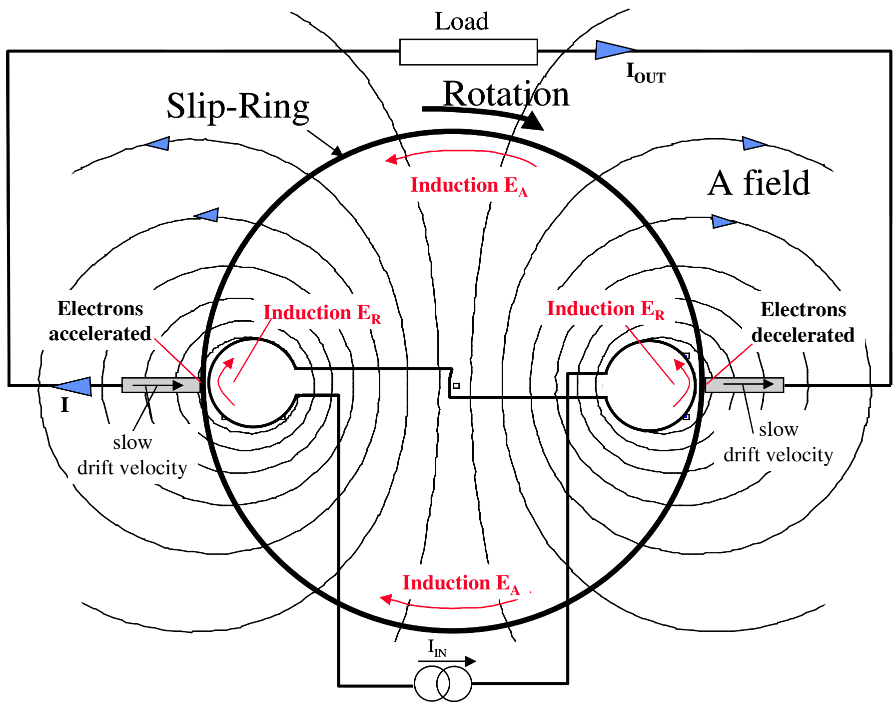


Figure 19 DC-DC Transformer

The electrons move from $-A_{MAX}$ to $+A_{MAX}$ thus seeing $\Delta A=2A_{MAX}$, where A_{MAX} is the **A** field value at the acceleration point, the brush tip. Hence by (11) the induced voltage $V_{OUT}=2vA_{MAX}$, driving a load current of $I_{OUT}=2vA_{MAX}/R_{LOAD}$. A_{MAX} can be obtained from the current element version of (5)

$$\delta\mathbf{A} = \frac{\mu_0 I.\mathbf{dl}}{4\pi r} \tag{12}$$

by taking the closed integral around the coil of N turns carrying current I_{IN}

$$\mathbf{A}_{MAX} = \mu_0 N I_{IN} \oint \frac{\mathbf{dl}}{4\pi r} \tag{13}$$

Hence

$$V_{OUT} = 2v\mu_0 N I_{IN} \oint \frac{\mathbf{dl}}{4\pi r} \tag{14}$$

The output current I_{OUT} determines the quantity of electrons accelerated at the brush tips, which by (8) create the radiation field E_R. The voltage induced into the two coils is obtained by integrating the E_R field (8) applied to each line element **dl** around each coil to get

$$V_{IN} = 2v\mu_0 N I_{OUT} \oint \frac{\mathbf{dl}}{4\pi r} \tag{15}$$

Note that the integrals in (14) and (15) are identical. Hence $V_{OUT}/V_{IN}=I_{IN}/I_{OUT}$, input power = output power. If we take the constant *K* given by.

$$K = v\mu_0 \oint \frac{\mathbf{dl}}{2\pi r} \tag{16}$$

then, since $V_{OUT}/I_{OUT}=R_{LOAD}$, we get $R_{IN}=K^2/R_{LOAD}$.

There is no power gain in this transducer, 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.

This DC-DC transducer might be considered speculative, since it defies convention. It relies on two unrecognized aspects of electromagnetic behavior, (a) static unidirectional closed-loop induction near accelerating charges and (b) longitudinal induction from charge movement through a non-uniform **A** field. Of interest is the fact that these unrelated aspects yield a COP of unity for the transducer, which could be considered indicative that the thing will actually work as stated.

8. The Marinov Generator

Now consider the source for the non-uniform **A** field, through which electrons are transported, as magnets. Disc magnets replace the coils of Figures 16 and 19, as shown in Figure 20. We can replace the input current I_{IN} with the equivalent surface current I_{ATOMIC}. 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.

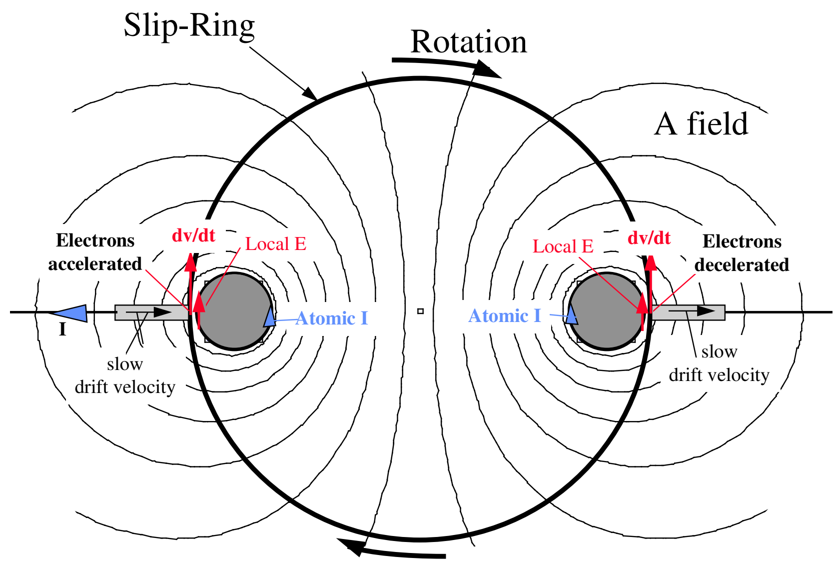


Figure 20. OU Marinov Generator

This homopolar generator is a variation of the Distinti Paradox2 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.

9. 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 21 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 radiation **E** field from each junction loads the quantum dynamos. Current across the junctions is supplied by an external source. The ring magnets produce a pair of opposing **A** fields along the super-conducting section, where the high speed electrons obtain longitudinal induction (gain energy) from the highly non-uniform **A** field.

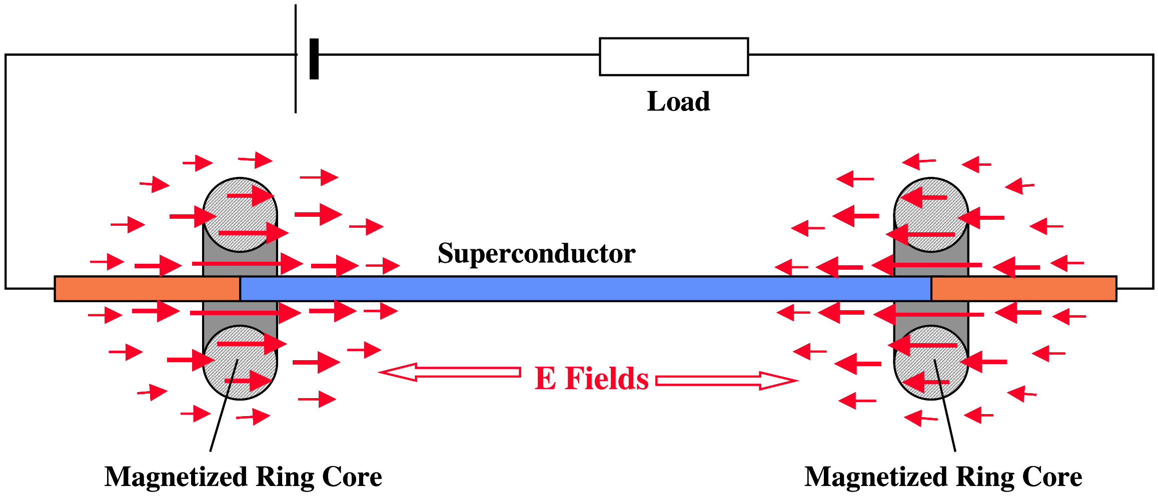


Figure 21. Solid State OU Generator.

This scheme illustrates a feature that can also be applied to the Marinov Generator (and to other OU homopolar generators). The more current we drive through the system, the greater the power extracted from the PM's. In the Marinov Generator it is not necessary to rely on the inherent voltage induction to create the load current. An external DC voltage source in series will drive greater current hence, in addition to supplying its own power, will extract more free power from the magnets.

10. Conclusions

It has been shown that an induction **E** field can extract energy from a permanent magnet, the **E** field "loads" the atomic circulations which create the magnetism, the *quantum dynamos*. Normally this induction comes from a changing **B** field, so that over a complete cycle systems are conservative, the extracted energy gets fed back to the *quantum dynamos*. However, it has also been shown that non-d**B**/dt unidirectional induction is possible close to accelerating electrons, yielding DC voltage induction into a coil. This feature, along with longitudinal induction from charge movement through a non-uniform **A** field, offers a DC-DC transducer or transformer. It is shown that such a transformer has a COP of unity (ignoring losses). When permanent magnets replace the coils of that transformer, an electrical load on its output puts a load on the magnet's *quantum dynamos*, thus yielding an over-unity machine. Two versions of this generator are considered, one where the electrons are accelerated as they pass from a brush to a slip-ring, the other where they pass from a normal conductor to a super-conductor.