Redefining the Electron (Part 1): The Implications for Electricity

by

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Abstract

By redefining the electron to be a **toroidal** form of concentrated energy rather than a monopole point-charge definition, such as used for the orbital nuclear atomic model of the Standard Model and Quantum Mechanics, the dynamic nature of electromagnetic fields and electricity become more logical and consistent, and easier to explain.

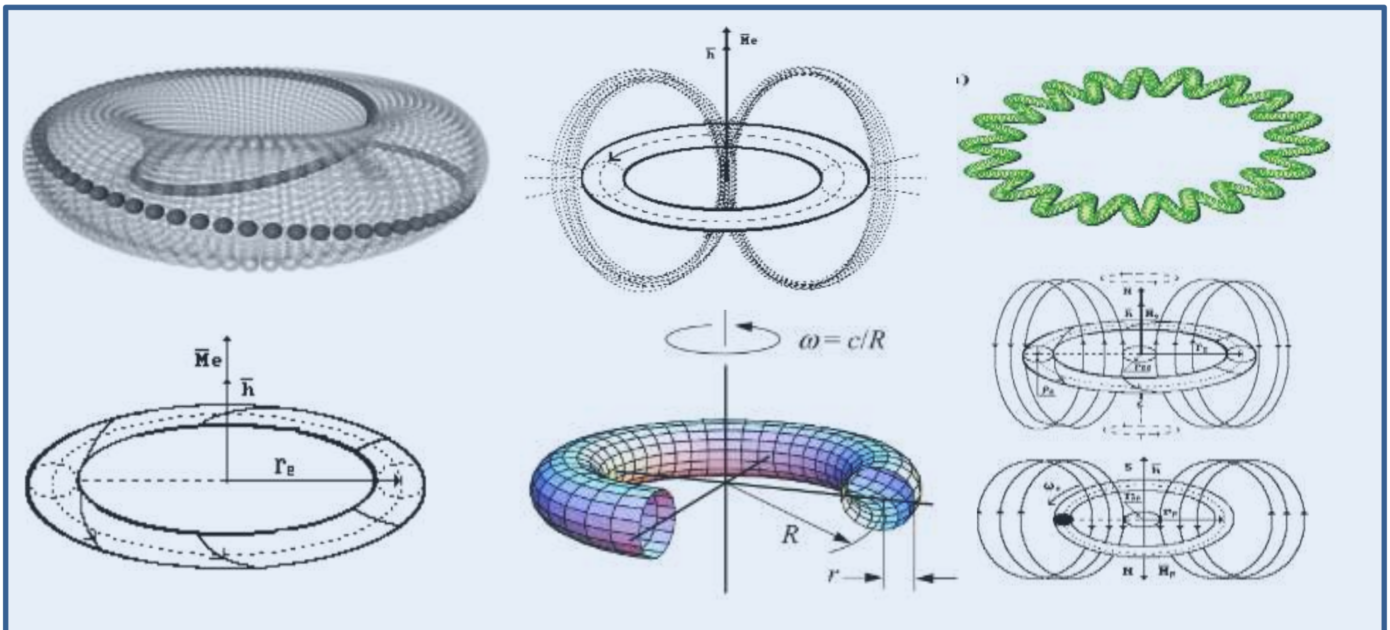
Redefining the Electron (Part 1) addresses the nature of electric and magnetic fields, electrons, positrons, electric current generation from battery and induction sources, capacitor charge and discharge, and superconductivity.

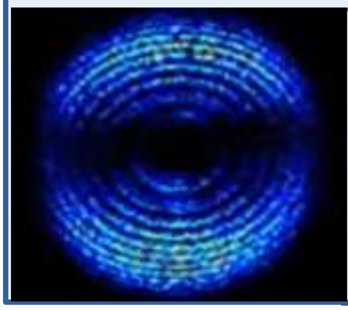
The second paper of the three part series explores the implications for atomic structure and chemistry, the role of electrons and positrons within matter, and beta and electron capture radiation. The third and final paper provides insight into the particle-wave nature of EMR and provides alternative explanations for spectral line emission and absorption, the photo-electric effect, the Compton effect, electron pair generation and annihilation, and Gravity.

Electron Models

The **orbital nuclear model** defines the electron as a point-form **Monopole Electric Charge** (MEC) for mathematical modelling purposes, with the electron commonly represented as a spinning sphere labelled **e**$^{-}$. A well-documented alternative model is the **Toroidal Solenoidal Electron** (TSE) which defines the electron as a spinning point electric charge that moves at high speeds in a solenoidal pattern around a torus-shaped pathway: some examples of variations of the TSE model are shown in figure 1. The mathematics developed for the TSE model for the electron would seem to better fit the electromagnetic characteristics of free electrons than the MEC model.

The **Spin Torus Energy Model** (STEM) for an electron is based upon a **bitron**, which consists of concentrated **core energy** flowing or spinning at close to the speed of light as a fluid-like continuum in the circular pathway of a torus. STEM is a hybrid model that is distinctly different to both the MEC and the TSE models, but shares aspects of both.





Picture left: A frame from [2008 video of an electron](#) made by Swedish scientists.

Picture right: A frame from of a **[Simple Universe](#)**® video. It considers the electron to have a toroidal structure made up of strand particles.

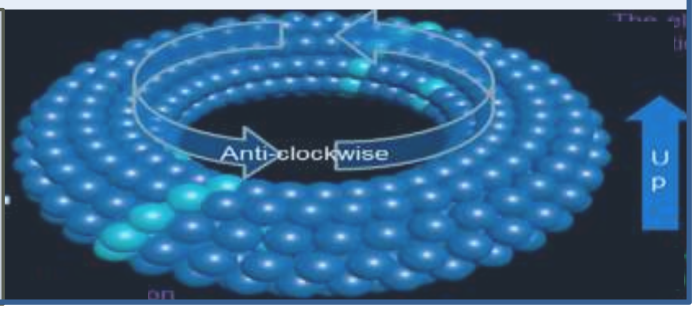
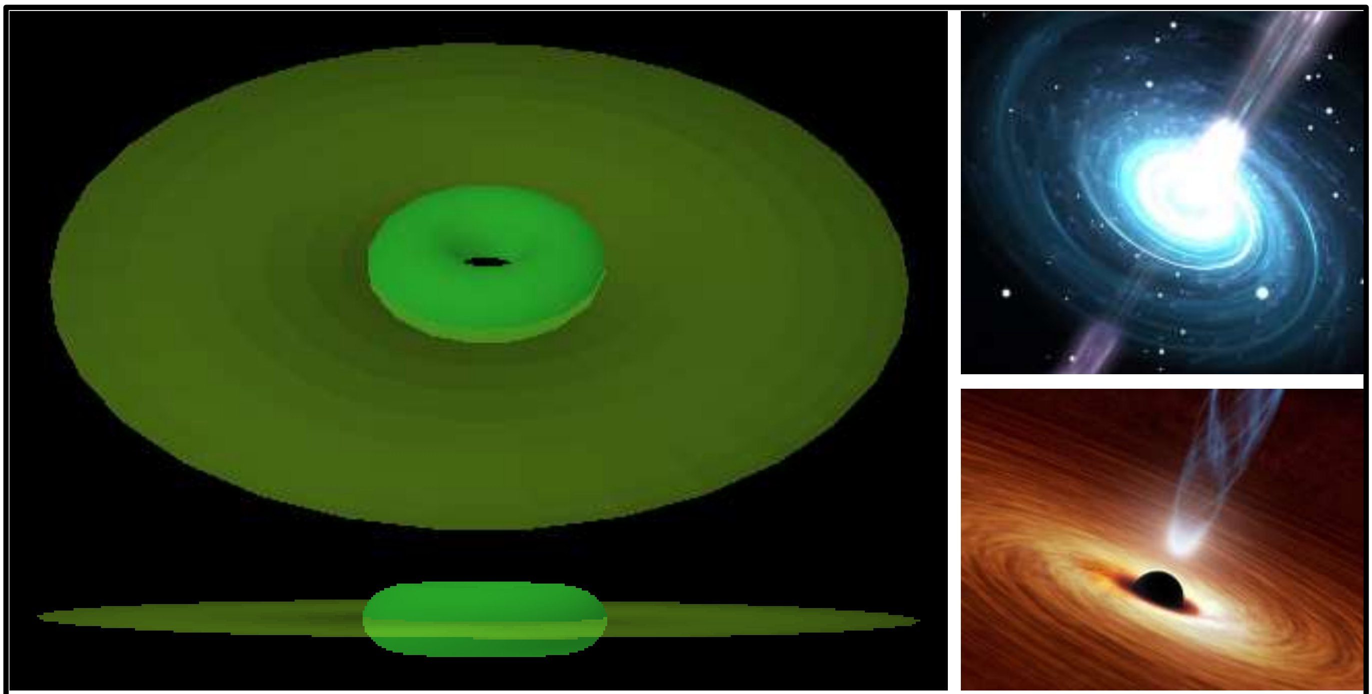


Figure 1: Examples of Electron/Positron Torus-based Models

The fast-flowing concentrated core energy generates an apparent centrifugal force[1] at the outer equatorial perimeter of a bitron. When the ductile strength of the core is exceeded, a stream of energy weeps from the equatorial perimeter to flow disk-like from around the bitron. Without the influence of an external electromagnetic field, the escaping energy expands and thins outwardly, remaining attached centrally like a veil-like extension of the core energy, so forming an outer **energy field** and becoming a **neutral bitron**. As can be seen in figure 2, diagrammatically the energy field of a neutral bitron at the sub-micro scale is not dissimilar to **accretion disks** observed at the macroscopic scale around massive central astrological objects: the latter are considered to be caused by MRI (Magneto-Rotational Instability, as variously called Balbus-Hawley or Velikhov-Chandrasekhar instability).



a) Neutral Bitron Energy Core and Disk-Like Energy Field **b) Accretion Disks**

Figure 2: Neutral Bitron

A neutral bitron does not have **chirality**[2] and is neither an electron nor a positron: it represents a state between the two which has the potential to become transformed into either. In neutral mode, the energy field of a bitron quivers or gently sways side to side, but under the influence of an external electromagnetic field it can be pushed and held towards one of the bitron's axial ends, causing the dynamics of its energy field to be transformed instantaneously.

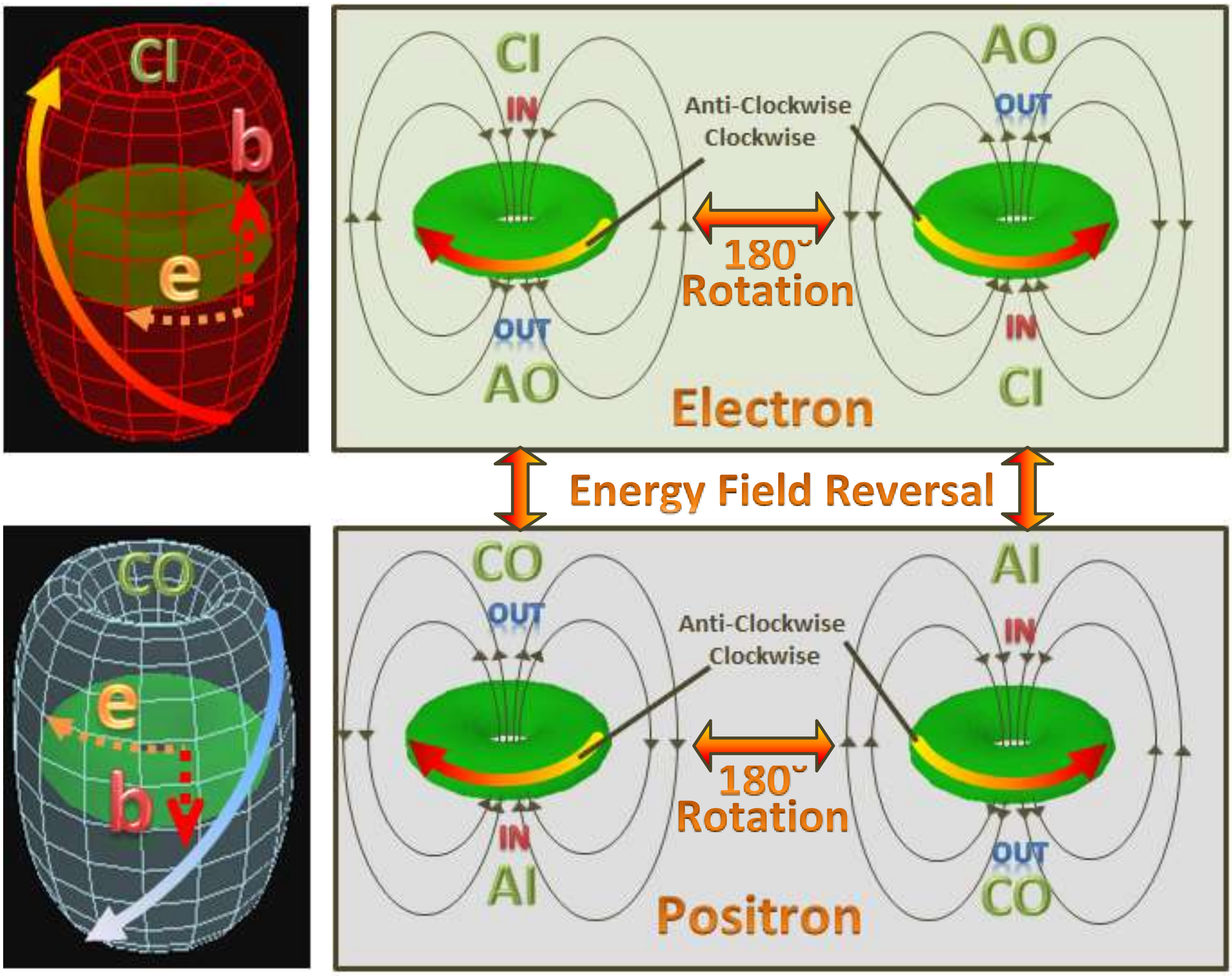
When the neutral nexus is broken, the field energy streams swirling (i.e. it has both circular and linear components) past one of the bitron's axial extremities where it folds back to be drawn back towards the inner surface of the spinning torus. As the energy field heads back towards the central hole of the energy core torus, its circular circulation radius is forced to reduce causing it to accelerate, thus creating an **inward-flow vortex**.

Having being forced to stream in the one direction by an external electromagnetic field, the quantity and flow rate of the energy field returning exceeds the ability of the inner surface of the torus core to absorb it; thus the bulk the returning field energy passes through the torus's central hole to spiral outwards on the other side of the torus. The now out-flowing energy forms an **outward-flow vortex** that then folds back (forming a pattern similar to that of a North magnetic pole) to join the energy field streaming from the torus circumference, so completing the circuit and so forming a swirling atmosphere-like envelope of low concentration energy around the bitron's core energy. Almost instantaneously, the now polarised energy field has become **chiral**, transformed into a continual circuitous swirling flow pattern, with the **chiral form** of the energy field determining whether it is an electron or a positron.

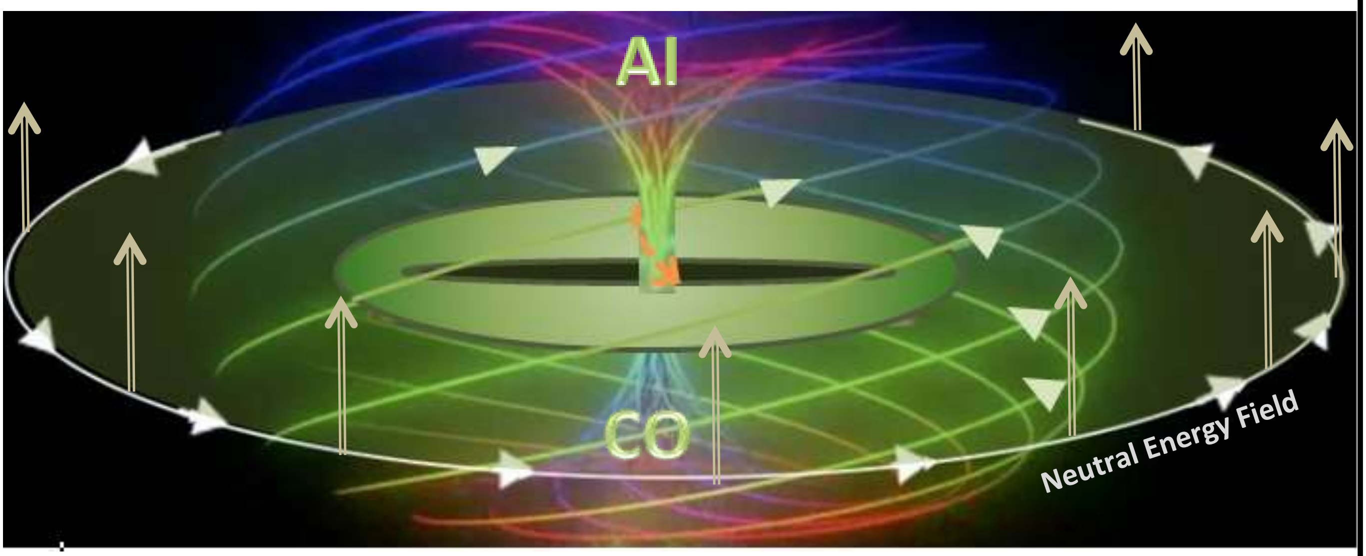
When looking at a bitron from one side, should its core energy appear to flow in a clockwise direction, then by rotating it by 180^{o} (see figure 3a) or by simply looking at it from the other direction, it will appear to flow in an anti-clockwise direction. Furthermore, a neutral bitron is **non-chiral** because it is identical to its own mirror image (albeit after a 180^{o} rotation), but when polarised (i.e. in electron/positron mode), a bitron's outer energy field flow has a directional axial flow component, which combined with a specific circular flow direction, makes the flow pattern chiral. As chirality is quite subtle and can be deceptive, a convention is required to identify the chiral form of a polarised bitron's energy field in order to determine whether it is a nominal electron or a positron.

[1] Alternative description is that the centripetal force provided by the ductile strength of the core energy is exceeded.
[2] A chiral object cannot be orientated to be superimposable upon its own mirror image.

In order to minimise confusion with common-use electromagnetic field terminology, the standard North/South and Positive/Negative nomenclature has been avoided. Instead a clockwise/anti-clockwise and in/out-flow terminology has been adopted, abbreviated by use of a dual-letter notation. The 1st letter of the notation identifies the core/field energy circular spin direction ('**C**' for **Clockwise** when looking along the spin axis towards the bitron, and '**A**' for **Anti-clockwise**); the 2nd letter is for the central axial in/out-flow direction of the energy field ('**I**' to represent **In-flow** of the inward-flow vortex, and '**O**' for **Out-flow** of the outward-flow vortex; away from the torus hole). Note that the inner axial flow direction within the vortices associated the torus hole is in the opposite direction to the outer zone's axial flow direction; thus the 'I' and 'O' notations refer only to the flow direction within the axial vortex regions.



a) Electron and Positron Energy Field Notations, Rotations and Reversals



b) Positron Field Energy Escape Zone and Flow Pattern

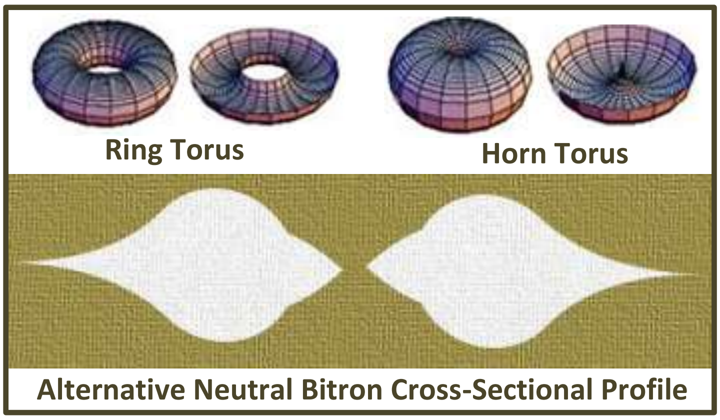
Figure 3: Electron and Positron Field Patterns

Using this simple dual-letter convention an electron is defined and/or identified by an AO and CI combination, and a positron by a CO and AI combination, as in figure 3. Due to chirality, only one end of the energy field needs to be established by the dual-letter convention to identify whether the polarised bitron is an electron or a positron. Often the axial AO/CI and CO/AI orientation of polarised bitrons is not show in diagrams: instead electrons are simply indicated by use of red energy field and positrons by blue as left in figure 3a. When used, the circular '**e**' gold dashed arrow and '**b**' red dashed arrow refer only to the outer zone (external) energy field components of polarised bitrons.

An important aspect of the STEM electron is that it can be easily converted into a positron by simply reversing or **flipping** the axial flow direction of its energy field. **Energy field flipping** also works in reverse, converting a positon into an electron, and does so without having to change the orientation of the torus energy core. Field flipping allows STEM to readily explain AC electricity and beta decay, which involves the transformation of protons to neutrons and vice versa, as addressed in Redefining the Electron (Part 2).

Figure 3b shows a more stylised depiction of a positron energy field flows: it also shows the position of the equatorial field energy disk when the bitron assumes neutral mode, with the hollow arrows indicating the direction in which the neutral energy disk was pushed to create the positron energy field pattern.

Figure 3b also represents the ring torus as being thin with a wide central hole, whereas figures 1a and 2a show a thicker ring torus with a smaller hole (such as used for all other diagrams in this paper. It could also be closer to a **horn torus** as shown right. Future mathematical modelling should shed more light as to the bitron's core energy geometry: it might even have a distorted tear-drop cross-section as show right. Any variation to the suggested geometry will need a central hole similar to that of a torus core to facilitate the flow of polarised energy fields.



Now that a definition and notation for an electron and positron have been established in terms of energy core and field flows, the nature of electric currents, electric and magnetic fields and electromagnetic attraction and repulsion can be explored and explained in energy specific terms.

Electric Currents

Within an electrical conductor the energy fields of neutral free bitrons cause them to become axially aligned with approximately equal numbers facing one way (clockwise say) and the other half the other (anti-clockwise say). The opposite spin direction of their energy fields causes the axially aligned bitrons to self-form into like-spin strands in which bitrons are evenly spaced. A good conductor allows the formation of longer, less contorted bitron strands and are characterised by less obstructions in terms of atomic and chemical structure, hairline faults and crystal faces.

An electric current can be generated within a conductor (e.g. a copper wire conductor) by a **source/sink** mechanism whereby electron and positron concentrations create a supply source that generates a movement to a lower concentration sink; or by **electromagnetic induction**. We shall now concentrate upon the source/sink generation of an electric current (electromagnetic induction will be covered shortly).

Electron and positron concentrations can be created by a variety of processes: chemical reactions (e.g. batteries), thermo-electric processes, the photoelectric effect, static electricity, surface effects (plasmons) and capacitor charge and discharge. At this stage we shall just be considering the effect of such concentrations rather than their cause.

Electrons and positrons have a propensity to move in the direction in which the out-flow component of their energy field is facing: the reason for this will soon become apparent. Thus when an electron is supplied to one side of a conductor, it enters at the electron supply end, which is conventionally labelled the **negative** terminal (the large red minus sign of figure 4), with its AO end facing towards the positive terminal. It attaches itself to the closest available bitron strand with the same spin direction, and should that strand be in 'neutral' mode, the bitron's energy field merges with that of the electron, resulting in two electrons with a shared energy field encompassing both them. This causes an immediate chain reaction of similar electron conversions along the length of the strand, turning it into an electron strand with an energy field equal to the sum of the energy fields of all the electrons within that strand.

As the source supplies further electrons, they latch onto close-by electron strands, so increasing their field strength and packing density. Even strands well clear of the electron supply which have the appropriate spin orientation can be induced to become electron strands by the powerful net fields of the newly created electron strands: thus a multiplier effect rapidly extends polarisation to all amenable strands within the wire conductor, which is now energised.

Meanwhile on the positron supply side of the wire conductor, positrons are added with their CO end facing the negative terminal so as to create positron strands out of the strands with the same spin orientation. The net result is electron and positron polarised strands, each with their energy field out-flows pointing in opposite directions, but with their spin orientation in the same direction as can be clearly seen in figure 4. Within strand electrons and positrons can be considered to represent small electric dipoles with **implicit positive** (CO and CI) and **implicit negative** (AO and CI) poles as shown the strand representation at the top of figure 4.

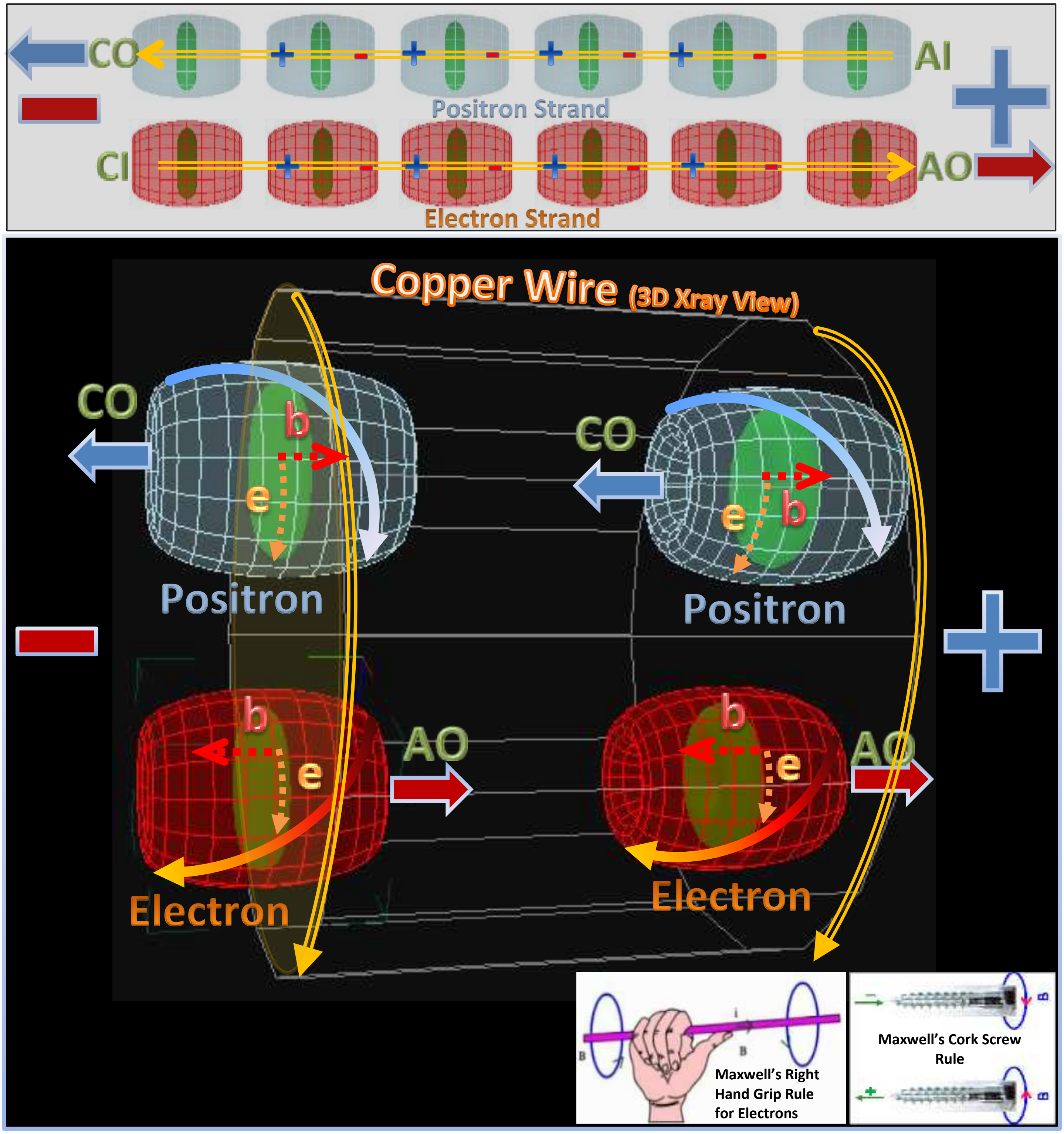
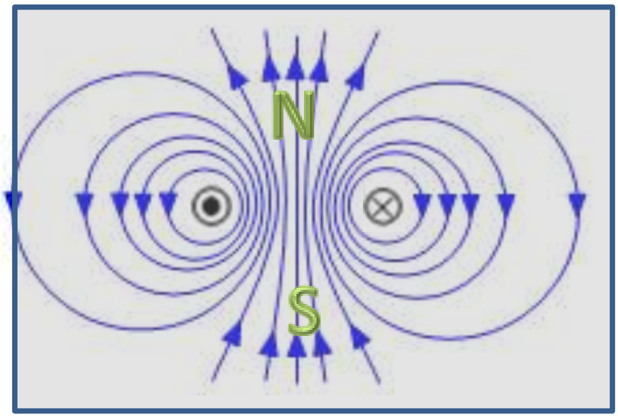


Figure 4: Electric Current: Electron and Positron Movement

Because the polarised bitron strands all have the same spin direction, the other half of the bitron strands, those with the opposite spin direction, remain unpolarised. These unpolarised bitron strands are interspersed amongst the polarised strands, with the solenoidal-style movement of the outer energy field of the polarised strands pushing against them so as to thrust themselves forward. It is the chirality of the electron strands' swirling solenoidal energy field flow pattern that causes them to lead with their AO pole, and positron strands with their CO pole, providing the screw-like action that propels them slowly through the conductor in opposite directions as an electric current. The neutral strands, on the other hand, are pushed back and forward by the polarised strands with no overall change of position: they just fibrillate as if they are dancing in the one spot.

Polarised strands are more energised than the neutral strands (i.e. those with opposite spin). Thus, although partially offset by the neutral strand spin energy, the combined external circular spin energy field (**e**) of the polarised strands generates an **induced magnetic field** around the current carrying wire conductor. However, as the axial component of the energy fields (**b**) of the electron and positron strands is in opposite directions, they cancel each other out.



Induced Magnetic Field around a Current Loop

When the positive and negative terminal ends are reversed, the situation switches: now the strands with opposite spin that were not polarised now become polarised, and both the current and induced magnetic field around the wire conductor reverse direction. Thus AC electricity cycles reflect the alternating polarisation of strands with opposite circular spin direction.

The strong energy fields associated with electron and positron strands present as **positive** and **negative electric fields** whenever they extend beyond the end of a wire conductor, such as when two probes are attached to the positive and negative side of a battery. Electric fields thus have a circular spin component to their flow pattern, unlike magnetic fields that consists of linear flow without any circular component.

STEM contends that **electricity** is the two-way movement of polarised electron and positron strands which, with the help of the neutral strands of opposite spin direction, push themselves in opposite directions to each other, leading with their AO and CO poles respectively. It is a simple, logical model that fits all the known facts related to electricity without the need to invoke fictitious positive hole and electric dipole constructs.

A subtle difference between the STEM and the TSE models is that STEM core energy flow is purely circular spin and is thus non-chiral, whereas the solenoidal nature of the TSE core energy makes the core itself chiral as reflected in the chirality of the associated energy field: it has no neutral mode. A result of this subtle, but important difference, is that the TSE model requires that all electrons and positrons to be flipped (i.e. be rotated by 180^o) in order to change current direction, which is considered to be untenable. Thus the TSE model, as referred to in earlier publications by the author, has been abandoned and STEM has been embraced.

Electric Circuits and Electric Fields

An electric circuit comprises of a power source connecting various electrical components in a direct or indirect circuit allowing the two way movement of polarised electron and positron strands. In order to more fully explore and explain the behaviour of bitron strands in relationship to an electric circuit, the following three states of a basic electric DC circuit will be considered:

a) No power source;
b) Open circuit with power source connected; and
c) Power source in place but with a break of circuit (i.e. switched off).

a) No power source

This option relates to a length of copper wire that is not connected to any circuitry. The neutral bitron strands are variously bent in by the electromagnetic fields within the wire's atomic lattice, but remain largely intact. Apart from possible heat-related jostling and buffeting, there is no directional movement of the strands or significant polarisation of the bitrons' energy fields: they are all essentially in neutral mode. With approximately equal numbers of clockwise and anti-clockwise oriented strands, the circular spin components of their energy fields cancel each other out so that no induced circular magnetic field results.

b) Open circuit with power source connected

When an energy source causes an electric current to flow, only one half of the bitron strands, those with the same circular spin direction within the conductor, are energised and polarised, with half of them have the chirality of an electron and the other half with that of a positron. The polarisation allows the strands to break free from the local electro-magnetic fields within the wire's atomic lattice, possibly straightening out somewhat in the process, and, by pushing against the neutral strands with opposite spin, start to move in opposite directions as an electric current. The positron strands work their way towards the negative terminal and electron strands towards the positive terminal.

The negative side of an open electric circuit thus acts as an **electron source** and a **positron sink**, and the positive side a **positron source** and an **electron sink**, resulting in a reciprocating **source-to-sink** model for electricity flow. Induced electric currents have implied (or virtual) positive and negative sources and sinks, whereas currents generated by chemical energy means (e.g. batteries) have physical sources and sinks.

The circular spin component of the electron and positron strand fields (**e** in figure 4) combine to create a circular magnetic field around the outside of the wire in a direction conforming with Maxwell's Right-Hand Grip for electron strands; Maxwell's Cork Screw Rule applies to both electron and positron strands (see inserts lower right in figure 4). The along-wire magnetic field components (**b**) moving outer zone of the electron and positron strands are in opposite directions and so cancel each other out.

The electromagnetic energy flowing through the centre of each core energy torus within a polarised strand combines so as to form a strong uninterrupted tunnel-like flow as indicated by the orange/gold arrows in the upper part of figure 4. The central strand-related energy flow is most important because it is responsible for the instantaneous nature of energy transfer by electricity and is responsible for the formation of the electric field patterns associated with electric point charges, as will be discussed shortly.

In summary, an electric current circuit causes the polarisation of bitron strands and the **emf** (electromagnetic force or voltage as measured in **volts**) across the circuit is a measure of the degree and strength of the polarisation. Electric current, as measured in **amperes**, is defined as the amount of the electric charge (i.e. electrons and positrons combined) passing a fixed point in the circuit per unit time. The movement of electron and positron strands is quite slow (in the order of 80 centimetres per hour), and it is the energy flow through the centre of polarised strands that is responsible for the instant availability of energy in an open electric circuit and the dynamic power of the circuit.

Whenever an obstacle is encountered within an electric circuit (e.g. a resistor), the two-way movement between electron and positron strands is restricted, causing a proportional change in electric current. For a resistance forming the load for an electric circuit, Ohm's Law indicates that for a resistor of R ohms (Ω) and an electric potential difference of V volts the resulting electric current is V/R amperes when the circuit is open.

c) Power source in place but with a break of circuit (i.e. switched off mode)

Should a pair of probes be attached to an energy source (e.g. a battery or A-to-D converter) then we have a powered source with a break of circuit (i.e. it is in OFF mode); when the probes are brought together directly, or indirectly via other circuitry, we have an open circuit. When in circuit-break (OFF) mode, the rounded tips of each probe can be used to approximate one half of a pair of spherical **monopole electric charges** as in figure 5.

In OFF mode, on the negative side of the circuit those negatively polarised bitron strands remain polarised just as they would be should the circuit remained open, and continue to push themselves towards the positive terminal but unable to move forward due to the circuit break; instead they the strands just compress and concentrate at the probe tip. The disconnected positron strands simply revert back to neutral strands, and with less than ¼ of the available strands energized the circular components of their energy fields cancel each other out so that there is no induced magnetic field around the wire and probes.

The energy fields of the stationary electron strands, concentrated at the outer surface of the probe tip with their AO poles pointing outward, extend beyond the probe tip, presenting as a **negative electric field**. Depending upon the strength of the power supply, their combined energised energy fields can extend well beyond the end of the probe tip. The same process is active on the positive side of the break of circuit to create a **positive electric field**.

As shown in figure 5, the energised strand fields display the same pattern of **electric lines of force**. With STEM lines of force, considered by conventional Science to be imaginary continuous lines or curves drawn in an electric field to indicate the direction of the electric force, have a physical explanation and justification, and are not just imaginary.

The spherical **equipotential lines** for the electric fields around the electric point charges are also shown as blue and red dashed circles.

As the two probes are brought together, the attraction between their negative (AO) and positive (CO) electric fields increases, with the polarised strands starting to induce polarisation of same-spin neutral strands within the approaching probe: as the probes are about to touch the energy transfer is so great that some electrons and positrons, being pushed from behind and pulled by attraction in front, prematurely jump the gap, ionising other molecules in their way and interacting with each other as they go, so generating heat and light ranging from an **electric spark** to an **electric arc**. By the time that the two probes are in physical contact with each other (i.e. the circuit is now open or ON), the polarisation of electron and positron strands throughout the circuit is complete and the current is flowing.

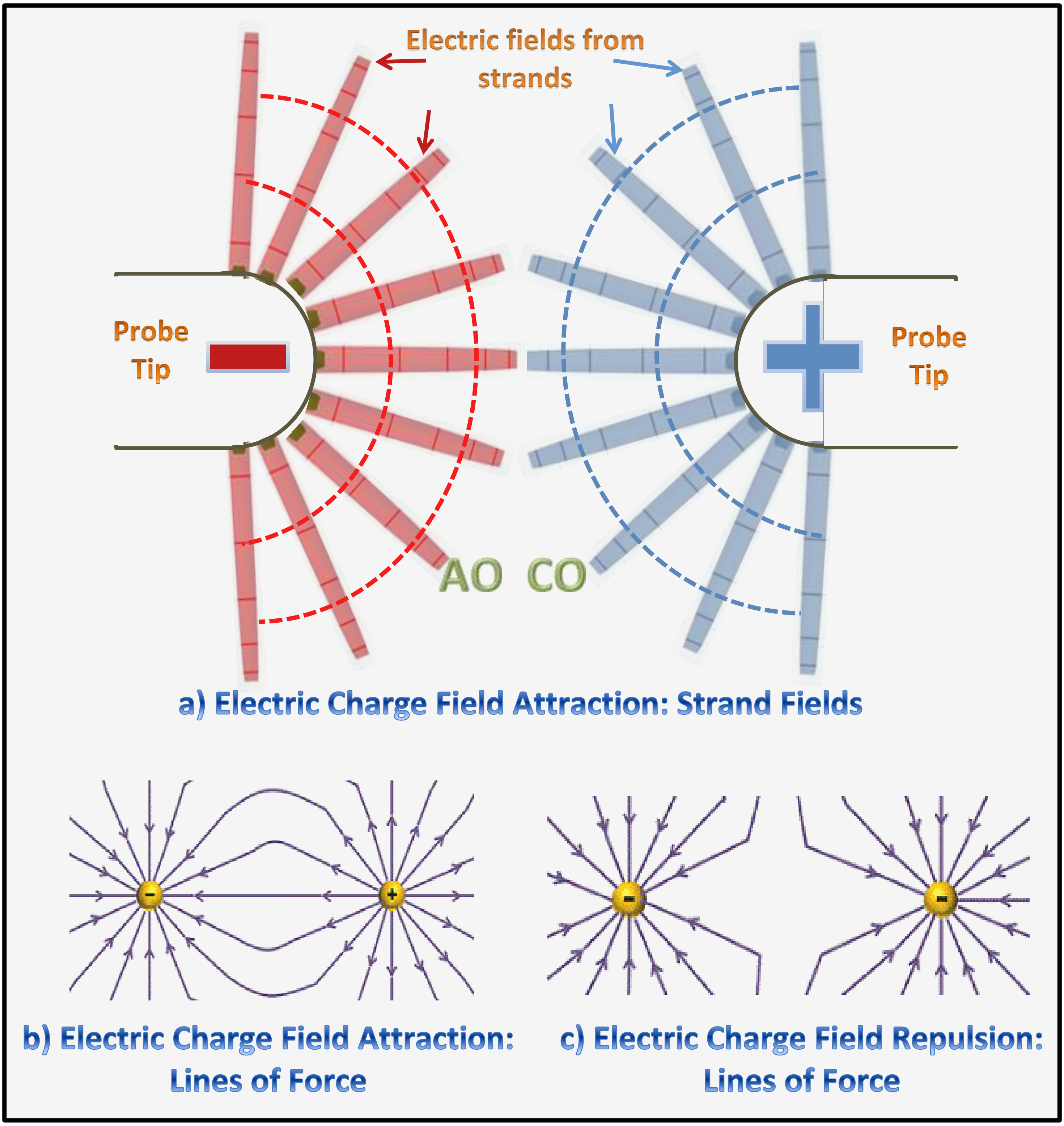


Figure 5: Monopole Electric Field Attraction and Repulsion

Electromagnetic Induction

Faraday's Law of electro-magnetic induction states that whenever a conductor is forcefully moved in an electromagnetic field, an emf is induced which causes a current to flow. For STEM, the current flow represents the synchronous movement in opposite directions of aligned electron and positron strands within the conductor.

In figure 6, a rod conductor (PQ) forms closure to a 'U' shaped electric circuit subjected to a uniform external magnetic field (B). When the rod moves (at speed v) towards the base of the 'U' as in figure 6a (thus creating a smaller loop area) a clockwise electric current (I) is generated, nominally from a positive Q to a negative P. When the rod moves in the other direction, away from the base of the 'U' as in figure 6b (thus creating a larger loop area), an anti-clockwise electric current (I) is generated, which by convention is nominally from a positive P to a negative Q.

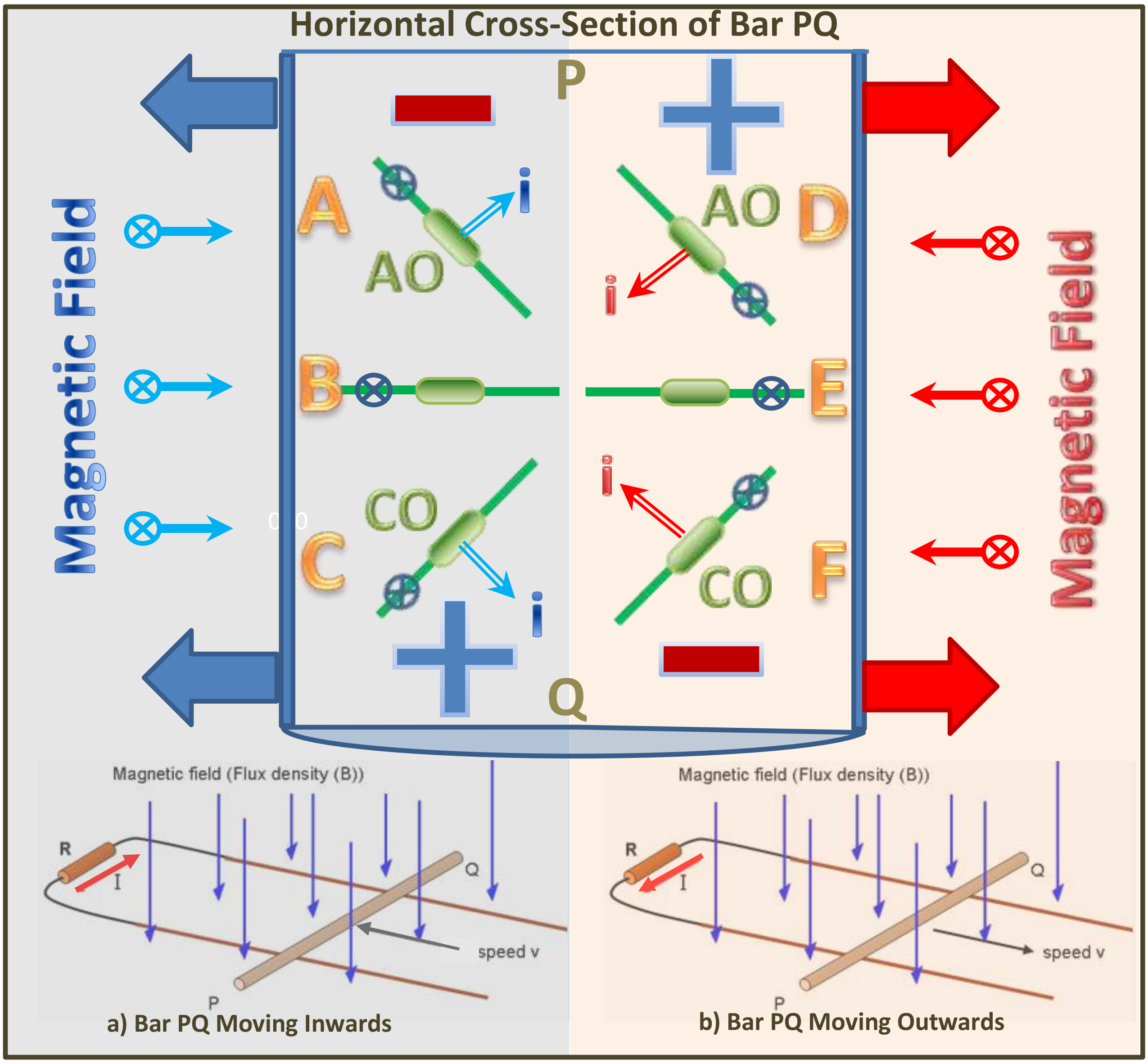
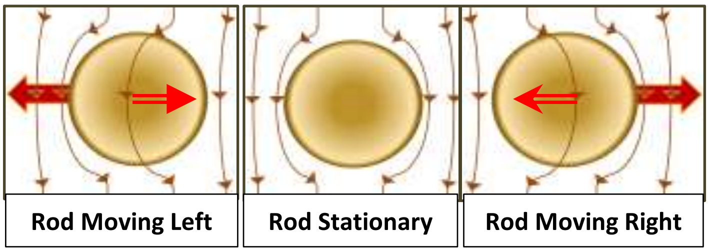


Figure 6: Magnetic Field Induced Current

As mentioned earlier, within a neutral wire conductor not connected to any power source, its bitron strands are variously bent by the electromagnetic fields within the wire's atomic lattice, but in spite of various twists and turns, the strands remain largely intact. Thus the orientation of bitrons within neutral strands can vary from being axially aligned to the rod (B and E in figure 6) to being perpendicular to the rod wall (not shown), with an average orientation 45^{o} to each (shown as the bitrons A, C, D and F in figure 6).

The magnetic field direction downwards into the page is shown is shown as the arrow-quill symbol (representing the disappearing cross-quills of an arrow fired through the page): the small attached red arrow represents the relative movement of the magnetic field due to the rod moving towards it.

A neutral bitron is represents by with the arrow-quill symbol indicating the bitron's spin direction (here into the page on the right-hand side to represent clockwise spin as viewed from the bottom of the page).



The diagram right shows vertical cross-sections of the bar PQ. When moved right through the magnetic field it distorts the field, shown as the bent lines of force. The magnetic field applies a force in the opposite direction in response being pushed aside, as shown by the hollow red arrow. When the rod moves to the left a reaction force similarly pushes right. When the bar is stationary, the lines of force tend to wrap around the rod so that any reaction forces on either side counteract each other.

First, considering figure 6b that represents the situation when the rod is moved to the right. For a bitron with orientation D, its leading edge of its energy field has the same direction is in the same direction (downwards) as the approaching magnetic flux field, and thus it gains in spin speed (increased angular momentum) and an increased boost of energy flow from its core energy. Next, in its more energized state, the reaction force pushes its energy field in the direction of the hollow red arrow as shown to form the AO-CI pattern of an electron. Using similar reasoning, bitrons orientated similarly to F become CO-AI positrons.

For bitrons axially aligned to the long axis of the rod (here E), their energy fields are aligned to the passing magnetic field's reaction force and so are unaffected, remaining neutral. However many other bitron members within the same strand most likely would become polarised, causing strand members such as bitron E to also become polarised.

With the rod being moved right, bitrons orientated similarly to A, B and C are partially de-energized because their leading edge flow direction is opposite to that of the magnetic field; they lose spin velocity and thus angular momentum. When their energy fields are pushed out of the neutral position by the magnetic flux, they have insufficient energy to form into electrons or positron, and quickly re-assume the neutral orientation without being able to influence neighboring bitrons within their respective strands. As the magnetic flux passes their trailing edge, they regain most of their lost spin speed and angular momentum. Thus bitrons with orientations such as those of A, B and C have no a pro-active role in the creation of electrons and positrons as the rod moves right.

The description above of electron and positron creation relates to isolated bitrons, but within strands within a conductor, bitrons are closely packed: thus there are thousands of bitrons within a bend in a strand that have a similar orientation, and it is their combined polarisation the causes other members within the strand to become polarised as well. The stronger the magnetic field and/or the faster the movement of the rod, the more effective and complete becomes strand polarisation. It requires energy to keep electron and positron strands moving: the poorer the conductivity of the wire conductor the larger are the energy loss. Unless you have super conductor circuitry, an ongoing energy supply is required to keep the current flowing, Thus, as soon as the magnetic field is removed or the movement through the magnetic field is stopped, so does the electric current.

Thus, for the bar moving outwards situation, the electron strands start to worm their way towards the P end of the rod, leading with their AO end forward, so creating the illusion of a positive terminal at the P end of the rod. Similarly the illusion of a negative terminal at the Q end of the rod is created by the movement of positron strands leading with their CO end. Although the mechanics of induced current generation is different to the source-sink process, both processes result in one half of the bitron strands (here those corresponding to D,E and F) forming an electric current and the other half remaining neutral (here A, B and C), which in itself is quite remarkable.

When the bar moves to the left (figure 6a), the electric current generated consists of polarised electron and positron strands moving in opposite directions to create the illusion of a negative terminal at the P end and a positive terminal at the Q end.

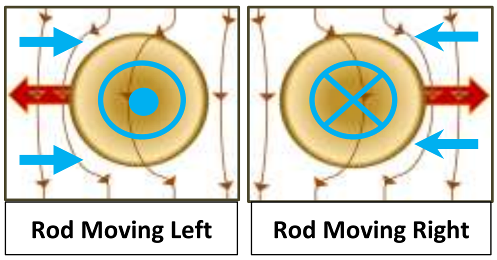


Figure 7: Induced Current Patterns

Energy sources such as chemical batteries and A-to-D converters generate electric currents by creating an electron source and positron sink situation that defines a physical negative terminal, and a positron source and electron sink defining a physical positive terminal. Induced electric currents do not require positive and negative terminals but the rod can be considered to be an energy source for the R side of the circuit, complete with a phantom positive and negative terminal. The difference between the two situations is quite subtle but most important conceptually and physically.

The physics of generating an electric current by moving a magnet through a closed loop circuit is not dissimilar to generating one by moving a rod conductor moving through a magnetic field. In order to simplify the description, consider the cross-sectional view of the rod for the moving rod example shown in figure 7: the blue arrows show the relative movement of the magnetic lines of flux towards the rod and the ⊗ arrow-quill symbol showing the movement of the electron strands into the page and the ⊙ arrow-tip symbol their movement out of the page.

Using **Maxwell's Right Hand Rule** and assuming that the circular flow direction of electron strands can be defined by the flux line direction in the area adjacent to the blue arrows (i.e. the approaching lines of flux side), the thumb points into the page for the 'Rod Moving Right' diagram, and out of the page for the other diagram.

The electromagnetic induction of a loop circuit caused by moving a magnet towards and away from it in different N-S polar orientations is shown in figure 8. The direction of the approaching lines of flux is shown by the blue arrows, the circular direction of magnetic flux at the blue arrow area by orange arrowed arcs, and the flow direction of the electron strands in the cross-sectional view of the loop (AB, CD, EF and GH) as determined by using Maxwell's Right Hand Rule or using the induced current direction guide provided by figure 7. What could be simpler?

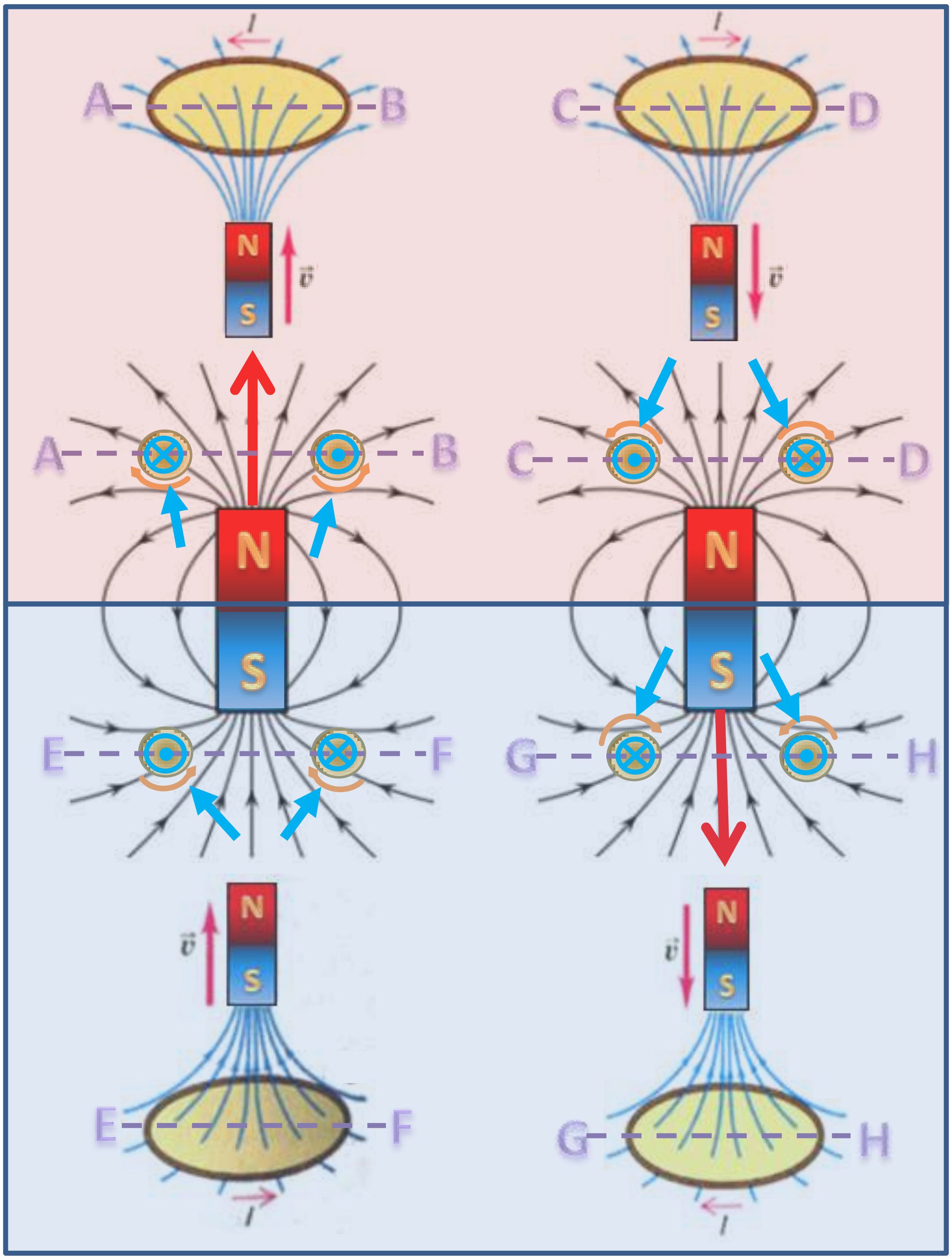


Figure 8: Magnet-Motion Induced Current within a Loop

Alternating current (AC) is created by switching the direction of the induced current at a specific frequency. The techniques for creating AC electricity from induced currents are well documented, as are the ways of creating and managing DC electricity: consequently these subjects will not be addressed in this series of papers.

STEM provides a simple, consistent causative explanation for induced current, its direction and the associated circular magnetic field. Current Science texts and associated articles provide descriptive explanation rather than a causative explanation of these phenomena. They provide is a series of inter-related rules and conventions but no physical explanation, which unfortunately adds mystery and confusion around electromagnetic induction and electricity.

Electrostatic Charges

An **electrostatic charge,** often called **static electricity**, is a surface collection of electrically charged particles that is typically generated by the rubbing together of certain materials. The conventional Science MEC explanation is that triboelectric materials have a tendency to give up electrons so as to become positive (+) in charge or to attract electrons to become negative (−) in charge. The STEM explanation is that static electricity is due to friction-induced polarisation of neutral and weakly polarised bitron strands, with the structure of some triboelectric materials pre-disposing them to develop more positron or more electron strands, and 'neutral' materials developing approximately equal numbers of weakly energised positive and negative polarised strands.

The **Triboelectric Series** is a list of materials, indicating which have a tendency to become positive, such as air, leather, rabbit fur, glass, human hair, nylon, wool, lead, cat fur, silk, aluminium, paper; those with a tendency to become negative, such as ebonite, silicone, rubber, teflon, silicon, polypropylene vinyl (PVC), polyethylene (e.g. Scotch and Cello tape), plastic wrap, styrene/styrofoam, polyester, acetate, rayon; and those with a tendency to remain electrostatically neutral, such as cotton and steel. The degree of polarisation varies according to the situation (e.g. contact surface area) and material combination involved.

The STEM explanation for static electricity is that when two matching positive and negative triboelectric materials are rubbed together, many neutral bitrons with the same spin direction (see figure 9a) are dragged past each other. Their energy fields are energetically forced past each other in the opposite direction, mechanically pushing their energy fields in the direction of the hollow arrows so as to polarise them, with one side forming an electron and the other a positron. As the bitrons are members of same-spin strands, there are many bitrons within the same strand so affected, and the whole strand is polarised. The frictional energy of the rubbing process is sufficient to highly energise the polarised strands, with many strands being broken up into smaller strands. The result is that the outer surface area of one material becomes positively charged (more positron strands) while the surface of the other material other negatively charged (more electron strands).

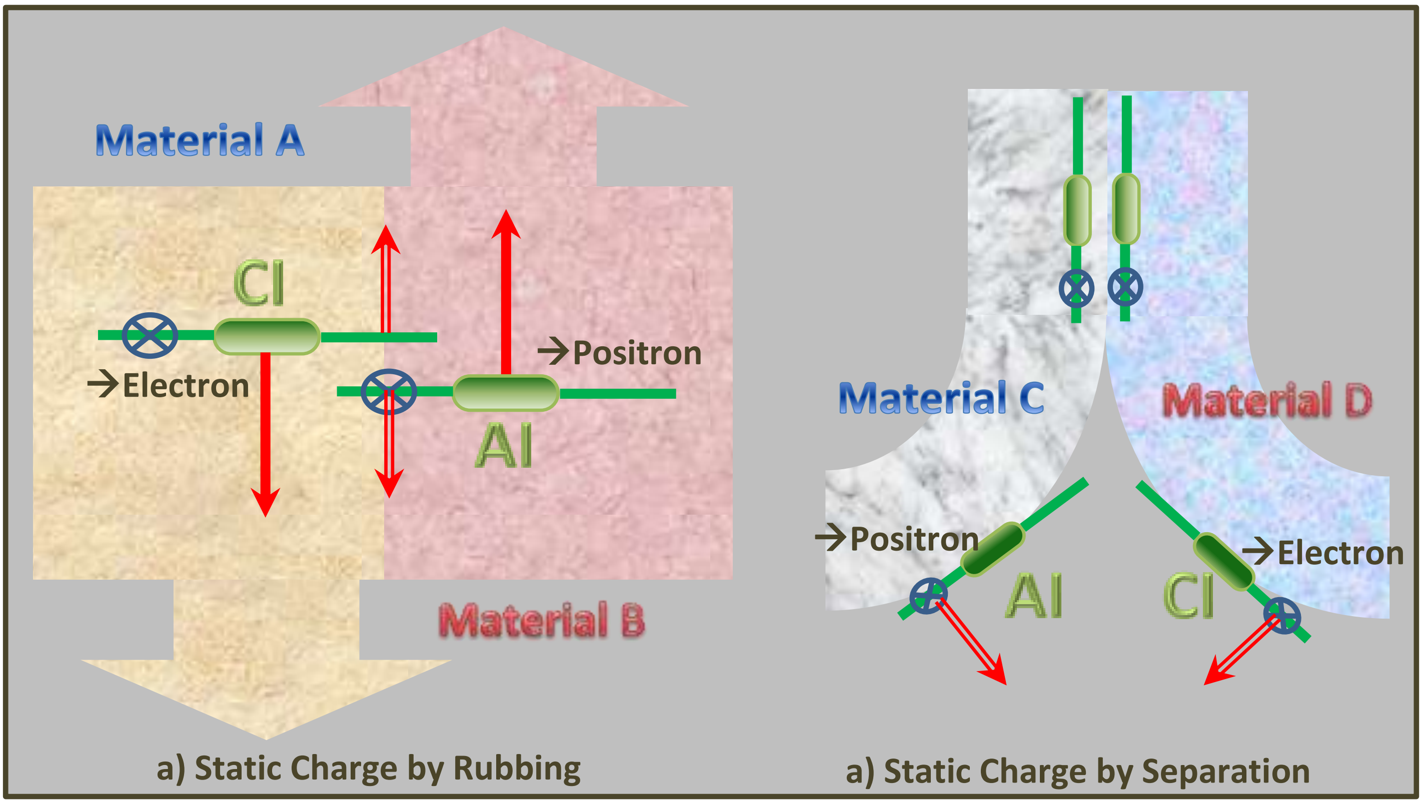


Figure 9: Static Charge Generation by Rubbing and by Separation

Once formed, there are several important features of static electricity that need to be noted:

1. The rubbing process results in fragmented but highly energised polarised strands.
2. Each material develops a surface concentration of positive-only or negative-only polarised strands, and thus no electric current, which requires both types of polarisation, is generated within either material.
3. The polarised strands push against neutral strands with opposite spin so as to concentrate at the outer surface of the material with their AO or CO poles facing outwards. The neutral strands, on the other hand, are pushed away from the outer surface; an effect apparent in Van de Graaff generators (to be covered next).
4. For electric currents, energy is being continually expended in order to maintain the movement of the polarised strands, with the polarisation dissipating as soon as the energy source (for source/sink electric

currents) stops providing electrons and positrons, or the magnetic field movement that induces strand polarisation (for an induced current) stops. However surfaces charged with static electricity can remain charged for quite some time, as the main energy losses are via interactions with external electric fields.

5. For an electric current only half of the bitron strands, all with the same spin direction, are polarised: of these, half are polarised to form electrons and the other half positrons, forming a 50:25:25 percentage split. When fully charged, static electricity results in a 50:50 split, with all bitrons of one spin direction being polarised with the same helicity (either positive or negative), so resulting in a very high surface charge density.

Static electricity can also be generated when two different but susceptible triboelectric materials are in close contact and then forcedly separated. When in close physical contact, the energy fields of many neutral and partially polarised bitron strands merge spanning the interface. When the two materials are then forcedly separated, usually by using a zip-like action, these weak strand joins are wrenched apart, pulling their energy fields towards the outer surface direction so as to induce the formation of electrons and positrons as shown in figure 9b. The mechanics of generating static charges by separation are different to rubbing, but the end result in terms of static electricity is the same.

A **Van de Graaff generator** is a mechanical electrostatic charge pump that uses a moving rubber belt to transfer charge to a hollow spherical metal structure and accumulate the charge to generate a high electric potential up to several million volts. There are many configurational variations of the generators: single dome, double dome, earthed, unearthed or supplemented by use of electric power. For simplicity, the charging process will explained for a double dome configuration, generating a static positive charge on the larger dome and a negative charge on the smaller.

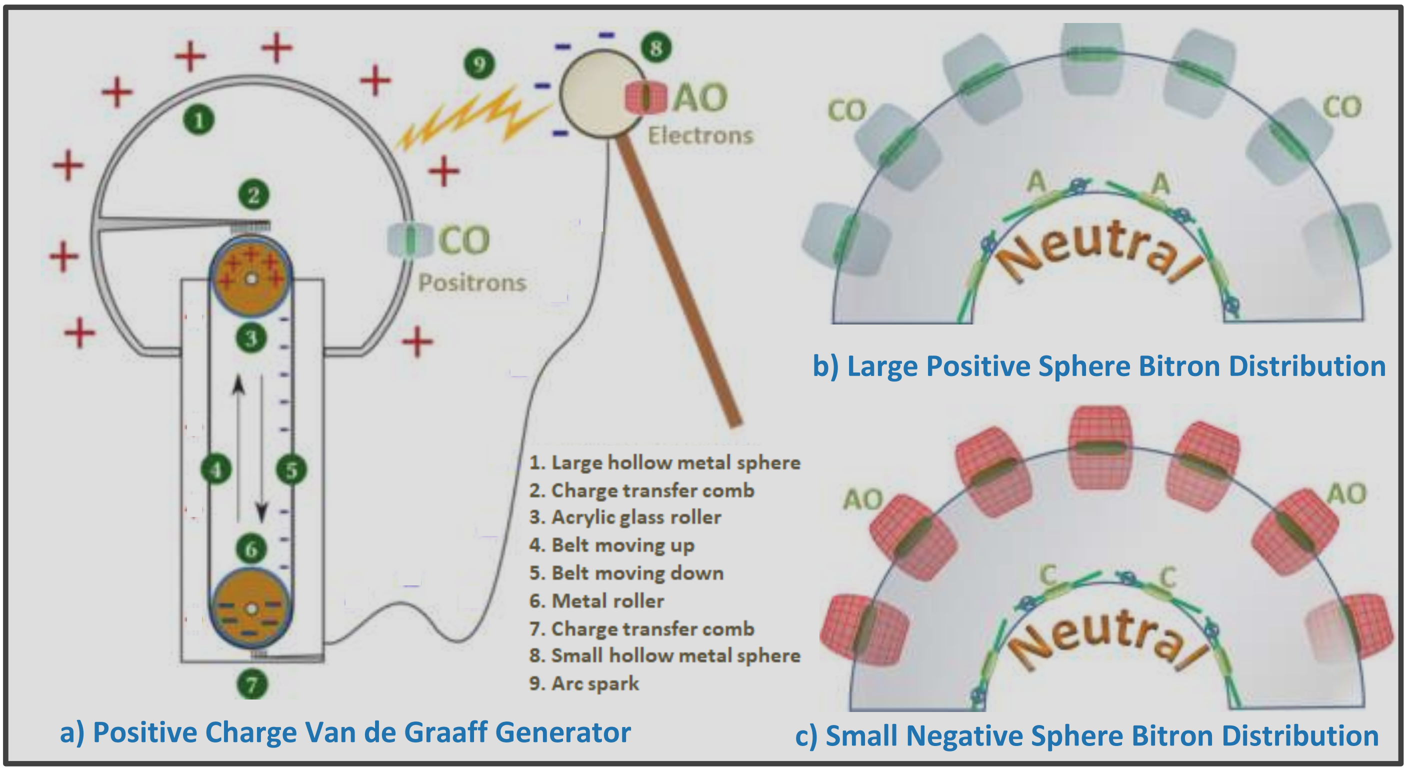


Figure 10: Van de Graaff Generator

Referring to figure 10a, the upper roller (3) is acrylic glass or similar, that becomes positively charged by separation from contact with the inner surface of the conveyer belt (5), which is made of rubber. The inner surface of the rubber belt correspondingly takes on a negative charge in accordance with the Triboelectric series.

Unlike many conventional Science explanations, **electrons are not carried** from the upper roller by the belt to be absorbed by the lower metal roller (6) so as to make it negatively charged. It is the negatively polarised strands, as created at the inner surface of the belt by separation that, via induction, negatively polarise neutral strands in lower metal roller. Static electricity, as the word '**static**' suggests, **does not involve** the complex physical movement of electrons hopping between the orbitals of atoms in rollers and belts: it is energy movement via electric field induction.

Importantly the electric charges around the rollers cumulatively become much more concentrated than any charge on the belt, with quite highly energised positron strands building around the outer surface of the acrylic glass roller (3) and electron strands around the metal roller (6). The strong electric fields being generated by these rollers are sufficient to polarise neutral bitron strands in the metallic charge transfer combs in spite of having to pass through the thin rubber belt which, although being an electric insulator, offers no real barrier to electric fields. These electric fields are sufficiently strong to ionise air molecules between the outer surface of the belt and the combs, generating low-level plasma visible as a corona discharge; some ions so generated can attach to the outer surface of the belt.

By induction, the strong negative fields at the lower combs (7) polarises those bitron stands with the same spin orientation. The polarisation effect extends to the small hollow metal sphere (8), resulting in a corresponding build-up of a strong negative charge at the sphere's surface. A similar induction process occurs at the upper metal combs (2) to positively charge the outer surface of the larger hollow metal sphere (1).

A cross-section of the hollow both hollow metal spheres (figures 10b and 10c) have similar electrical cross-sectional profiles. As mentioned in point 3 above, the polarised strands push against neutral strands that have opposite spin so as to concentrate at the outer surface of the material with their AO electron or CO positron poles facing outwards. As surface concentrations build, they spread sideways to become evenly distributed around the outer surface of their sphere. The neutral strands, being pushed away from the outer surface by the polarised strands, migrate towards the inner surface of the domes, so rendering the inner surface of the dome electrically neutral.

The electric charge build-up on the surface of the spheres continues until all the strands with the appropriate spin orientation (half of all the strands) on the dome side of the belt are polarised and energised to the maximum extent possible from the charge field emanating from the rollers. Huge cumulative static electricity charges are achievable on the outer surface of the domes because the polarised strands have pushed and squeezed all neutral strands from the outer surface area. When fully charged, the outer surfaces are packed entirely with outfacing polarised strands and their associated electric fields. When the positively and negatively charged domes are brought close together, the large electric potential difference between the positively and negatively charged spheres ionises air and water molecules between the two, creating low-level plasma, that quickly escalates into a large-scale charge transfer as an **electric arc** (9), as positrons and electrons strands directly exchanged electrons and positrons between the spheres.

Chemical DC Electricity Generation and Recharge

The manner in which electrons and positrons are involved in chemical reactions is explained in Redefining the Electron (Part 2). In the meantime, figure 11 shows the conventional Science view of the chemistry of galvanic and electrolytic cells, but the description provided is in terms of the STEM interpretation involving positrons and electrons.

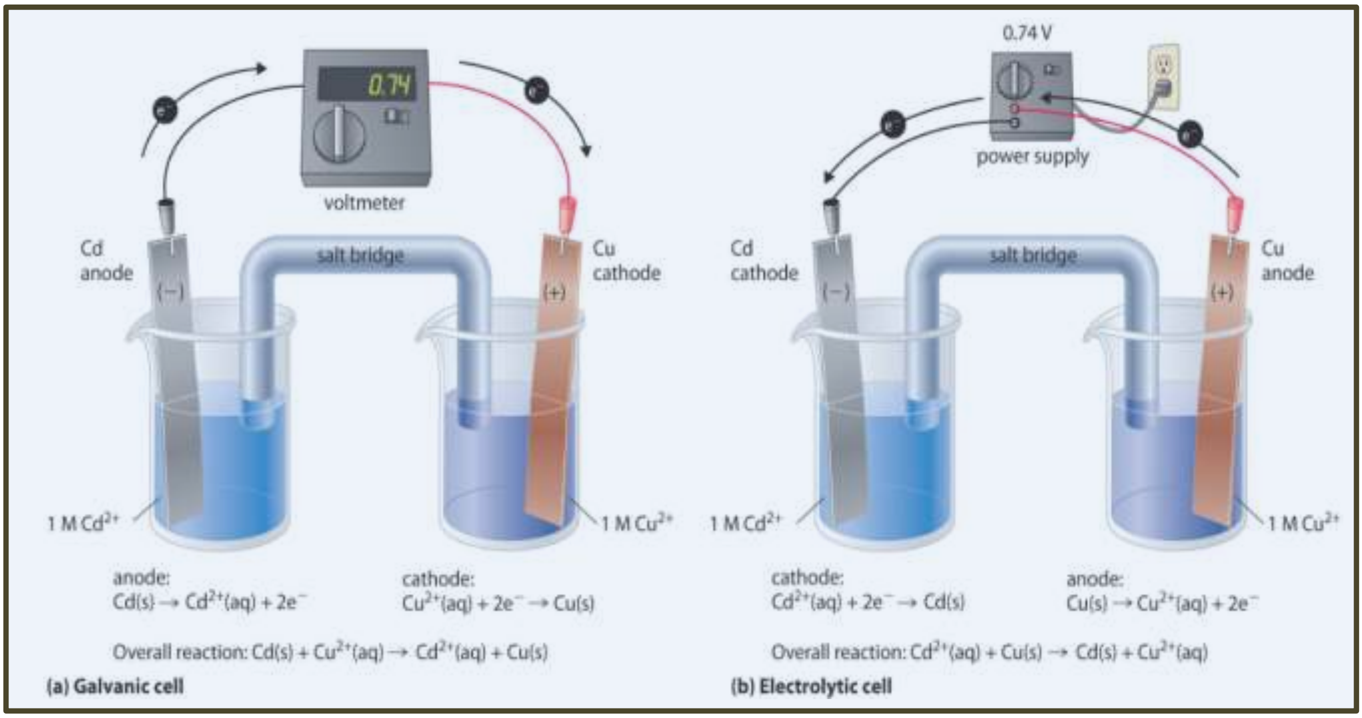


Figure 11: Galvanic and Electrolytic Cells

The **Galvanic Cell** example figure 11a creates Direct Current (DC) electricity by chemical reaction (i.e. is a chemical battery). At the anode, cadmium atoms release electrons and absorb positrons as cadmium atoms in the anode are converted into cadmium cations in solution, so acting an electron source and positron sink. At the cathode, copper cations in solution release positrons and adsorb electrons to deposit copper metal at the cathode, so acting a positron source and electron sink. The electron and positron sources polarise neutral strands with the same spin, resulting in an electric current consisting of the synchronous movement of electron strands from anode to cathode and positron strands in the opposite direction.

The **Electrolytic Cell** example of figure 11b represents the reverse process of the Galvanic Cell. When a DC current (shown as 0.74volts from an AC-to-DC converter) is applied, it becomes an electron supplier on the cathode side and a positron supplier on the anode side of the circuit. As electron strands work their way to the cathode, electrons are adsorbed by cadmium cations to deposit cadmium metal onto the cathode, which acts as an electron sink. The cathode also acts as a positron supplier as positrons are also released by the same chemical reaction. At the anode, positrons from the power supply are absorbed by the copper metal and electrons are released as copper cations are released into the solution: thus the anode acts as a positron sink and an electron source.

Such chemical cells demonstrate how concentrations of electrons and positrons, whether derived from chemical reactions or artificial power sources, create sources and sinks for free electrons and positrons, causing strands of them to move in opposite directions as an electric current.

Electromagnetic Attraction and Repulsion: An Explanation

Magnetic and electric fields consist of the same type of energy and have many similarities; but each form is subtly different. Magnetic fields are associated with magnets or generated by an electric current around moving in a loop circuit or coil (see Electromagnetic Induction). Unlike electric fields, magnetic fields do not involve energy field spin.

Both types of field form a broad looped torus pattern around their respective poles (e.g. the lines of force around a dipole magnet and the energy field around a polarised bitron). Magnetic fields flow out from a North pole to return back via a South pole; electric fields have a divergent out-flow and a convergent in-flow poles. For both types of energy field their like-poles repel and opposite-poles attract. In this section we will take a closer look at the nature of these fields in order to provide an explanation of their attraction and repulsion characteristics.

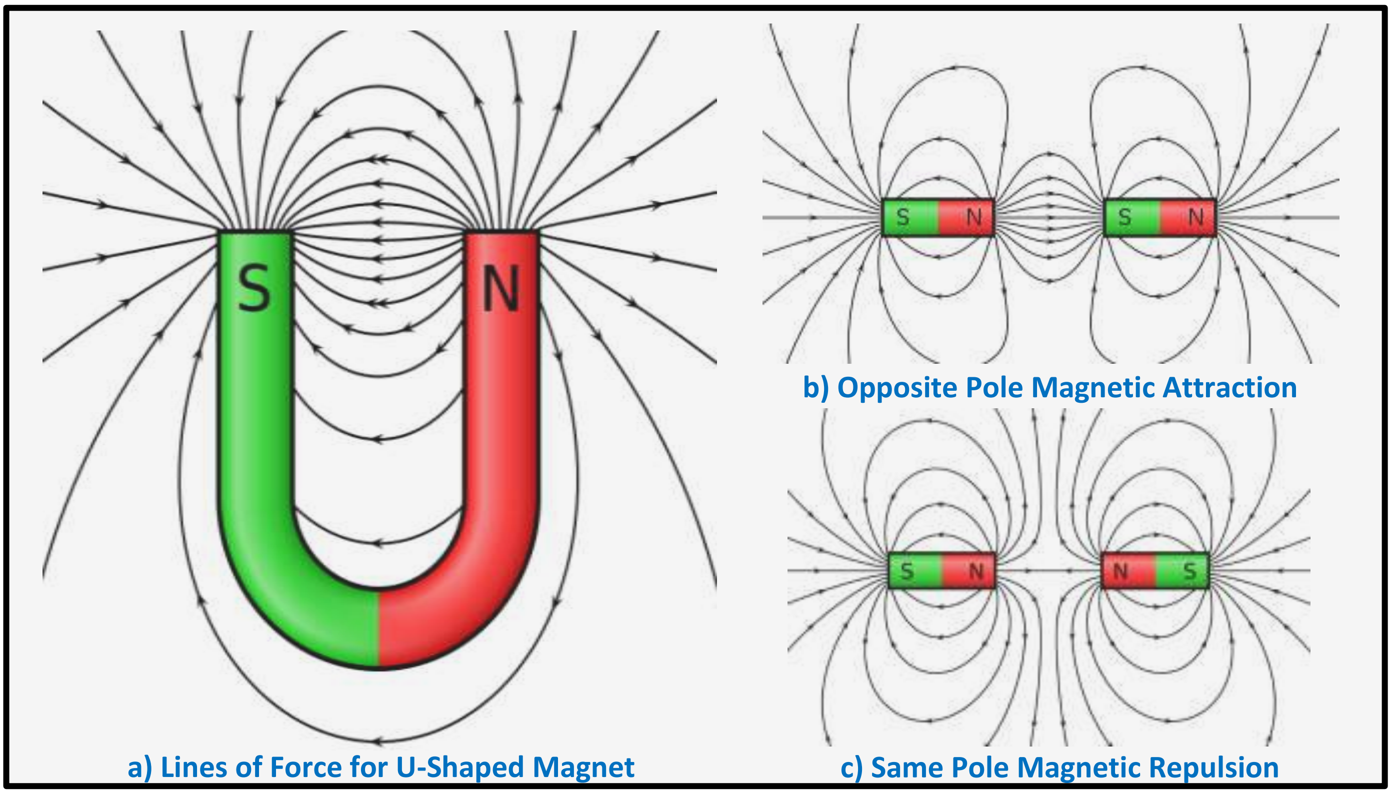


Figure 12: Opposite-Pole Attraction and Like-Pole Repulsion in Magnets

The flow of electromagnetic energy for a magnetic field is out from the North pole and back in at the South pole: the energy flow has no circular component apart from its large arc trajectory around the magnet or current loop creating it. Opposite pole attraction occurs because the magnetic out-flow (North) and in-flow (South) field lines energy join as shown in figures 12a and 12b, and seek the shortest route possible with the in-flow of the South pole acting like a fishing reel pulling the North pole towards itself. Like-pole repulsion occurs because the energy flows push against each other in opposite directions as shown in figures 12c for opposing North poles: simply reverse the flowline arrows for opposing South pole repulsion.

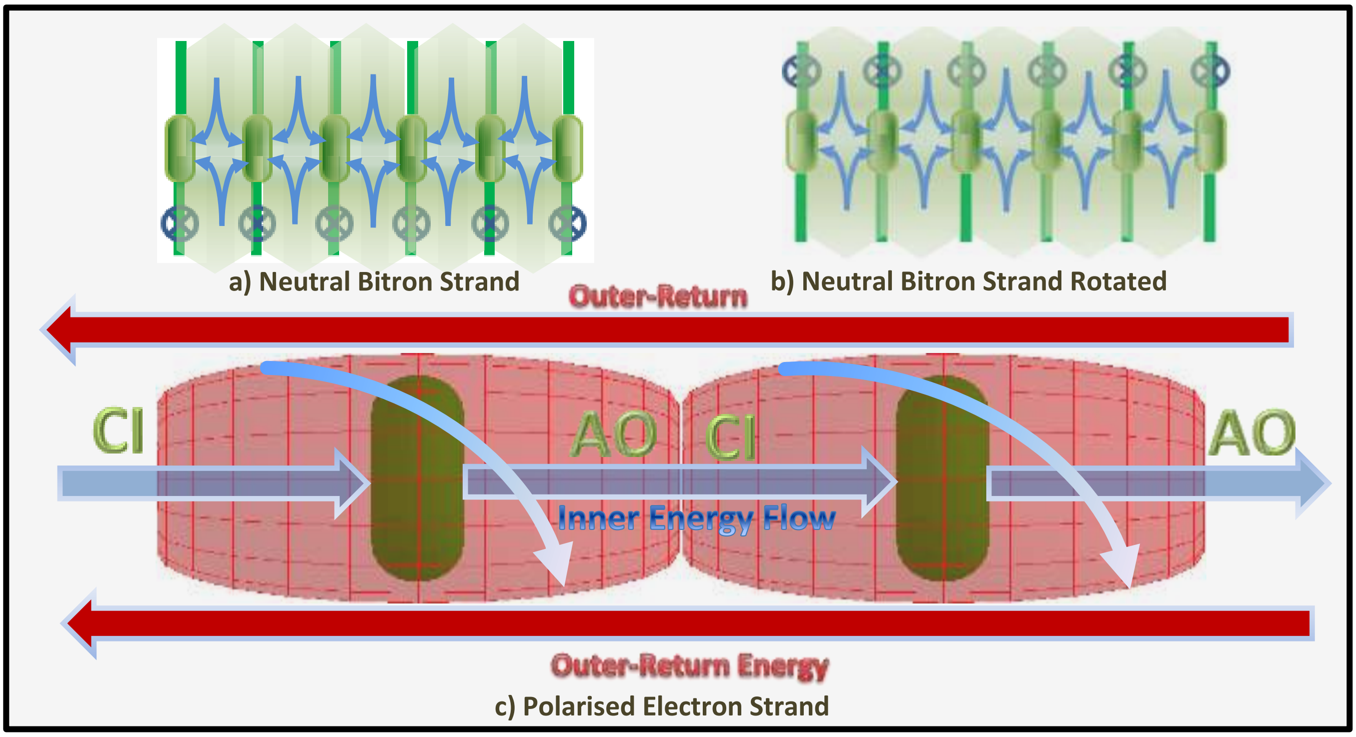


Figure 13: Polarised Bitron Strand Energy Flow

The mechanics of attraction and repulsion for electric fields are similar to those for magnetic fields, but involves fields with energy components flowing in opposite directions and a circular flow component. But before considering the mechanics of attraction and repulsion between electric point charges, an explanation of attraction and repulsion between bitrons within bitron/electron/positron strands is required.

The circular spin of the neutral bitrons' energy fields helps to jostle the bitrons into like-spin compatible strand-like groupings. Within a strand-like grouping, low concentrations of energy accumulates between the bitrons as in figure 13a and b. Each bitron is then competing for the available energy, drawing it towards the central hole of their core energy: it is the mutual competition for this energy that causes them to be pulled towards the resource-in-common (the blue arrows), so creating equal spacing between them.

When equally spaced aligned stand-like groups of bitrons are polarised the inner field energy flows from one bitron to the next, with an outer-return flow in the opposite direction as for the electrons in figure 13b. The field energy flows in opposite directions, with a combined flow twist in the same circular direction, serves to draw and keep them together, representing what we call **attraction**. Rotate 1 of the 2 electrons shown in figure 13a by 180^{o} and the inner, outer and circular flow components would all oppose each other to create what we call **repulsion**. The same applies to positrons, except that the circular rotation direction is reversed: thus a pair of electrons, or a pair of positrons, can attract or repel each other depending on their relative directional orientation (i.e. which way they are pointing).

A note about monopole electric charges: The way that monopole charges are created in a laboratory is and always has been via probes (or the equivalent thereof) attached to a DC power source. Although sub-atomic charges such as electrons and positrons, allegedly monopole point charges, can be isolated and manipulated in a laboratory, their point charge equivalents can only be simulated from an electric circuit set-up. The following explanation of electric field attraction, repulsion and lines of force relates to electric fields derived from electric power sources, with an explanation of electric fields emanating from atomic particles being covered in Part 2 of the series.

An electric field can be created by the combined outwardly directed fields of electron and positron strands from an electric circuit. E-strands generate outwardly directed fields called **e-wisp fields** (or simply **e-wisps**) with an AO heading away from the negative pole associated with the negative side of an electric power source. P-strands similarly generate **p-wisps** with a CO heading from the positive side of an electric power source.

The negative pole end also generates p-wisp fields with an AI heading which, when connected to a CO headed p-wisp field, produces a **p-thread** field which transfers energy centrally from the positive to the negative pole (shown as the blue p-thread arrows of figure 14). A similar pattern applies to the red AO-to-CI **e-threads**.

The outer energy flows of p- and e-threads are in opposite directions and thus cancel each other out. Similarly, their inner or core flows are in opposite directions, and together represent conventional electric field lines of force.

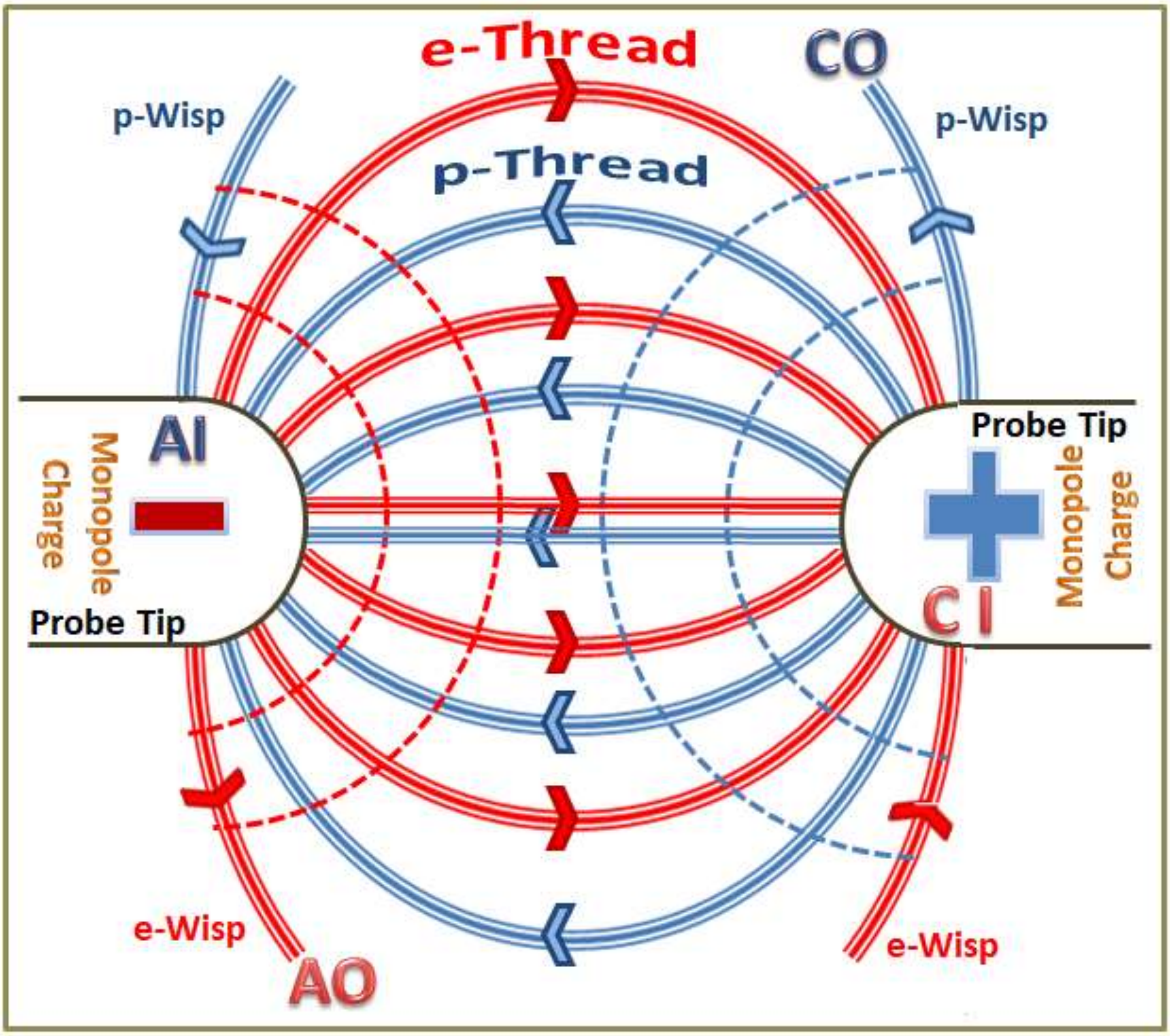


Figure 14: Opposite Charge Attraction between Monopole Point Charges

On the other hand, the circular energy field component of both e-threads and p-threads is in the same direction and thus merge. It is possible that the circular flow component may help to bend and connect p-wisps to create a p-thread, and similarly for e-thread formation.

Attraction between electric poles of opposite charge is due to the pull of energy by e-threads (and thus the e-strands) towards the positive side, and the pull in the opposite direction by the p-threads towards the negative pole. However conventional lines of force diagrams simply show an electric field moving inwards to a negative charge and outwards from a positive charge as in figures 5b & 5c, which correspond to the p-wisps and p-strands, and thus only represent half of the story. Figure 5a shows a simpler version of the STEM approach that is closer to the conventional diagram.

Repulsion between like electric poles is due to wisps with the same heading clashing head-on, deflecting and pushing each other away: they also cancel out each other's circular field component. The result is repulsion and the associated lines of force that are the same as for like magnetic pole repulsion; but electric attraction, as explained above, is distinctly different to magnetic attraction.

Capacitor Charge and Discharge

The **dielectric material**, as used in an electric capacitor, is an electric insulator that thus provides significantly more resistance to bitron movement than an electrical conductor. Also a dielectric contains considerably less free bitrons than an electrical conductor. Although dielectric bitrons are sparse and bitron strands less densely packed and possibly more contorted within the dielectric material, the bitrons can be polarised and become quite highly energised so as to store electrical energy when in **charge mode**. The energy stored by the bitrons can then be released as an electric current that flows in the opposite direction when the circuit is in **discharge mode**.

During the charge phase (figure 15a and the circuit diagram of 15d**)** polarised electron and positron strands within the circuit cannot enter the dielectric insulator, but instead compact and become concentrated on the capacitor plate's outer surface. Via induction from the strong electric fields that have built up on the capacitor's outer surfaces, the bitron strands within the dielectric become polarised, forming electron strands on the negative side of the circuit and positron strands on the positive side. These polarised strands slowly and laboriously work their way in opposite directions (the small arrows of 15a) through the dielectric as a weak micro-electric current (internal to the dielectric).

Eventually the dielectric strands have moved as far as they can towards their respective sides of the capacitor and cannot absorb any more energy: the capacitor has thus reached full capacity. However because the dielectric bitrons are so few in number compared with those available in the charging circuit, and in spite of a significant loss of energy in moving through the dielectric insulator, the dielectric's polarised strands each accumulate significantly more energy than their counterparts in the open charging circuit: this is most important for the discharge phase.

For the **discharge phase,** the charging power supply is switched out as in figure 15e and the charged capacitor becomes the new power source. The removal of the charging power source causes all the polarised strands in the charging circuit to instantly revert back to being neutral strands (see figure 15b); but not so for the much more highly energised polarised strands within the dielectric. The powerful electric fields of the electron strands that have built up along the outer surface of the dielectric now induce the polarisation of the newly neutral strands (which were previously positive strands on the positive side of the charging circuit), transforming them into negative strands. The new electron strand concentration represents an electron supply situation, thus converting the once positive side of the circuit into a negative terminal. The reverse happens on the other side of the capacitor, creating a positive terminal. Thus a source-sink electric potential has been created, and an electric current flows in the opposite direction to the charging current as shown in figures 15c and 15e.

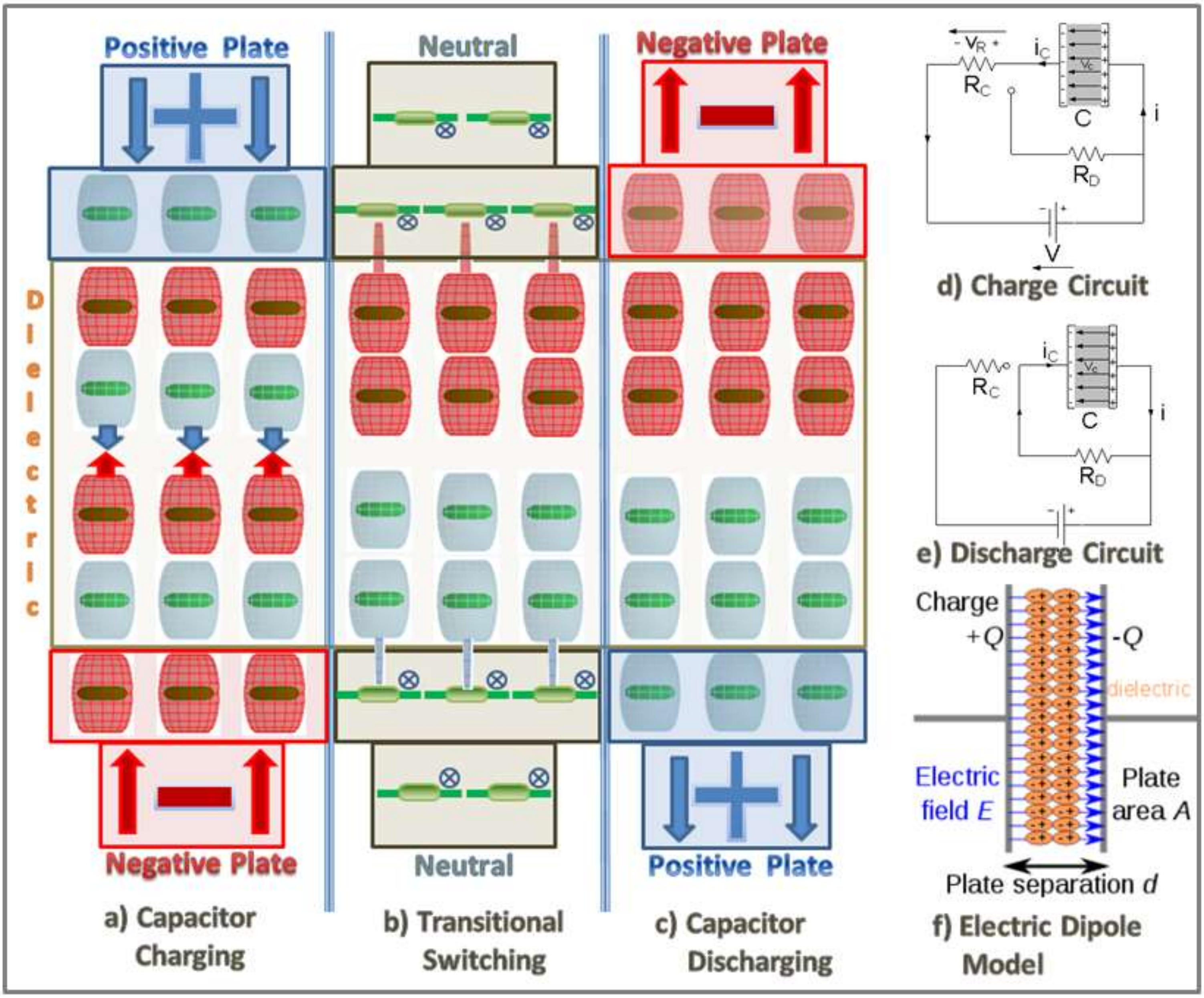


Figure 15: Electric Capacitor Charge and Discharge Phases

Eventually the dielectric strands lose energy and revert to their neutral state, and the capacitor power is exhausted and so the discharge current flow stops.

Interestingly, the Wikipedia definition for a dielectric is '*an electrical insulator that can be polarised by an applied electric field*', and the explanatory diagram provided for 'dielectric polarisation' (duplicated as figure 15f), involves the use of **electric dipoles**, which are incompatible with the concept of monopole electric charges of conventional Science's MEC model, to explain the phenomenon. In a similar vein, the creative use of fictional **positive holes** to explain micro-electrical charge transfer (as addressed in Redefining the Electron Part 3) provides another example of conventional Science's dilemma with trying to explain electricity. STEM, on the other hand, does not require any such adjustment or compromise, as all the subtleties of electricity and magnetism are fully accounted by the model.

Superconductivity

So far this paper has suggested that the electron and positron strands are continous from source to sink, but this is far from the case. In temperatures above about 170K, even the best of electrical conductors (e.g. Au) are far from perfect conductors: structural flaws (crystal interfaces and micro-fractures associated with the manufacturing process) and contaminants ensure that is the case. Structural flaws and contaminants, provide barriers that can break strands into smaller strands. Where possible, broken strands can re-connect with other strands to build into longer strands, but the process of bending, breaking and (re)joining strands creates energy loss in the form of heat and light. The electromagnetic fields of atoms of the carrier also push and pull on the strands, impeding their movement. It is the level of difficulty encountered by strands that determines the carrier's resistance (Ω).

Usually when a metal conductor is cooled there is an increase in conductivity. As explained in Redefining the Electron (Part 2), STEM contends that cooling, and super cooling in particular, involves the loss of energy by the atoms of the conductor rather than the loss of energy of the free electrons and positrons within strands. Energy losses of atoms within the conductor reduce the stregth of their electromagnetic fields which increases conductivity accordingly.

Superconductivity for **superconductive materials** commences at about 170K (164K, under 30GPa of pressure for $HgBa_2Ca_2Cu_3O_{8+x}$). The electomagnetic barriers presented by atoms in the superconductor, including contaminants, are minimised as the temperature appoaches the conductor's **Critical Temperature**. When a current is applied the electron/positron strands connect for the full length of the conductor without break, virtually unimpeded by atom and contaminant electromagnetic fields, turning it into a **perfect conductor**. In superconductor mode virtually no energy is lost negotiating barriers to strand movement and the energy flow ouside the strands is so strong that the magnetic flux from external magnetic fields is excluded. Even after the power source is removed, the electromagnetic fields of the conductor atoms are so weak that the free electrons and positrons within strands keep most of their axial alignment to display perfect diamagnetism (the **Meissner Effect**).

Free Electron and Positron Farming

Electrons are most commonly sourced from thermionic cathode ray tubes (e.g. first generation TV tubes): those used in research settings are usually called **electron guns**. Unfortunately, by reversing the anodes and cathodes of electron guns does not create a Positron gun (it can become a proton gun) because, as explained in Redefining the Electron (Part 2), positrons require much more energy in order to be ejected from matter as free positrons.

Low level concentrations of positrons can be sourced from to β+ decay and Electron Capture (topics addressed in Redefining the Electron (Part 2)). One practical application of this source is **P**ositron **E**mission **T**omography (PET). PET is a gamma imaging technique using radionuclide tracers that generate positrons which trigger electron-positron annihilation inside a patient's body: the resulting pair of gamma ray travel in opposite directions, and are detected allowing the tracer locations to be accurately mapped producing a high resolution image.

Although electrons and positrons can easily be manipulated and concentrated (e.g. a Van de Graaff generator or simply rubbing a synthetic cloth against a glass or perspex rod), it is difficult to to generate larger quantities of free positrons outside their host medium.

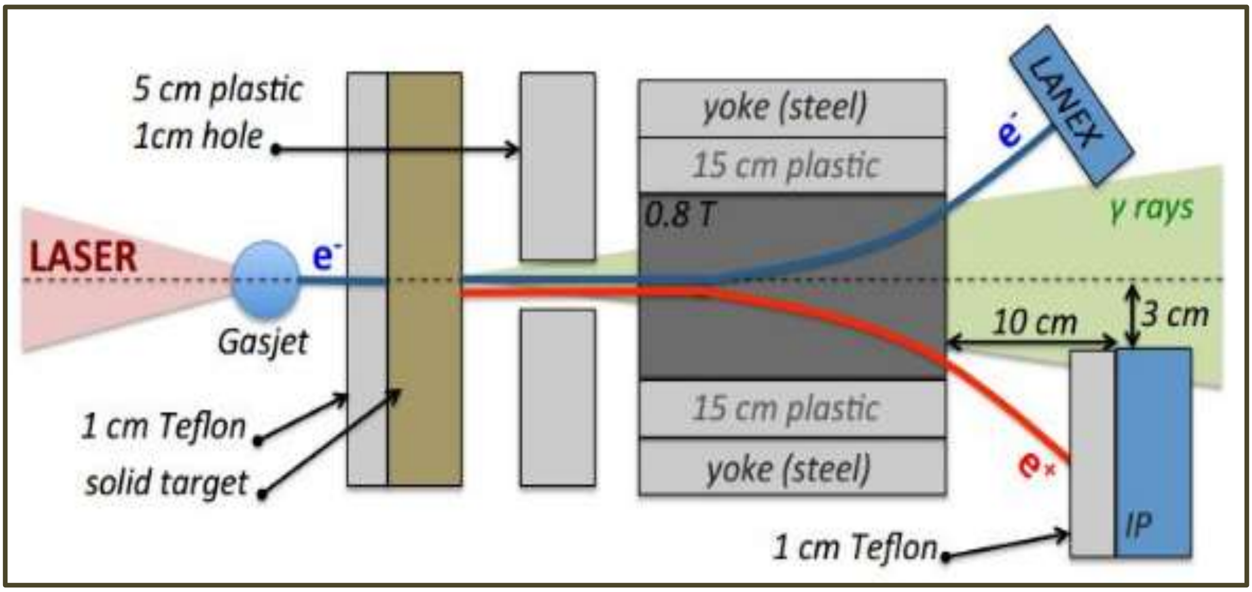


Figure 16: Laser Setup for Electron and Positron Generation

One brute-force technique for generating useful quantities of free positons is to bombard a metal film with high kinetic-energy electrons so as to knock positrons out of the metal film. At CERN, the **LIL** (**L**arge Scale Electron-Positron Collider **I**njector **L**inac) uses an electron gun to assemble electrons with an energy of 80 keV; these are in turn accelerated to an energy of around 200 MeV which are then shot at a tungsten target to produce positrons that can be magnetically separated and further accelerated for particle collision purposes. This is an expensive, larger-scale operation of limited availability to a small handfull of researchers.

On a smaller scale, in their 2013 paper titled 'Table-Top Laser-Based Source of Femtosecond, Collimated, Ultra-relativistic Positron Beams', by G. Sarri et. al. report the generation of a positron beam using a laser-driven particle acceleration setup (see figure 16). A petawatt (10^{15}W) laser was fired at a sample of inert helium gas, creating a stream of electrons moving at very high speed, which were directed at a very thin sheet of metal foil: the resulting collisions produced a stream of electron and positron (and gamma ray) emissions which could be separated using magnets. This has led to cheaper, more practical setup options for researchers.

Summary and Conclusions

Good electrical conductors contain abundant neutral bitrons, orientated so that half spin clockwise and the other half anti-clockwise, with like-spin bitrons self-organising into linear groups called strands. STEM contends that electricity is the two-way movement of strands polarised with the same circular spin direction but different chirality: it thus involves only half of the bitron strands. Of these, half are electron strands and the other half positron strands. The helicity of the polarised strands' outer energy fields causes them to push against the neutral strands and so move, but in opposite directions. Such movement results in an electric current with electron strands moving towards the positive terminal (physical or implied), leading with their AO poles; and positron strands towards the negative terminal, leading with their CO poles. As the polarised strands have the same spin direction, their outer energy fields combine to produce an induced circular magnetic field around the wire conductor through which they move.

An electric field, such as generated by attaching a probe to the appropriate terminal of an electric power source, is formed by the combined energy fields of energised polarised bitron strands that extend beyond the outer surface of the probes. As extensions of polarised bitron stands that have a circular spin component, electric lines of force also have a spin component, whereas the lines of flux associated with a magnetic field do not have a spin component. However both electric and magnetic fields consist of exactly the same type of energy but with different flow patterns.

STEM provides logical, consistent explanations regarding the nature of electric and magnetic fields, electrons, positrons, electric current flow, capacitor charge and discharge, the induction of electric current, and superconductivity. It represents a new and different approach that has the potential to cause a major re-think about electricity that is radically different from the interpretation based upon the MEC monopole electron. The future ramifications for all areas of Science, industry and education are significant, because electricity is just the start.

Chapter Headings: Redefining the Electron Parts 2 and 3

Part 2: The Implications for Atomic Structure and Chemistry explores how the STEM approach impacts upon the atomic structure and the physical characteristics of elements in the Periodic Table, molecules and compounds; and how they interact chemically with each other. It provides an explanation of how the electrons and positrons are generated, and addresses beta and electron capture radiation.

Part 3: The Implications for EMR and Gravity provides explanations for the particle-wave nature of EMR, spectral line emission and absorption, the photo-electric effect, the Compton effect, plasma formation, electron pair generation and annihilation, Gravity and Gravity waves. Chapter heading for parts 2 and 3 are provided below.

Part 2

- Preons and Concentrated Energy Sources
- Quarks
- Nucleons and Nucleon Bonding
- Atomic Structure of the Elements of the Periodic Table
- Beta Decay and Electron Capture
- Ionisation and Chemical Compounds

Part 3

- Photons, Energy Transfer and Spectral Lines
- Light Refraction
- Constructive and Destructive Interference
- The Photoelectric Effect
- Electron-Positron Annihilation
- Semiconductors, P-N Junctions and Holes
- Plasma and Cosmic Radiation
- Spin and the Orbital Nuclear Model
- The Pull of Gravity
- Appendix: Micro and Radio Waves

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