DISPLACEMENT FIELD TECHNOLOGIES INC.

New Electrodynamics

Theoretical and Mathematical Description Including an in-depth Analysis of Relativistic Electric Fields and the Methods to Effect Motion

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The following document is a theoretical description of the devices that are being developed by Displacement Field Technologies Inc. This includes a mathematical and physical description of the theory behind the operation of these devices along with test data from these devices.

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The information disclosed herein is proprietary information, is owned by Richard Banduric, and is ***PATENTED***!

U.S. Patent No. 9,337,752 for "Interacting Complex Electric Fields and Static Electric Fields to Effect Motion" issued May 10, 2016.

Other patents are **Patent Pending** and **Unpublished** in the US, PCT and other countries.

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Preface

This document provides a complete description of how electric fields from electrically isolated charges, in relative motion, interact with each other. This includes a ***COMPLETE*** theoretical description and mathematical model used to describe these interactions. These interactions do not follow the rules of superposition that is ***erroneously*** applied today to these types of interactions. Instead, these interactions follow a subset of rules that is the source for the magnetic force that the magnetic field is used to describe.

This document gives an example of one type of implementation of these interactions to create the next generation of propellant-less propulsion device. This device uses the interaction of the electric fields from charged elements in relative motion to implement a spacecraft propulsion device.

All the information in this document is contained in patents filed with the US patent office and in other countries. The information that is in this document is a continuation of the material that was contained in these patents and previous documents. This document is to give the reader an in depth understanding of the principles and the mathematics behind these principles for the implementation of the Static Electric Displacement Field propulsion system.

The mathematical model used in this document is Maxwell's original complex quaternion or bi-quaternion and the reader should be able to understand the resulting mathematical derivations. The vector-based equations created by Oliver Heaviside that are known as Maxwell's equations are just special cases of these root complex-quaternion equations. These vector-based equations have presented an incomplete view to science of all of the types of interactions that are possible.

The reader is expected to be familiar with the complex quaternion and know how to derive the vector equations that are used today from there root complex quaternion. If the reader is an "Engineer/Physicist, or have a prefix of Dr. or suffix of PhD" who are accustomed to using abstract notations like tensors and they do not know the how to perform these derivations [that these tensors are based on], ***that is just plain stupid***.

This document will be describing the meaning of the terms in the resulting equations along with their derivations so that an understanding of the mathematical operations is not necessary to understand the results. It will be an advantage if the reader is not comfortable with the current mathematical framework used today.

In this document, the mathematical framework used today for electrical conduction currents is going to be shown to be invalid for electrical convection currents. The assumptions that today's mathematical framework have embedded in them will even be a hindrance to the reader if they are comfortable with the current mathematical methods that are used today to describe electromagnetic effects.

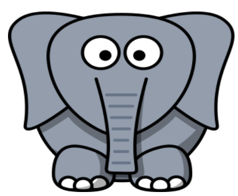
This document will present a theoretical background at the level that an electrical engineer or electronic technician will be able to understand in electrical engineering terms. The in-depth analysis of the data or theory is going to be done in this document. The emphasis in this document is going to be on going over what is wrong with today's mathematical framework. The correct mathematical model with supporting data is going to be in this document.

The implementation details of the described technologies are going to be in this document. **The devil is in the details.** The general understanding of electrical conduction currents is a major ***disadvantage*** to someone attempting to implement this technology.

The primary method to implement this breakthrough technology is by using ***electrical convection currents*** and not electrical conduction currents**.** The rules that an electrical engineer would use to layout electrical circuits with conductors are *invalid* when attempting to create relativistic electric fields from electrical convection currents.

The generalized assumptions that an electrical engineer would use today about electrical currents are also not valid for electrical convection currents. The materials used today for electrical conduction currents are also a major problem and a number of techniques to minimize their negative effects that will be in this document.

We are also taking great care and time to point out some minor little points that are somehow over looked by today's engineers and physicists. Plus, to make this document a little less dry and more fun to read we will be pointing these issues out with our friend the "Elephant in the Room"



The end result is that a PhD in science (physics) or engineering (electrical engineering) who is comfortable with the methods and concepts that are used today [*like the magnetic field*] is going to be more successful at implementing this technology than a garage tinkerer or backyard inventor. (**:-J**)

"I can state flatly that heavier than air flying machines are impossible."

***Source: Lord Kelvin*.**

"…We hope that Professor Langley will not put his substantial greatness as a scientist in further peril by continuing to waste his time and the money involved, in further airship experiments. Life is short, and he is capable of services to humanity incomparably greater than can be expected to result from trying to fly...For students and investigators of the Langley type there are more useful employments."

***Source: New York Times, December 10, 1903, editorial page*.**

"The proposals as outlined in your letter...have been carefully reviewed...While the Air Corps is deeply interested in the research work being carried out by your organization...it does not, at this time, feel justified in obligating further funds for basic jet propulsion research and experimentation..."

Source: Letter (excerpts) from Brig. Gen. George H. Brett, Chief of Materiel, U.S. Army Air Corps, to Robert H. Goddard rejecting his rocket research proposals (1941):

"That is the biggest fool thing we have ever done...The bomb will never go off, and I speak as an expert in explosives."

Source: Adm. William Leahy told President Truman in 1945

"The Galvanic Chain, Mathematically Worked Out" George Simon Ohm's theory of electricity was published in 1827 and called:

"A web of naked fancies."

Source: Hart, Ivor B. Makers of Science. London, Oxford University Press, 1923.

"The electroweak sector is very well understood. While the EW sector *does* couple to a scalar field (the Higgs), the photon does not. Furthermore, we can safely say that there isn't any new "longitudinal electromagnetic wave" stuff to be discovered, for the simple reason that this is essentially something you'd notice with the naked eye."

Source: https://forum.nasaspaceflight.com/index.php?topic=36909.0

Field Propulsion? **"Another Whacko!"** Scientists have proven that is impossible over 300 years ago, by Sir Isaac Newton. Newton laws third law states that for every action there is an equal and opposite reaction "."

Source: Science community …, 2012, 2013, 2014, 2015, 2016, 2017

For Newton’s 3rd law to be valid

Whenever one object exerts a force on a second object, the second object always exerts a force on the first. These two forces are equal in magnitude, are opposite in direction, ***and have the same nature.***

Newton's laws hold only with respect to a certain set of frames of reference called Newtonian or inertial reference frames. Some authors interpret the first law as defining what an inertial reference frame is from this point of view. The second law only holds when the observation is made from an inertial reference frame, and therefore the first law cannot be proved as a special case of the second. Other authors do treat the first law as a corollary of the second.[8][9]

The explicit concept of an inertial frame of reference was not developed until long after Newton's death.

This is thoroughly explained on the wiki link Newtons_laws_of_motion

This concept of “Newton third law only valid when the forces are of same nature” Is clearly spelled out in:

Minds on Physics: Interactions, Volume 2

By William J. Leonard, Robert J. Dufresne, William J. Gerace

- **Publisher:** Kendall Hunt Pub Co (January 1999)
- **Language:** English
- **ISBN-10:** 0787239291
- **ISBN-13:** 978-0787239299

Chapter 2 page R50

Chapter 2 Page 50 of “The Minds on Physics: Interactions Volume 2”

Maybe it is time for an update. It is the 21st century…

A lot has changed since the Newton’s time.

Background

Before 1905

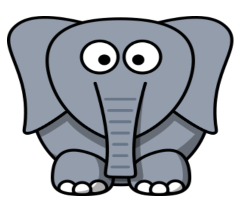
The current electromagnetic mathematical framework that is used today is Maxwell's equations. The four equations that make up the basis for this mathematical framework are below:

$$\nabla \cdot D = \rho \qquad \text{Gauss's law for electricity}$$
$$\nabla \cdot B = 0 \qquad \text{Gauss' law for magnetism}$$
$$\nabla \times E = -\frac{\partial B}{\partial t} \qquad \text{Faraday's law of induction}$$
$$\nabla \times H = J + \frac{\partial D}{\partial t} \quad \text{Ampere's law}$$

These equations are the reformulated equations from James Maxwell's original formulation of 20 equations. Even though these equations are known as "Maxwell's Equations", these equations are really the result of the work that Oliver Heaviside and Josiah Willard Gibbs of Harvard did to simplify the mathematical description that James Maxwell had used to unify electric and magnetic fields. The simplification done by Oliver Heaviside employed the curl and divergence operators of the vector calculus to reformulate 12 of these 20 equations into four equations in four variables (**B**, **E**, **J**, and ρ), the form by which they have been known ever since (see Maxwell's equations).

Less well known is that Heaviside's equations and Maxwell's equations are not exactly the same, and in fact, it is easier to modify the latter to make them compatible with quantum physics. That would have resulted in a unified mathematical framework instead of two incompatible mathematical frameworks known as QM (Quantum Mechanics) and GR (General relativity) that we have today.

Then there is one of our first elephants in the room. If this simplification of reformulated 12 of 20 equations to give us todays mathematical framework, ***what happened to the other eight equations?***



However, the reformulated equations by Oliver Heaviside and Josiah Gibbs did make it easier for electrical engineers to describe the forces from conduction currents. This reformulation of Maxwell's equations is possible by the application of the mathematical construct known as a gauge.

This reformulation produced a set of vector equations that correctly describe the forces from conductors and magnets. In addition, the mathematics of this framework was familiar to engineers and scientists and did not require using a more advanced mathematical framework.

James Maxwell, Peter Tait, and Sir William Hamilton all had advocated the use of complex quaternions to describe electrodynamics but they could never support the reasons as to why. This lead to the 'Vector Algebra Wars' of the 1890's between Hamilton and Josiah Willard Gibbs of Harvard for the correct mathematical framework to use for electromagnetics.

A quick history of the vector wars is the following link.

History of Vector Analysis

The formulation of these equations took place in the nineteenth century, starting from basic experimental observations, and leading to the formulations of numerous mathematical equations, notably by Charles-Augustin de Coulomb, Hans Christian Ørsted, Carl Friedrich Gauss, Jean-Baptiste Biot, Félix Savart, André-Marie Ampère, and Michael Faraday. The experimental observations produced the forces known as the magnetic force and the electric force. The equations that described these forces were representing these two forces as being mediated by independent fields.

The apparently disparate laws and phenomena of electricity and magnetism were integrated by James Clerk Maxwell, who published an early form of the equations, which modify Ampère's circuital law by introducing a displacement current term.

Maxwell added displacement current to the electric current term in Ampère's Circuital Law. In his 1865 paper A Dynamical Theory of the Electromagnetic Field Maxwell used this amended version of Ampère's Circuital Law to derive the electromagnetic wave equation.

James Maxwell derived a set of root equations that unified the magnetic field and the electric field thru the use the use of the mathematical construct of the complex quaternion. This set of root equations described all the forces that the empirically derived equations described. However, these root equations also predicted a number of other effects.

These root equations use the following potentials.

$$\Phi = \frac{Q}{4\pi\varepsilon_0 r} \text{ Volts} \qquad \vec{A} = \frac{\mu_0 \vec{I}}{4\pi} \text{ Volt Second/Meter} \tag{1}$$

The two equations that connected the electric field to the magnetic field are below.

$$\vec{E} = -\frac{\partial \vec{A}}{\partial t} - \vec{\nabla}\Phi \text{ Volt/meter} \tag{2}$$

$$\vec{B} = \vec{\nabla} \times \vec{A} \qquad \text{Volt} \cdot \text{Second/meter}^2 \text{ or Tesla} \tag{3}$$

These equations were the key to unifying the magnetic field and electric field and demonstrating that light was a form of electromagnetic radiation. From these two equations, all the vector based equations that Oliver Heaviside had created could be derived.

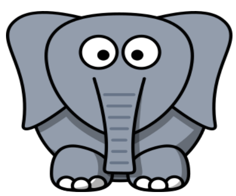
But these equations were based on potentials. Potentials were considered to be just mathematical constructs and not physical. It wasn't until the 1960's that the Aharonov-Bohm effect had demonstrated the physicality (the reality) of these potentials.

While these empirically derived equations described all the forces that were being observed from conductors, they were correctly describing these forces only if a complex set of rules and assumptions were followed. These rules included taking integrals over specific segments of an electronic circuit and not others to get a correct result. These assumptions included ignoring initial conditions of conduction currents and field representation differences between magnets and electric currents that even today is just glossed over.

Then there are the elephants in the room that no one ever resolves without a lot of hand waving.

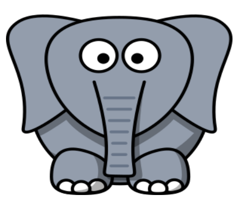
1. The first elephant was the **Displacement Current** and its associated field that James Maxwell created to tie things together. It is represented by:

$$\oint_C B \cdot dl = \mu_0 I_D \qquad (4)$$



2. The other elephant in the room that everyone pretends that it isn't there was the 3rd equation that James Maxwell's approach produced. This equation (5) is called the **Magnetic Scalar Equation**.

$$S = \frac{1}{c^2}\frac{\partial \Phi}{\partial t} + \vec{\nabla} \cdot \vec{A} \quad \text{Tesla or Volt sec/meter}^2 \qquad (5)$$



Displacement Current:

The idea of the displacement current was conceived by James Clerk Maxwell in his 1861 paper On Physical Lines of Force, Part III in connection with the displacement of electric particles in a dielectric medium. Maxwell added displacement current to the electric current term in Ampère's Circuital Law. In his 1865 paper A Dynamical Theory of the Electromagnetic Field Maxwell used this amended version of Ampère's Circuital Law to derive the electromagnetic wave equation.

This derivation is now generally accepted as a historical landmark in physics by virtue of uniting electricity, magnetism and optics into one single unified theory. The displacement current term is now seen as a crucial addition that completed Maxwell's equations and is necessary to explain many phenomena, most particularly the existence of electromagnetic waves.

Few topics in modern physics have caused as much confusion and misunderstanding as that of displacement current.[10] This is in part due to the fact that Maxwell used a sea of molecular vortices in his derivation, while modern textbooks operate on the basis that displacement current can exist in free space. Maxwell's derivation is unrelated to the modern day derivation for displacement current in the vacuum, which is based on consistency between Ampère's law for the magnetic field and the continuity equation for electric charge.

An example illustrating the need for the displacement current arises in connection with capacitors with no medium between the plates. Consider the charging capacitor. The capacitor is in a circuit that causes equal and opposite charges to appear on the left plate and the right plate, charging the capacitor and increasing the electric field between its plates. No actual charge is transported through the vacuum between its plates. Nonetheless, a magnetic field exists between the plates as though a current were present there as well. One explanation is that a **fictitious** ***displacement current*** I_D "flows" in the vacuum, and this current produces the magnetic field in the region between the plates according to Ampère's law:[3][4]

However, if your explanation to describe something is to create a ***fictitious*** item, then this should have flagged that there was something wrong with your worldview. If you have to make something up to describe something, then you missed something. Nevertheless, this ***common practice*** of making up stuff in physics to describe something that does not fit your worldview continues today.

Think **"Dark Matter"**.

Magnetic Scalar Equation:

The first problem with equation (5) was that this magnetic scalar equation was also a potential. In the 1880,'s the science community still believed in the material ether, and believed that only force fields were real and that potentials were just mathematical conveniences having no physical reality. Then there was Oliver Heaviside that gave us today's equations. For potentials, he stated that they should "***be murdered from the theory***".

Another problem was that while the electric potential is measurable, this new scalar was never physically measured. The electric potential had the units of volts and could be measured by counting charges or by the measuring the electric field that these charges produce.

In addition, no one was seeing the effects of this equation or the magnetic scalar potential in experiments using conductors or magnets. Yet we could create it mathematically. This potential was implying that we must have a new potential that produces an electric field. This potential would also be able to decouple from the electric charges that produce the electric and magnetic field. It was obvious to any mathematician that either physics did not have the root equations or that physics has missed something.

Nevertheless, this extra equation was complicating the solving of the other two equations. This extra equation was implying that there was a potential that was going to feed back onto the electric field and magnetic field equation in some way that no one understood. This was creating an unresolved term that made the exact solution for these equations unsolvable without a computer due to this unseen feedback. Since we could not measure it physically, there was no one needed to consider it when calculating the forces from conduction currents or magnets.

Plus, before 1905 the material dependencies that the electric conduction current or "$\vec{I}$" needed to produce the magnetic force that the magnetic field is based from was not resolved or understood and still isn't realized even today by most PhD's in electrical engineering or physics. Along with the ease, that someone could mathematically make this term go away by applying a gauge. Moreover, if you were observing the effects from this term it was so easy to make those effects to go away by **"Just Ground It"**.

Even today, when we observe the effects from this equation (5) from moving charged non-conducting surfaces, electric discharges, Ball lightning and ***advance propulsion systems***, these reports are discounted.

Then, there is the view that mathematical constructs, like the potentials and complex-quaternions that were producing this extra equation do not need to have a physical meaning. So, it was just too easy to rationalize the terms in this equation to be 0 even though no one had experimentally proven that these terms were actually "0". This was done with the application of gauge fixing (or by choosing a gauge) so that this equation could be made to go away. This operation ended up creating the Coulomb gauge and Lorentz gauge.

Yet, while in the software world leaving loose ends like uninitialized variables or unconnected interrupt vectors is considered sloppy at best. The physics world seems to be very happy with leaving loose ends, like extra equations and unsolved potentials, around with no real effort to resolve them.

After 1905

When in 1905, Albert Einstein's paper on relativity was published it explained the physical mechanism behind the magnetic forces that wires feel when conducting electric currents. Einstein's paper made it clear that charges in different inertial frames of reference will appear to have an apparent charge density increase due to the effects of Lorentz contraction. The effect of the apparent Lorentz contraction of the moving mobile electrons and fixed protons, when they are viewed from the others inertial frame of reference, is now accepted as the source of these magnetic forces. This allows a conductor with an electrical conduction current flowing in it to be charged in one inertial frame of reference and neutral in another.

The magnetic force is really just the interactions of the electric fields from the negative moving charges modified by the effects of relativity and the positive charges physically coupled in a stationary conductor. There was not a separate field mediating the magnetic force from the electric field. The magnetic force was now just the interactions of electric fields from charges in different inertial reference frames in a conductor or magnet.

The mathematics for electromagnetics that describes two separate primary fields to describe the electric force and a separate magnetic force was incomplete. The first crack in this view was when James Maxwell unified these fields and there were unexplained "extra terms". Then when Einstein solved the reason for this unification was dependent on the properties of a conductor, a major rewrite was needed.

While using this mathematical framework to describe the effects from conductors and modern electric circuits based on copper conductors was very adequate for an Electrical Engineer. However, this mathematical description is based on the wrong assumptions and it was now obvious that the physics community needed something else.

This new information should have started a major rewrite of the mathematical framework used in physics to describe the electric fields of charges in different inertial frames of references. The mathematical description needed to describe electric fields in different inertial frames of references interacting with each other mediated by the material that the charges resided in.

These electric fields in different inertial reference frames would ***NOT*** follow the rules of superposition that static electric fields follow. Then these interactions would have a separate set of rules to follow. These new rules would define a mathematical framework that supports a description of a magnetic field as a special case for conductors, semiconductors and magnets.

However, did not happen!

Instead, we kept the magnetic field and defined its units as:

The SI unit of magnetic flux (flow) density (magnetic induction). The magnetic flux density of a uniform field that produces a torque of 1 newton- meter on a plane **current loop carrying 1 ampere** and having projected area of 1 square meter on the plane perpendicular to the field. (T = N/A m).

1st question that someone should have asked was is that "current loop" a Copper Wire, Graphene Ribbon, or Nichrome Tube or some other material that have radically different drift velocities and geometries as such experience much different forces from one ampere of current flowing thru them. Then what about the wires shape, flat or round? On the other hand, what about the sources for these wires, are they coupled or not and to what?

This one historical event has colored our view of the forces in nature that still has not been resolved today.

Instead, physics create new ways to mathematically describe and represent the forces from electric currents flowing thru copper conductors using mathematical abstractions like the electromagnetic tensor that form the basis for the special **unitary group**s SU (1), SU (2), and SU (3) used in electromagnetics.

The Electromagnetic Tensor and the SU (2) group

$$\begin{bmatrix} 0 & -E_x/c & -E_y/c & -E_z/c \\ E_x/c & 0 & -B_z & B_y \\ E_y/c & B_z & 0 & -B_z \\ E_z/c & -B_y & B_x & 0 \end{bmatrix} = F^{\mu\nu} \begin{bmatrix} 0 & E_x/c & E_y/c & E_z/c \\ -E_x/c & 0 & -B_z & B_y \\ -E_y/c & B_z & 0 & -B_z \\ -E_z/c & -B_y & B_x & 0 \end{bmatrix} = F_{\mu\nu}$$

$$E_i = cF_{0i}$$

$$B_i = -\frac{1}{2}\varepsilon_{ijk}F^{jk}$$

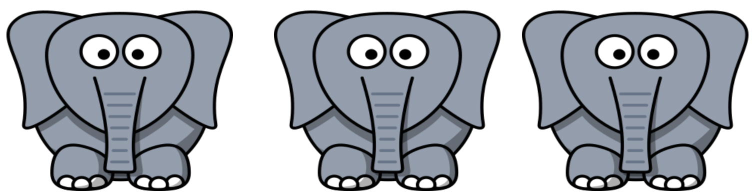
E = Electric Field Vector

B = Magnetic Field Vector

No seems to notice that by incorporating the magnetic field into our tensor that we now have a mathematical descriptor that is a special case mediated from the forces observed from the properties of a material. This took a complex set of interactions of electric fields created in different inertial frames of references and created a mathematical description that described a small subset of forces that a copper conductor produces. This ends up hiding the true reality of what is going on from these interactions that now colors our view of electrodynamics.

We call that coloring of our worldview of these interactions of electric fields "***Electromagnetics***".

Couple of Elephants in the Room so far:



The Potentials

Today the science and engineering community exclusively uses the Heaviside-Gibbs vector system of equations that described the forces from copper conductors to describe electromagnetic forces. However, the use of complex quaternions or Clifford algebras is steadily appearing in many fields of engineering and physics. Nevertheless, the Heaviside-Gibbs vector system of equations still colors today's worldview by the assumptions that these equations are based on.

The two potentials that unified the Heaviside-Gibbs vector systems of equations are below.

Electric Potential Magnetic Vector Potential

$$V = \frac{Q}{4\pi\varepsilon_0 r} \text{ Volts} \qquad \text{and} \qquad \vec{A} = \frac{\mu_0 \vec{I}}{4\pi} \text{ Volt Second/Meter}$$

This results in one primary potential "Volts" that is a scalar based on a spherical point electric charge in one inertial reference frame. This potential is measurable from its electric field or by the electric current that flows in a conductor from the potential difference. The electric field from this potential is different depending on the charge-holding object. A charge-holding object like a conductor will have the same potential throughout the conductor if there is no current flowing thru it. If the charge-holding object is, a non-conductor that does not allow the charge to migrate in response to an electric field, the potential observed from the object can change depending on its shape or interactions with other electric charges.

The electric fields from separated electric charges in the same inertial reference frame follow the rules of superposition. The rules of superposition allow the electric field intensities from separate charges to be summed together using vector calculus. *The constant ε_0 used in this potential implies that the medium that the universe can be polarized to an inertial reference frame, like a stationary dielectric with a dielectric constant of one.*

Then other potential, the "Magnetic Vector Potential" is a vector. By being a vector, it is also coupled to an inertial reference frame. In addition, it has a direction. Nevertheless, this potential only follows the rules of superposition from magnetic vector potentials created from the same inertial reference frame or thru some sort of physical coupling like a wire conductor.

Yet this Magnetic Vector Potential is not directly physically measured. This potential was first indirectly observed in the 1960s as the Aharonov-Bohm effect. Even then, this potential is being derived from the same equations that were defined from the magnetic force. These magnetic forces are from the interactions of two different primary electric potentials that are in two different inertial frames of references thru the properties of copper wires.

Then there are the assumptions that the symbols of this equation have built into it like, $\vec{I}$ that implies that any electric current will create a Magnetic Vector Potential whether $\vec{I}$ is a convection electric current or a conduction electric current in a wire.

These potentials create different effects from two very different types of interactions. These differences give us much different types of interactions that are dependent on a number of factors from the types of materials that the charges are in to the coupling that the charges have. Today's vector equations just describe a small subset of uncoupled forces that is restricted by the properties of the materials and the inertial reference frames that the forces originate that could be harnessed.

Electric Potential

Charge **(Q)** is a physical quantity in one inertial frame of reference the stationary one. This equation is dividing the charge by $4\pi\varepsilon_0$. This creates a structure description based on a sphere that has one parameter charge. The size of the sphere is not a major factor since as the size of the sphere increases the electric field intensity decreases. Nevertheless, this equation is restricting the charge to be a point source. However, in reality our charges are not point sources. The positive charge is about 1000 times larger than our negative charge and the positive charge is not mobile while the negative charges are mobile in a conductor. These differences give us the all sorts of effects and decoupled forces that are written out of our current set of vector equations.

Magnetic Vector Potential

Electric current **(I)** is the amount of negative charge **(Q)** moving thru a fixed physical structure of positive charge every second. Current is a multi-parameter structure with four parameters.

1. Velocity difference of the two different charges in a wire conductor
2. Charge mobility differences of the wire conductor
3. 2-Dimensional Structure or Shape of the physical object that the current is flowing thru
    a. X axis of plane that is perpendicular to the current flow
    b. Y axis of plane that is perpendicular to the current flow
4. The 3-dimensional charge density of the different charges in the physical object

This structure has a scalar element (Charge), a vector element (Velocity differences), an area element that the charge is flowing thru and a charged density element that could have multi parameters. This equation is dividing the charge by 4π. This creates a structure description that is described by a cylinder that reduces parameter 3 to one parameter. The size of the cylinder is ***assumed*** to not be a factor in this potential since as the size of the cylinder increases, the field intensity decreases for a particular current.

Charge flowing thru an circular plane is reduced to a scalar known as amperes. This value can be the same for less charge flowing at a higher speed thru that point or it can be more charge flowing at a slower speed thru that point. These infinite numbers of combinations of speed and charge, but today these combinations are represented by a scalar with the units of Amperes.

https://en.wikipedia.org/wiki/Ampere

Ampère's force law states that there is an attractive or repulsive force between two parallel wires carrying an electric current. ***This force is used in the formal definition of the ampere***, which states that the ampere is the constant current that will produce an attractive force of 2×10^{-7} newtons per metre of length between two straight, parallel conductors of infinite length and negligible circular cross section placed one metre apart in a vacuum.[2][10]

The SI unit of charge, the coulomb, "is the quantity of electricity carried in 1 second by a current of 1 ampere".[11] Conversely, a current of one ampere is one coulomb of charge going past a given point per second:

$$1A = 1\frac{C}{S}$$

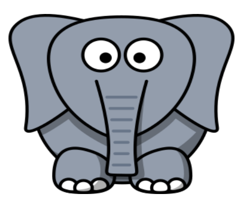
In general, charge *Q* is determined by steady current *I* flowing for a time *t* as *Q* = *It*.

The ampere is defined from the force that it produces from an incomplete physical description. The force that two conductors will experience is going to be different depending on the drift velocity of the charges that compose the electric current.

If these conductors are made of copper or graphene, the drift velocities will be drastically different and will experience different forces between these conductors when one coulomb of charge flows thru these conductors made of these different materials.

Do we now have another elephant in the room? We have a description of current that now is just one scalar with the units of "amperes" that creates a force from wire conductors with the units of Newton's that is based on assumed assumptions. The magnetic vector potential is derived from this one scalar.

So now, today we have turned a complex multi term description into a scalar that is dependent on a material and the direction that the charge is flowing in the material. Do we have another ***BIG*** elephant in the room that no even thinks is even there?



If the conductor was made of graphene, which has a higher drift velocity for the moving negative charge, the force from one ampere flowing thru the conductor is now going to be different.

$\varepsilon_0 = \dfrac{1}{\mu_0 c^2}$ $\mu_0 = \dfrac{1}{\varepsilon_0 c^2}$ The relation relates these two equations $c = \dfrac{1}{\sqrt{\mu_0 \varepsilon_0}}$

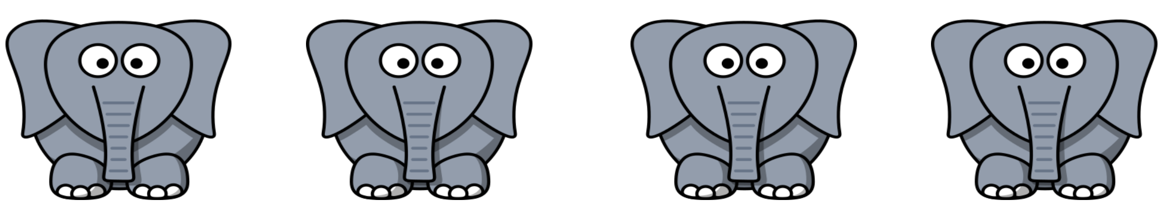
The constant ε_0 is a constant that is derived from the measurements of the forces generated by static electric charges. The constant μ_0 is a constant that is measured from the forces created from electric currents flowing thru ***COPPER*** conductors. These relations have worked fine for electric currents flowing thru ***COPPER*** **wire conductors**. However, when we use this constant for other types of electric currents in different substances we end up with the wrong values and the wrong assumptions on how these materials react to electric currents.

This ends up creates a set of mathematical representations that have one constant that is based on the properties of the universe and another that is based on the properties of round long thin wire copper conductor. The electric field is the primary field that is defined from a constant that is independent of matter and another pseudo field [known as the magnetic field] that is based on the properties of matter that integrates these attributes into modern day field descriptions. This resulted in a set of mathematical representations that hid Maxwell's "extra terms" and thus writing out the complete set of forces that can be harnessed.

The perception that science had before 1905 was that a magnetic field is created from any moving charge was not correct anymore. ***Only materials/objects that have charges in different inertial frames of references in the same physical object will produce a magnetic force that can be mathematically described by a magnetic field.*** Yet, this is one of incorrect generalizations about electric currents that science had before 1905 that is still being taught today as correct. Examples of materials that can have moving charges in different inertial frames of references and generate a magnetic field include conductors, semiconductors, magnets, and neutral plasmas. Examples of moving charges that have all their charges in the same inertial frames of references as such **can't generate a magnetic field** or magnetic force are beams of electrons, protons, ions or moving charged objects (including rotating charged disks). These examples of moving charges are still affected by magnetic fields from electric currents in conductors, magnets, even though they **do not generate** a magnetic field.

However, no one seems to notice…

Nevertheless, we now seem to have a nice little parade of elephants in the room.



Physically Coupled Charges

The simple representation of an uncharged conductor

The following figure 1 is a representation of a copper conductor with no electric current flowing through it. “X” is the average apparent distance between the positive ions and “Y” is the average apparent distance between negative electrons. In this case, “X” is equal to “Y’ so that the conductor is electrically neutral in all inertial frames of references.

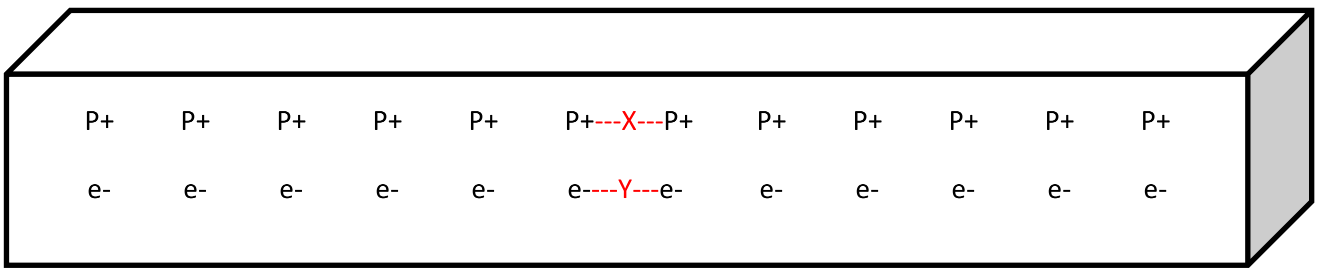


Figure 1

A more in depth analysis of an uncharged conductor

In reality, the charges are coupled to the physical structure of the conductor differently. The positive charges in a conductor are fixed to the molecular matrix and cannot move. Most of the electrons are tightly coupled to the protons and cannot move around except for the conduction electrons.

The number and availability of these conduction electrons is different for different materials. Copper has one electron per atom available for conduction. The free electron concentration in copper is equal to 8.5 × 10^{28} per m^3. These electrons will be moving in random directions at an average speed of 1 x 10^5 m/s over a distance of .4 nm.

Comparing these numbers to the average drift velocity of an electric current in copper that is in the range of 1 x 10^{-4} m/s to 1 x 10^{-5} m/s we might have to take into consideration the randomly moving electrons.

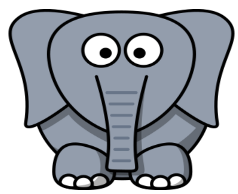
In addition, these electrons now have an acceleration component to get to the average velocity of 1 x 10^5 m/s that seems to be missing from our mathematical descriptions. Could be important?

The first thing that we have to take into consideration is that these moving electrons electric fields are going to have an electric field that is going to be different than if they were stationary. This is due to the effect of the Lorentz contraction of the negative charges due to the relative average random motion of the negative electrons compared to the stationary positive ions.

The direction is not going to be important in a copper conductor, just that the moving electrons when viewed perpendicular to their motion, we will see their electric fields increase. This will tend to push a small number of electrons to the outside of the conductor to keep the electric field inside the conductor at zero. When the number of mobile electrons are equal to the positive ions in the conductor the conductor has a slight negative charge from the electrons motions.

A copper conductor should normally have a negative charge. That is until the conductor makes contact with another conductor that has a connection to ground that allows some of these electrons to go to ground that allows the conductor to be neutral.

Another elephant that is in the room that no one mentions is that conductive materials will have a history that is not taken into account today.



When this conductor is connected to an almost infinite source/sink for electrons like the earth (a conductive sphere with a circumference of about 25000 Miles) some of these electrons will flow to the ground leaving the conductor slightly deficit of electrons as compared to the positive ions to create a material with no electric charge. This conductor now has a history that effects how it will react to electric fields in the present, which is not being taken into account in our current mathematical framework.

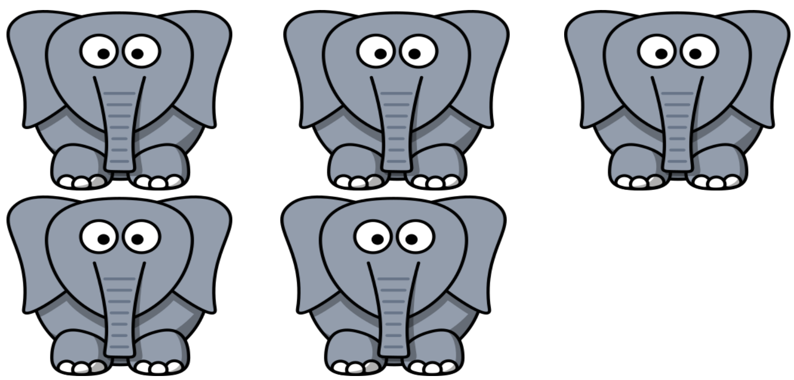
This would be different as compared to an uncharged insulator with its electrons and positive ions coupled in the atoms or surface structure and are not able to move off the insulator or around in the insulator.

These differences require us to use a different set of equations for a charged and uncharged insulator as compared to a charged and uncharged conductor or moving isolated electric charge.

Therefore, we have to mathematically model a charged insulator differently than a charged conductor. In addition, different types of conductors like copper, silver, nickel, chrome, graphene, and nichrome will have different characteristics. These differences include a different number of free electrons, electron speeds, time to collision, drift velocity, and many other parameters that will not allow these materials to modeled the same mathematically as a copper conductor. We also now have to take into account the shape of the conductor and insulator differently. ***Something that we do not do today.***

The conductor also has electric charges connected to the charge-holding object that is different from the charges on/in a charged insulator. In an insulator, the negative and positive charges are physically/chemically connected (a.k.a. coupled) to the charged object. The conductor has only the positive charges physically/chemically connected/coupled to the charged object. The negative charges are mobile and are only connected or coupled to the charged object thru the physical shape of the conductor.

This allows the negative charges to migrate around in the conductor to the effects of an external or internal electric field to keep the electric field at zero inside the conductor. A charged insulator will not allow the charge on it to move in response to an electric field. Instead, the entire charge element has to move to the electric field differences.



The simple representation of two uncharged conductors flowing an electric current.

Figure 2 is a representation of two copper conductors in the stationary frame of reference with a negative electric current flowing through it to the right. "X" is the average apparent distance between the positive ions and "Y" is the average apparent distance between the negative electrons when viewed from the stationary frame of reference. In this case, "X" is greater than "Y" so that the conductor is not electrically neutral in all inertial frames of references. This is the result of the effect of Lorentz contraction of the negative charges due to the relative average motion of the negative electrons compared to the positive ions.

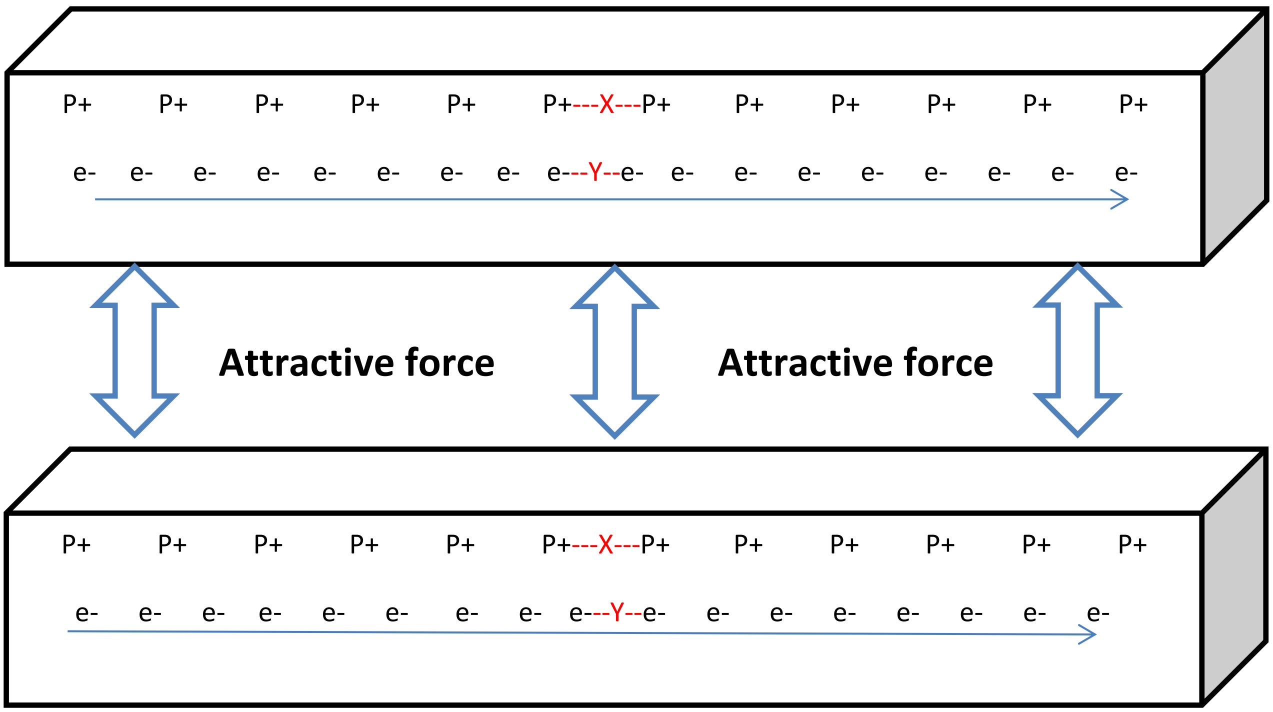
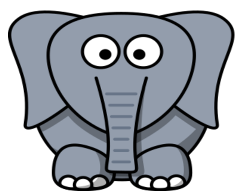


Figure 2

In the stationary frame of reference, the positive ions in both conductors now see an increase in the negative charge in the other conductor. This is from the apparent increase in the density of the negative electrons from their apparent Lorentz contraction. This effect is also seen in the moving frame of reference from the electrons perspective. From the perspective of the electrons, the positive ions appear to be moving to the left and are seen to have an apparent increase in the density of their positive charge from their apparent Lorentz contraction.

This results in a magnetic force between the wires that is mathematically represented as being mediated by a separate field known as the magnetic field. While this mathematical abstraction is great to describe the forces that an engineer would observe. It is inadequate to describe all the forces observed from charges in relative motion. Yet, today this mathematical abstraction is now indiscriminately used by laymen to physics PhDs for everything from plasma flows to isolated charged particles and even moving charged objects including planets and stars.

In reality, the attractive force is the interaction between the electric fields from the positive charges and the relativistic electric fields seen by the charges in two different inertial frames of reference **in the same physical object**. The attractive force is ***not*** mediated by a separate field that is known as the magnetic field. Instead, what is observed is just the interaction of electric fields from charges in different reference frames contained in a wire.



In addition, there is this new elephant in the room that everyone who describes magnetic forces between wires just kind of glosses over. If the total electric field from a wire with some electric current increases from the stationary frame of reference, then our wire now has a negative charge with a negative electric field from it. However, from the inertial frame of reference of the moving electric charges a positive electric field is observed.

If this stationary wire has an electrically isolated battery or electrostatic power supply to supply, the voltage that causes a current to flow this system will now give the system a negative electric charge from the stationary frame of reference. That is unless the voltage source is a modern power supply that has a connection to ground thru the transformer or ground connection that allows some of the charge to flow off this system to keep it neutral in the stationary reference frame.

Did we miss something?

The electric field that we see from this system now has a different set of electric fields and forces if we **DO NOT** ground it as compared to this system with a conductive path to ground. Nevertheless, what if we ground the wire and then remove the ground before we apply power to the wire from an isolated battery, we will observe one set of electric fields. On the other hand, we could ground it while an isolated battery powered the wire and remove the ground and then remove the power we now have a wire with a different electric field from it than the wire had before we powered it.

Maybe???

Isn't this the second time that we see that this conductive sphere, with a circumference of 25000 miles, is necessary to make our current mathematical framework called "Electromagnetics" work, right?

A more in depth representation of two uncharged conductors flowing an electric current.

In reality, this is close to what is happening as long we do not think about it...

We now have two descriptions for an electric current in a conductor. One description has the conductor that has never touched our conductive sphere and is powered by sources that do not have a connection to this sphere. Then another couple of other descriptions that is in some way has been or is connected to this conductive sphere.

We still have two different charges in two different inertial frames of reference (the charges are in relative motion and the ones that are stationary) that now have different electric fields that are interacting with each other. We also have the charges that are coupled by the physical wire that is based in the stationary frame of reference.

If these electric charges and their electric fields were in the same inertial reference frame the rules of superposition of electric fields would apply to the electric fields. Nevertheless, when they are in different inertial reference frames the electric fields are modified by relative motion. The rules of superposition for these differences in the electric fields will not apply any more.

That is unless there is a physical connection between the charges then a subset of the rules of superposition applies depending on the physical characteristics of the physical object that connects the charges. The reason is that in one inertial reference frame the electric field observed by another electric field from a charge in a different inertial reference frame isn't necessarily the same as that the electric field observed by the charge in the different inertial reference from the charge in the other inertial reference frame. That is unless they are physically coupled.

This gives us the magnetic force when an electric current is flowing thru a wire conductor. **NOT some separate magnetic field from the electric field**. What makes these interactions look like a separate field is the fact that electric fields from charges in different inertial reference frames do not follow the same rules of superposition that static electric fields would follow.

Today the electric field from an electric current flowing thru a conductor with a zero or low resistance is assumed to be zero due to the interactions of the electric fields of the positive and moving negative charges adding up to 0 from the rule of superposition. The question someone forgot to ask was:

When is this assumption valid?

1. When there is an electric current flowing thru a conductor and the conductor has a connection with our earth. This gives the conductor a connection to a reference that its electric field can be measured against. This also allows the electric charge to migrate between ground and the wire to stay neutral.
2. When the power supply that is providing the charge, has some resistance between the outputs as a modern power supply has.
3. The charges in the conductors are made of the same materials that are flowing in the same pattern and have the same velocity difference between the charges in the materials.

So, if these conditions are met (which usually with today's technologies) the standard equations that we use to calculate forces between forces from conduction currents shown below is usually a good approximation.

$$\vec{B} = \vec{\nabla} \times \vec{A} \quad \text{Tesla}$$

$$\vec{B} = \frac{\mu_0 I_1}{2\pi r} \quad \text{Tesla}$$

The force between 2 wires flowing 2 currents I_1 I_2:

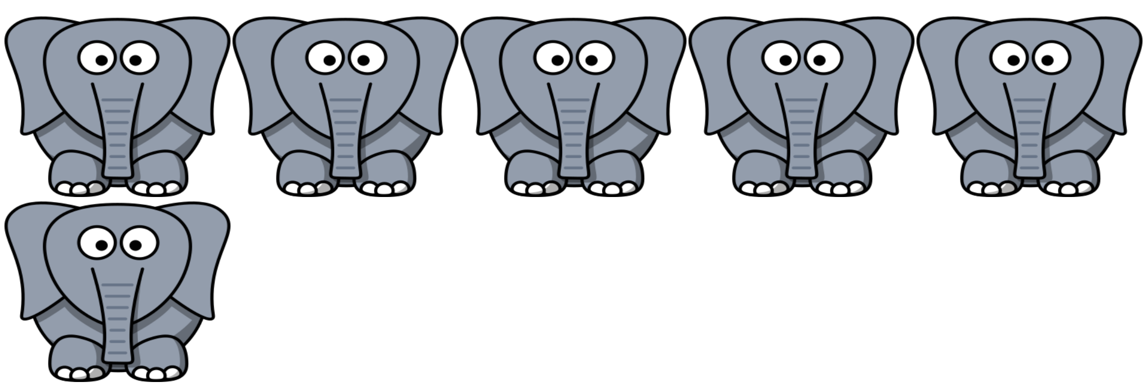
$$F = \frac{\mu_0 I_1 I_2}{2\pi r}$$

Now that we know that the magnetic field is really a mathematical abstraction and not a real field, are these equations going to be adequate to describe all the forces that we can exploit?

Nope!

Therefore, to exploit all these electric field interactions we must have a set of equations that are going to describe how these electric fields interact to calculate these new forces.

However, we do not have any equations that describe these interactions…



Today's representation of a two particle beams moving to the right forming an electric "*CONVECTION*" current.

Figure 3 is a representation of two electron beams in the stationary frame of reference that represent a negative electric ***convection current*** flowing to the right. "Y" is the average apparent distance between negative electrons in the stationary frame of reference. In the stationary frame of reference the two electron beams have an electric field that is slightly greater than the electric field that they would have if they were stationary (when viewed perpendicular to their direction of motion in the stationary frame of reference).

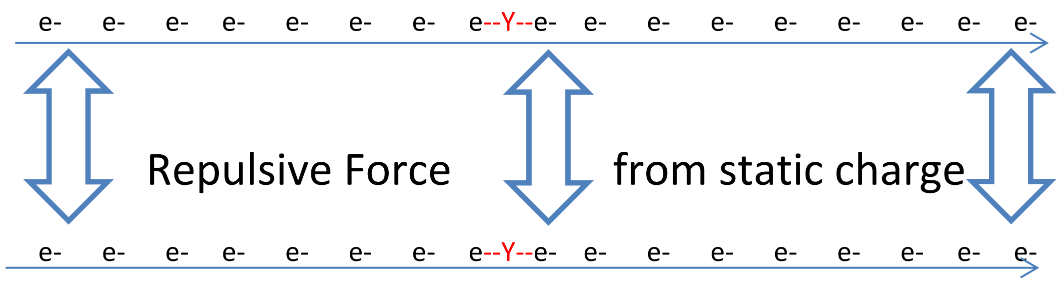


Figure 3

Today the first glance that someone would assume is that we have two electric currents that create a magnetic field that would cause these electric currents to attract each other as shown by the following equations:

$$\vec{B} = \vec{\nabla} \times \vec{A} \quad \text{Tesla}$$

$$\vec{B} = \frac{\mu_0 I_1}{2\pi r} \quad \text{Tesla}$$

The force two electric currents I_1 I_2:

$$F = \frac{\mu_0 I_1 I_2}{2\pi r}$$

These two beams of electrons could be two beams of protons or two plasma filaments from the sun or two charged moving insulated wires or two-charged moving wire conductors. These are all examples that have just one type of charge in a different inertial reference frame that are not physically coupled to the stationary frame of reference. If you actually measure the magnetic field from these types of convection currents, you measure nothing. If there were just a magnetic field producing a magnetic force, then these currents would converge into one beam. In reality, they diverge.

Then someone could use the Lorentz Force Law for each of the individual charges or on an external negative charge:

$$F_{External} = q\vec{E} + q\vec{v} \times \vec{B}$$

From the charges, inertial reference frame, "$\vec{v}$" is zero for all the charges so the filament charges will only observe the static electric fields from the other filament. However, this equation now predicts that a negative charge in the stationary reference frame will observe a magnetic field from these two filament streams that will be attractive on the stationary charges. That would not give us the correct result. Of course, the response today would be you use a different set of equations for different conditions. That should have hinted that there is something wrong with these equations if you have to do a lot of hand waving and special conditions to mathematically describe something.

So then, someone would take into account the electrostatic fields from the negative charges and then calculate the total forces on these beams from the electric force and then the magnetic force from these beams. The electric force on an external negative charge is:

$$F_{External} = 2\left[\frac{l_{stream}}{2\pi\varepsilon_0 r}\right]$$

Then we would also have a magnetic force described from the following equation:

$$F_{External} = \frac{\mu_0 \left(\lambda \nu\right)^2}{2\pi r}$$

The electrostatic force is repulsive and the magnetic force is attractive so the equations for the force would be:

$$F_{External} = \frac{4l_{stream}}{4\pi\varepsilon_0 r} - \frac{\mu_0 \left(\lambda \nu\right)^2}{2\pi r}$$

Both of these views are wrong. We do not see any attractive force between these electron beams. In addition, we do not observe any magnetic force between these beams and an external stationary force. This equation implies that if the beams are moving at the speed of light then the attractive force would be equal the attractive force and then the beams would observe no force between the two beams.

If the moving electric charge is replaced by moving charged wires, we do not see any attractive force between these moving charged wires either. Even if one of the beams is replaced with a stationary wire with an electric current, the electron beam will observe a magnetic force that is ½ the force that would be observed if both beams were replaced by wires with an equal electric current.

If an external negative stationary charge were to observe the electric fields from these two electron beams, the stationary charge would see a repulsive force that would be greater than if these electron beams were stationary.

$$\overrightarrow{F}_{Total} = \overrightarrow{F}_{Static} + \overrightarrow{F}_{relative\_motion}$$

The external negative stationary charge would not feel a magnetic force from the magnetic field from these beams. Even a moving external negative stationary charge would not feel a magnetic force from the magnetic field from these beams.

Instead, we could use an equation that represented the forces on these filament currents or to an external charge from the motion of the electric charges in the filament current without a magnetic field. The electric fields from the individual electric charges would increase by the following equation.

$$\vec{E}_{Static} = -\nabla\Phi$$

$$\vec{E}_{Velocity} = -\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$$

$$\vec{E}_{Total} = \vec{E}_{Static} + \vec{E}_{Velocity}$$

$$\vec{E}_{Total} = -\nabla\Phi \; -\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$$

Then from these equations, we could calculate the forces that would always be different depending on the inertial reference frames that these electric fields are viewed. Then if these charges are contained in a conductor or some sort shaped physical container, these equations would be mathematically coupled by the physical attributes of the physical container or conductor.

Then one set of equations would be used for all these conditions without a lot of fudging to get the physical reality to match the results of the equations. The equations that are known as Maxwell’s equations bring about all sorts of problems that are not really problems. An example is shown below.

Einstein's 1905 paper that introduced the world to relativity opens with a description of the magnet/conductor problem.[1]

It is known that Maxwell's electrodynamics – as usually understood now – when applied to moving bodies, leads to asymmetries that do not appear to be inherent in the phenomena. Take, for example, the reciprocal electrodynamic action of a magnet and a conductor. The observable phenomenon here depends only on the relative motion of the conductor and the magnet, whereas either the customary view draws a sharp distinction between the two cases in which the one or the other of these bodies is in motion. For if the magnet is in motion and the conductor at rest, there arises in the neighborhood of the magnet an electric field with a certain definite energy, producing a current at the places where parts of the conductor are situated. However, if the magnet is stationary and the conductor in motion, no electric field arises in the neighborhood of the magnet. In the conductor, however, we find an electromotive force, to which in itself there is no corresponding energy, but which gives rise – assuming equality of relative motion in the two cases discussed – to electric currents of the same path and intensity as those produced by the electric forces in the former case.

— A. Einstein, On the electrodynamics of moving bodies (1905)

Then to tie everything together the follow explanation is used.

Instead, an alternative unification of descriptions is to think of the physical entity as the electromagnetic field tensor, as described on page 16. This tensor contains both **E** and **B** fields as components, and has the same form in all frames of reference. This obtains the same form in all frames of reference by the physical coupling that the charges in different inertial reference frames have inside a wire or magnet.

To repeat as to what is wrong for those who still do not get it.

This obtains the ***same form in all frames of reference by the physical coupling that the charges in different inertial reference frames have inside*** a wire or magnet.

This is a good example of:

While we can have described all the forces that were being observed from conductors with electric currents, they were only correctly describing these forces only if a complex set of rules and assumptions were followed. Along with a lot of hand waving…

Figure 4 is the view of the electrons in the electron beams inertial frame of reference from Figure 3. In the electrons, inertial frame of reference, they are unaware that they are moving so the electron beams see only their static electric fields. This is because there is no apparent contraction of the distance between the individual electrons when the two electron beams are in the same inertial frame of reference. Again, the two electron beams now see only an electrostatic repulsive force from the negative charges. The beams observe no attractive force between these beams from there “magnetic field” as they would see if charges were moving in a conductor. Our external stationary charge does not observe any magnetic force either.

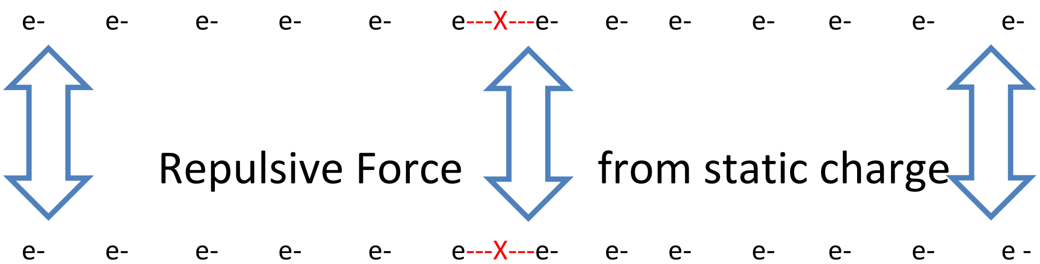


Figure 4

In addition, if the external charge were in moving at the same velocity and direction as the beams, it would not observe any magnetic force from the magnetic fields from the electron beams. Instead, the external charge would observe just an electrostatic force.

$$\vec{F}_{Total} = \vec{F}_{Static}$$

If a negative stationary charge were observed by these charges, the charges would observe the stationary charge to be moving to the left. The electric fields from these two electron beams, it would see a repulsive force that would be greater from the stationary electric charge than if the stationary electric charge was moving at the same velocity as these two beams.

The force on these electron beams from the stationary electric charge would be correctly mathematically represented by:

$$\vec{F}_{Total} = \vec{F}_{Static} + \vec{F}_{Motion}$$

However, not by this equation:

$$F_{External} = q\vec{E} + q\vec{v} \times \vec{B}$$

Unless there was a wire conductor or magnet, included in our example, then this equation would be correct.

Figure 5 is a representation of two electron beams in the stationary frame of reference that represent a negative electric current flowing to the right and a negative current flowing to the left. "Y" is the average apparent distance between the negative electrons in the stationary frame of reference. "Y" is the same for both beams since the velocity of these electrons in these beams is equal but in opposite directions when viewed from the stationary frame of reference. In the stationary frame of reference, the two electron beams have an electric field that is slightly greater than the electric field that they would have if they were stationary. This is the result of the apparent increase in the electron density from the Lorentz contracted distance between the electrons. Again, there are no magnetic fields generated from these two electric ***convection currents***. Just a new ***complex electric field***.

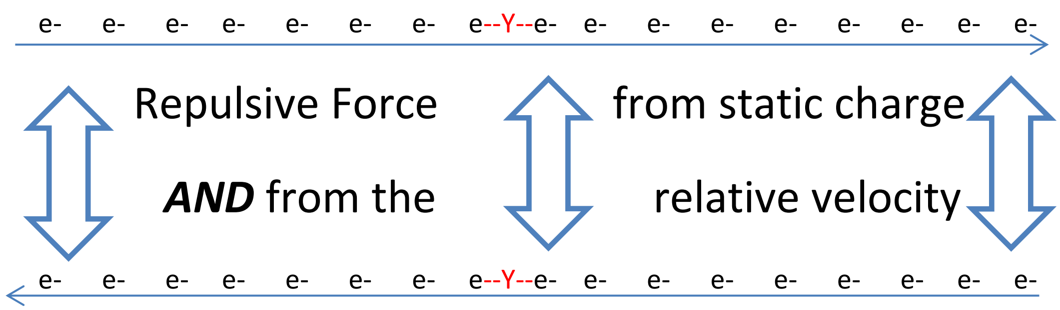


Figure 5

If a negative stationary charge were to observe the electric fields, from these two electron beams, it would see a repulsive force that would be greater than if these electron beams were stationary.

$$\vec{F}_{Total} = \vec{F}_{Static} + \overleftarrow{F}_{left\_motion} + \vec{F}_{right\_motion}$$

The direction of the electron beams is irrelevant and could be from the left or from the right and the force increase on a stationary charge would be the same.

The force that the negative moving electric charges would observe would correctly mathematically represented by:

$$\vec{F}_{Total} = \vec{F}_{Static} + \vec{F}_{relative\_motion}$$

However, not by this equation:

$$F_{External} = q\vec{E} + q\vec{v} \times \vec{B}$$

Unless there was a wire conductor or magnet, included in our example, then this equation would be correct.

Figure 6 is a representation of the of two electron beams from the inertial frame of reference of the top electron beam. "X" is the average apparent distance between negative electrons in the top beams frame of reference, which is now greater than "Z" the apparent distance between the electrons in the bottom beam. This is because there is no contraction of the distance between the individual electrons in top electron beam when viewed from its own inertial frame of reference. However, the bottom electron beam now has a velocity that is 2 times the velocity that is observed in the stationary frame of reference. This results in the apparent Lorentz contracted distance between the electrons in the lower beam to be twice as much as in the stationary frame of reference. This increases the relativistic electric field component that is observed by the top electron beam by a factor of two from the increase that is seen in the stationary frame of reference. Thus, the increase in the force from the interaction of the top electron beams static electric field and the relativistic electric field component from the bottom electron beam is greater by a factor of two.

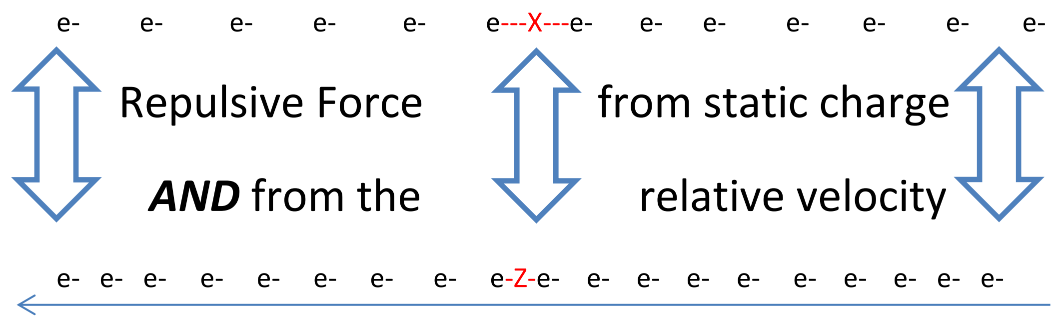


Figure 6

The force on these electron beams and on the stationary electric charge would be correctly mathematically represented by:

$$\vec{F}_{Top\_Beam} = \vec{F}_{Static} + \vec{F}_{Motion\_of\_Bottom\_Beam} \qquad \vec{F}_{Stattionary\_Charge} = \vec{F}_{left\_motion} + \vec{F}_{Right\_motion}$$

This example can be reversed, where we use the bottom electrons beam frame of reference and we see that both the top electron beam and the bottom electron beam see a greater repulsive force from the other beams Lorentz contracted electric field with their own static electric field. The force that they see is twice as much from the relativistic electric field component of the complex electric field that would be observed in the stationary frame of reference.

This would not be correctly represented by the same mathematical representation that would be used today of:

$$\vec{F}_{Total} = +\vec{\nabla}\Phi - Q_{Ext}\vec{u}\times\vec{B}(\rho) \quad \textbf{Or} \quad \vec{F}_{Total} = \frac{4l_{stream}}{4\pi\varepsilon_0 r} - \frac{\mu_0(\lambda v)^2}{2\pi r}$$

What if we mix a conductor with an electric current and an electron beam that is moving at the same speed as the drift current is flowing in the wire as shown in Figure 7?

From the stationary frame of reference, the electron beam will experience a force that we could call it a magnetic force. In reality, what we see is the electron beam is experiencing repulsive and attractive electrostatic forces from the negative charges of the electric current in the conductor and the stationary positive charges. The electron beam observes an attractive force from the positive charges that is greater than the repulsive force from the electrons due to the Lorentz contraction of the positive charges from the electrons inertial reference frame.

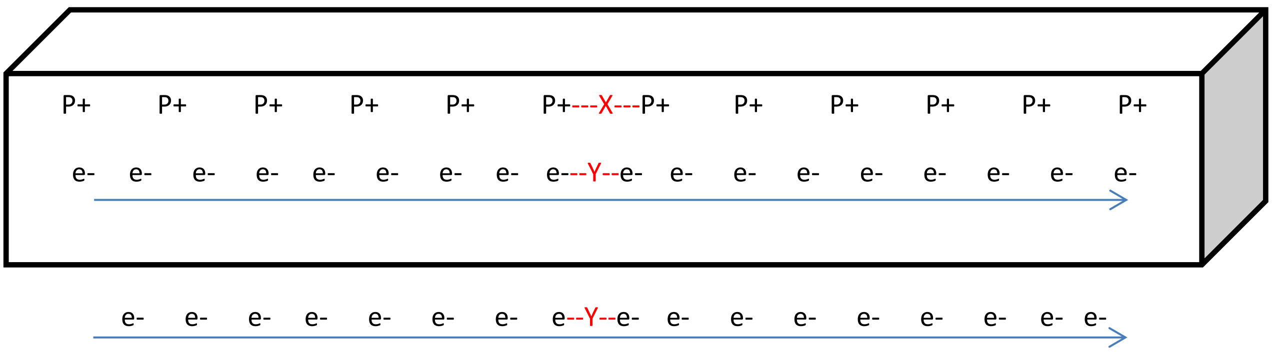
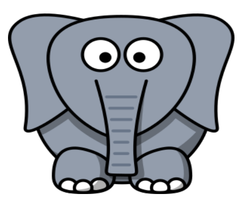


Figure 7

Today we would end the story and declare we have completely described and declare that electromagnetics has described the forces that we would see. However, we forgot about the history and the connection that this current has to our earth ground that is our next elephant in the room.



1. Let us assume our wire is connected to a battery or electrostatic power supply that has no connection to ground and has had no connection to ground when the electric current was flowing. Then when the current is flowing in the wire the wire is going to have a slightly negative charge from the now Lorentz contracted negative electric charge from the electric current in the wires reference frame.
   a. An electrically isolated stationary negative charge will observe a **repulsive force** from the wire**.**
   b. The stream of electrically isolated electrons will observe an **attractive force** as the same magnitude as ‘a.’ from the wire that can be model as a magnetic force.
   c. If the stream of electrically isolated electrons is moving faster than the drift velocity of electrons in the wire, the **attractive force** that the electron streams observes is the same as b**.**

2. Let us assume that the wire with conduction current has a connection to ground to allow some of the negative charge to flow to our infinite sink of electrons (Ground). Now the wire will not have a negative charge in the stationary reference frame.
    a. An electrically isolated stationary negative charge will **NOT** observe a repulsive force from the wire**.**
    b. The stream of electrically isolated electrons will observe an **attractive force** from the wire that can be model as a magnetic force.
    c. If the stream of electrically isolated electrons is moving, faster than the drift velocity of electrons in the wire, the **attractive force** that the electron streams observes is the same as b**.**
3. Then let us disconnect ground while the current is flowing. Now the wire has a positive charge when the current is not flowing in the wire. An electrically isolated stationary negative charge will observe an **attractive force** from the wire**.**

This is why the history of a conductor is important. This is also the reason that when you observe strange electric fields or forces that you cannot describe with today's mathematical framework ***just ground it*** and electromagnetics starts working again.

Since these forces are really from electric fields originating from uncoupled charges that change differently from the effects of relative motion and not a "magnetic field", then what about the shape of the charge holding objects. Won't the electric fields from differently shaped charge objects change differently due to relative motion?

It should be obvious that the mathematics used today to describe the changes to electric fields from the effects of relativity is incorrect. This should have been obvious in 1905 after the theory of relativity was accepted. However, it seems like it was not…

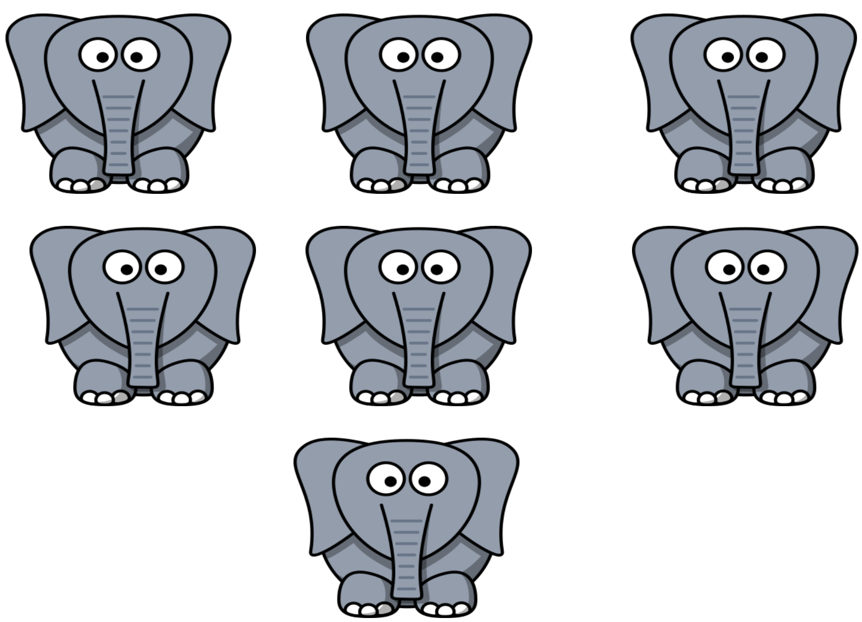
These are examples where the mathematical framework that we use today called electromagnetics is at best incomplete. The generalization that any moving electric charge has an electric field and a magnetic field when viewed from a different inertial frame of reference is wrong. Instead, a ***complex electric field*** is observed from a different inertial frame of reference that is composed of the static electric field and the added component from the Lorentz contraction from its motion. This ***complex electric field*** is different depending on the inertial frame of reference and direction to the relative motion of the beams that the two beams are viewed. Then if these charges are coupled physically, we observe a magnetic force. This does not preclude the moving charges from being bent from the mathematical abstraction that we call a magnetic field generated from another conductor conducting an electric current or another magnetic material.

Two moving charged non-conductive objects can replace the filament currents in the preceding examples. With ***charged non-conducting objects,*** only the excess charge on each charged object has to be considered. A neutral or uncharged object that has their charges **physically connected** to a solid uncharged object will ***normally*** be uncharged in all inertial frames of reference. However, the excess charge that a charged object has will have a total electric field that will be different when viewed from different inertial frames of reference.

Two moving charged conductive objects can **NOT** replace the filament currents in the preceding examples. With ***charged conductive*** objects, the mobile negative electrons will redistribute to neutralize any differences in the electric fields created by the interactions of the electric fields from the relative motion of charged conductive objects in different inertial reference frames.

This will require different mathematics to correctly model the electric fields from charged conductors and charged non-conductors in relative motion.

Do we now have herd elephants now?



Current Derivation

The current mathematical model for electromagnetics is based off the following vector equations that are today known as Maxwell's equations.

$\nabla \cdot D = \rho$ **Gauss's law for electricity**
$\nabla \cdot B = 0$ **Gauss's law for magnetism**
$\nabla \times E = -\partial B/\partial t$ **Faraday's law of induction**
$\nabla \times H = J + \partial D/\partial t$ **Ampere's law**

Maxwell's equations describe electromagnetic fields and have terms for a magnetic field. These equations having terms to describe a magnetic field and are optimized to describe the effects from conductors when an electric current is flowing through them. These equations are not going to be valid to describe the complex electric fields from ***electrical convection currents*** (moving charged objects).

The original mathematical framework promoted by James Clerk Maxwell, Peter Tait, and Sir William Hamilton for electrodynamics was based on the complex-quaternion (Bi-Quaternion) mathematical framework, or in its modern form known as a geometric algebra or as the even sub algebra of Clifford Algebra of Rank 0, 3. Oliver Heaviside originally derived Maxwell's equations from Maxwell's original complex-quaternion mathematical framework for electrodynamics. This paper is not going into the details of the original derivation or on operations that are done in Clifford Algebras. I will describe the terms in the following equations and the physical effects that terms are predicting that should be observable in the real world.

The mathematical representation of the quaternion and bi-quaternion that I will be using is below:

http://www.andre-waser.ch/Publications/GeneralisationOfClassicalElectrodynamics.pdf

Definitions of Symbols and Operators

Quaternion : $X = x_0 + ix_1 + jx_2 + kx_3$ or $X = x_0 + \vec{i} \cdot \vec{x}$

Bi-Quaternion: $X = x_0 + \mathrm{i}y_0 + \vec{i} \cdot \left(\vec{x} + \mathrm{i}\vec{y}\right)$

Nabla : $\nabla = \left(\frac{i}{c}\frac{\partial}{\partial t} + \vec{i} \cdot \vec{\nabla}\right) \qquad \vec{\nabla} = \left(\frac{\partial}{\partial x_1}, \frac{\partial}{\partial x_2}, \frac{\partial}{\partial x_3}\right)$

The reason for using this complex framework is that the much simpler frameworks using vector algebra was not able to unify the magnetic force with the electric force. At the time that Maxwell used this framework, he did not understand the reason as to why this framework worked to unify these forces and the simpler vector algebra did not. Today we know why, it is relativity.

Today we know the reason why the simpler framework did not work was because the electric force is a primary force and the magnetic force is a complex force of the interactions of the electric fields from charges in different inertial reference frames contained in a material object. The vector equations used today are just special cases of this more complex framework that ***SHOULD*** have told physics that there was still an untold story here.

The following derivation is the modern derivation of the electric field and magnetic field equations from Maxwell's original bi-quaternion electromagnetic potential. The units used for the modern derivation is the units of the magnetic vector potential of a Weber/meter.

Quaternion Electromagnetic Potential Equation

$$A = \frac{i}{c}\Phi + \vec{i}\cdot\vec{A} \quad \text{Weber/meter} \qquad \text{Note: } x_0 = 0, \mathrm{i}\vec{y} = 0$$

$$\nabla A = \left(\frac{i}{c}\frac{\partial}{\partial t} + \vec{i}\cdot\vec{\nabla}\right)\left(\frac{i}{c}\Phi + \vec{i}\cdot\vec{A}\right) \quad \text{Tesla}$$

$$\nabla A = \left(\frac{1}{c^2}\frac{\partial\Phi}{\partial t} + \vec{\nabla}\cdot\vec{A}\right) + \vec{i}\cdot\left[\vec{\nabla}\times\vec{A} + \frac{i}{c}\left(\frac{\partial\vec{A}}{\partial t} + \vec{\nabla}\Phi\right)\right] \quad \text{Tesla}$$

Resulting Equations

$$\vec{E} = -\frac{\partial\vec{A}}{\partial t} - \vec{\nabla}\Phi \quad \text{Volt/meter} \qquad \text{Note: } \frac{i}{c}\left(\vec{E}\right) \text{ Tesla} \tag{4}$$

$$\vec{B} = \vec{\nabla}\times\vec{A} \quad \text{Volt sec/meter}^2 \quad \text{or} \quad \text{Tesla} \tag{5}$$

$$S = \frac{1}{c^2}\frac{\partial\Phi}{\partial t} + \vec{\nabla}\cdot\vec{A} \quad \text{Volt sec/meter}^2 \quad \text{or} \quad \text{Tesla} \tag{6}$$

The resulting equations are reformulated to derive the vector calculus based Maxwell's equations. Equations (4) and (5) correctly describe the electric and magnetic forces from current carrying conductors.

That is from *"current carrying **COPPER** conductors"*.

These equations are based off two potentials that are derived from our constants ε_0 and u_0:

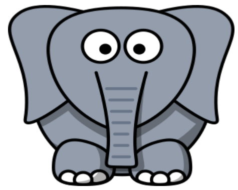
$$\Phi = \frac{Q}{4\pi\varepsilon_0 r} \text{ Volts} \qquad \text{and} \qquad \vec{A} = \frac{\mu_0\vec{I}}{4\pi} \text{ Volt Second/Meter}$$

"A" or the magnetic vector potential is derived from the forces generated from copper conductors flowing one amp of current.

These equations have their constants tied together by:

$\varepsilon_0 = \frac{1}{\mu_0 c^2}$ $\quad \mu_0 = \frac{1}{\varepsilon_0 c^2}$ These two equations are related by the equation $\quad c_0 = \frac{1}{\sqrt{\mu_0\varepsilon_0}}$

Then there is the ***<u>GREAT BIG</u>*** elephant in the room equation (6).



Equation (6) was a major problem for this derivation. At the time, James Maxwell produced this derivation, Albert Einstein's theory of relativity had not yet been formalized and the concepts of time dilation and the Lorentz contraction was still being developed. Equation (6) is the source of the famous "extra terms" in Maxwell's original derivations.

An equation that is referenced to a point in space with one term based off ε_0 and u_0 and produces a scalar with the units of Tesla. This does not make any sense. However, it should have. This equation is telling us a number of things.

1. There is something wrong with our constants of ε_0 and u_0.
2. Have a decoupled potential that feeds back unto the electric and magnetic field.
3. This new field is coupled to an inertial reference frame and a point in space.
4. We must have some kind of coupling in the math to the properties of a material.
5. Something is wrong with the units in our equations.
6. Alternatively, we do not have the root equations yet.

The first obvious answer would be, is that we do not have the root equations and there must be a derivation that we can derive all of our vector equations without the gauges and hand waving. Yet, it has been over 100 years and no one has come up with them.

In 1905, science was not observing the effects from this equation. In addition, when they did observe the effects from these ***'extra terms',*** they discounted the reports. Instead, science created a mathematical construct called a gauge to allow science to ignore this equation and pretend that our great big elephant was not there.

The reasons that the Magnetic Scalar Potential is not observed in everyday conduction currents are due to the characteristics of conductors and the units used in this derivation. The speed of the mobile electrons in a copper conductor is in the range of 1 cm/second so the effects from the magnetic scalar are going to be very small for electric currents used today. The second reason that the effect from equation (6) is not being observed is the units for this potential are incorrect. As such, this potential cannot be measured with a magnetic field meter.

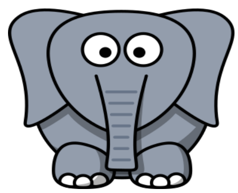
NOT THAT IT DOES NOT EXIST!

The effects of this scalar are seen as a longitudinal force in wires when conductors have large currents moving through them. This effect was confirmed in "THE EUROPEAN PHYSICAL JOURNAL D" in the article "An experimental confirmation of longitudinal electrodynamic forces by N. Graneau, T. Phipps Jr, and D. Roscoe". This is effect has also been seen in dense plasmas as an unknown longitudinal force.

Then there is that **"Displacement Current"** in between capacitors plates.

Nevertheless, the scientific and engineering community has been readily able to *rationalize* equation (6) away without any experimental proof that it really was just "extra terms". Oliver Heaviside and Lorentz were able to remove equation (6) through "symmetrical re-gauging" under the assumption that it wasn't a factor in conduction currents, not that the physical effects from this equation were really "0". This gave us the Coulomb and the Lorentz gauges.

Then there is other elephant that is standing in front of your face at the top of page 40 that should be flashing that something is missing. Can you find it? Do you have multiple PhD's and you still can't find it? Is one of them PhD's in mathematics?



Answer: $x_0 = 0, iy = 0.$

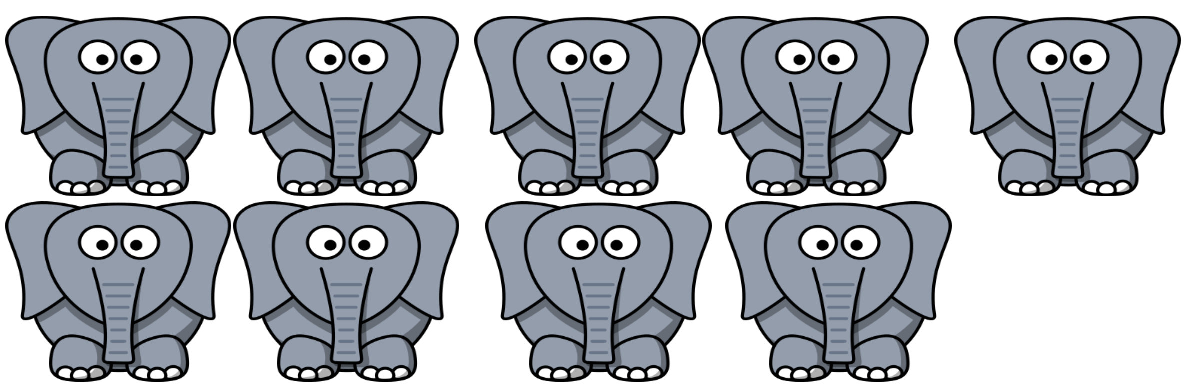
For these terms to be zero either, we do not have the root equations. Alternatively, we are missing something.

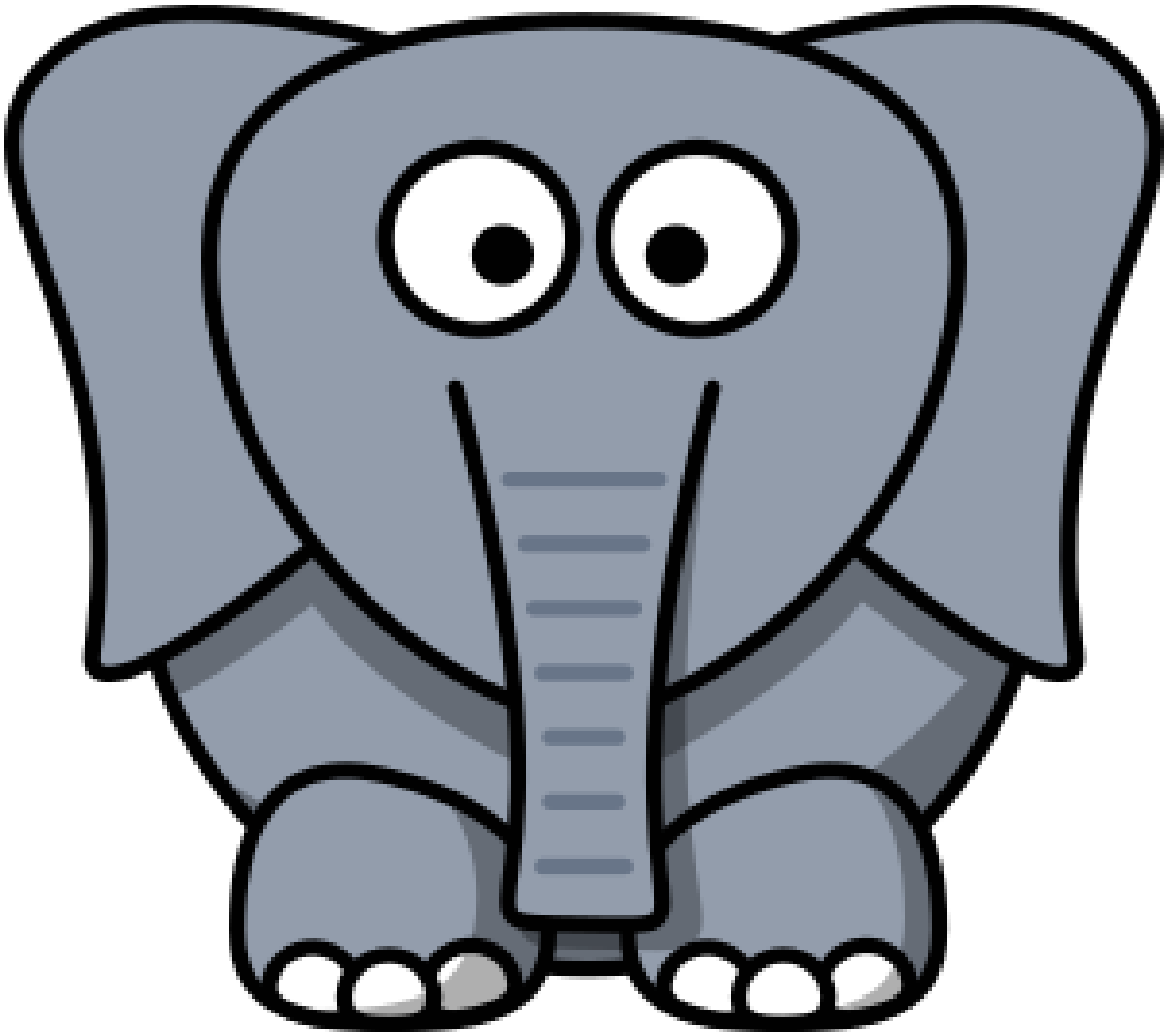
A number of people have tried to find these root equations all the way from Alexander Hamilton and could not it. Then there was Oliver Heaviside and Josiah Gibb that slapped on a couple of gauges (the Lorentz gauge and the Coulomb gauges) and called it "Electromagnetics".

These missing terms are implying that there is still another real scalar potential and its coupling to a hidden vector potential that physics still has not found yet.

Alternatively, it could mean if you have a PhD in physics, you are not good enough at math to be able to derive the real root equations without fudging the math with a gauge…

Do we now have a bigger herd elephants?





$$S = \frac{1}{c^2}\frac{\partial \Phi}{\partial t} + \vec{\nabla} \cdot \vec{A} \quad \text{Volt sec/meter}^2 \quad \text{or} \quad \text{Tesla}$$

The Lorentz gauge is derived by setting the magnetic scalar equation (6) = 0 since it wasn't seen in conduction currents.

$$0 = S$$

$$0 = \frac{1}{c^2}\frac{\partial \Phi}{\partial t} + \vec{\nabla} \cdot \vec{A} \quad \text{Tesla}$$

Lorentz Gauge

$$\vec{\nabla} \cdot \vec{A} = -\frac{1}{c^2}\frac{\partial \Phi}{\partial t}$$

The Coulomb gauge is used in electrostatics so the term $\frac{1}{c^2}\frac{\partial \Phi}{\partial t}$ is going to be 0 for electrostatic charges by the definition of "electrostatic".

Coulomb Gauge

$$0 = \frac{1}{c^2}\frac{\partial \Phi}{\partial t}$$

$$0 = 0 + \vec{\nabla} \cdot \vec{A}$$

$$0 = \vec{\nabla} \cdot \vec{A}$$

The Coulomb Gauge and the Lorentz Gauge are two special cases of velocity gauges. The form of the velocity gauge is shown below:

Velocity Gauge

$$\vec{\nabla} \cdot \vec{A} = \frac{1}{u^2}\frac{\partial V}{\partial t}$$

V is the scalar potential

A is the vector potential

u is the velocity gauge which is either c (speed of light) or u $\to \infty$

The Lorentz gauge sets the propagation speed of the **vector potential** at the ***speed of light*** and the Coulomb gauge sets the speed of propagation of the **scalar potential** at ***infinite speed***. Translating these gauges into the real-world effects, these gauges are implying that the magnetic field, electromagnetic radiation, and the electric field propagate at the speed of light and the speed of the scalar potential approaches infinite velocity. It is beyond the scope of this paper to derive the speed of the scalar potential and its consequences. The paper "The Unification of the Lorentz and Coulomb Gauges of Electromagnetic Theory" by David M. Drury is the place to do further research if the reader still has questions.

New Electrodynamics Derivation

To arrive at the correct mathematical framework for **electrical convection currents** like electron beams or moving charged objects these equations are re-derived from Maxwell's original bi-quaternion electromagnetic potential to eliminate the terms for a magnetic field. As such, Maxwell's original bi-quaternion electromagnetic potential is converted to the electrodynamic potential having units of Volts instead of a Weber/meter. To change the units, the following derivation is used, multiplying the magnetic vector potential by c (speed of light) to convert to Volts.

Quaternion Electromagnetic Potential

$$A = \frac{i}{c}\Phi + \vec{i}\cdot\vec{A} \qquad \text{Weber/meter}$$

$$cA = \frac{ci}{c}\Phi + \vec{i}\cdot c\vec{A} \quad \text{Volts}$$

$$cA = \Phi$$

$$\Phi = i\Phi + \vec{i}\cdot c\vec{A} \qquad \text{Volts}$$

Then to get all the terms of the equation in the same form we have to convert $c\vec{A}$ into Φ.

Conversion of $c\vec{A}$ to Φ

$$A = \frac{\mu_o Q\vec{V}}{4\pi R} \quad \text{Weber/meter}$$

$$c = \frac{1}{\sqrt{\mu_o \varepsilon_o}} \quad \text{Meter/second} \qquad\qquad \text{Note } \mu_o = \frac{1}{\varepsilon_o c^2}$$

$$cA = \frac{c\mu_o Q\vec{V}}{4\pi R}\ \frac{\text{Weber meter}}{\text{second meter}} \quad \text{or Volts}$$

$$cA = \frac{cQ\vec{V}}{\varepsilon_o c^2\, 4\pi R} \quad \text{Volts}$$

$$cA = \frac{\vec{V}}{c}\ \frac{Q}{4\pi\varepsilon_o R} \quad \text{Volts}$$

$$\Phi = \frac{Q}{4\pi\varepsilon_o R} \qquad \text{Volts}$$

$$cA = \frac{\vec{V}}{c}\ \Phi \qquad \text{Volts}$$

This gives us a complex quaternion equation (Quaternion Electrodynamic Potential) that has all of its terms based off the same constant (ε_o).

Quaternion Electrodynamic Potential for a moving charged object

$$\Phi = i\ \Phi + \vec{i}\ \cdot \frac{\vec{V}}{c}\ \Phi \text{ Volts}$$

Now we can derive the correct field equations for a moving charged object.

Definitions of Symbols and Operators

Quaternion : $X = x_0 + ix_1 + jx_2 + kx_3$ or $X = x_0 + \vec{i} \cdot \vec{x}$

Bi-Quaternion: $X = x_0 + \mathrm{i}y_0 + \vec{i} \cdot \left(\vec{x} + \mathrm{i}\vec{y}\right)$

Nabla : $\nabla = (\frac{i}{c}\frac{\partial}{\partial t} + \vec{i} \cdot \vec{\nabla})$ $\quad \vec{\nabla} = \left(\frac{\partial}{\partial x_1}, \frac{\partial}{\partial x_2}, \frac{\partial}{\partial x_3}\right)$

Quaternion Electrodynamic Potential for a moving charged object

$$\Phi = i\ \Phi + \vec{i}\ \cdot \frac{\vec{V}}{c}\ \Phi \text{ Volts}$$

$$\nabla\, \Phi = (\frac{i}{c}\frac{\partial}{\partial t} + \vec{i} \cdot \vec{\nabla})(i\,\Phi + \vec{i}\ \frac{\vec{V}}{c}\ \Phi) \text{ Volts/Meter}$$

$$\nabla\, \Phi = -(\frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla} \cdot \frac{\vec{V}}{c}\Phi) + \vec{i} \cdot [\ \vec{\nabla} \times \frac{\vec{V}}{c}\ \Phi + i\ (\ \frac{\partial \vec{V}}{\partial t}\frac{\Phi}{c^2} + \nabla\Phi)] \text{ Volts/Meter}$$

Electric Field Equation

$$\vec{E} = -\ \frac{\partial \vec{V}}{\partial t}\frac{\Phi}{c^2}\ - \vec{\nabla} \times \frac{\vec{V}}{c}\Phi - \vec{\nabla}\Phi \text{ Volts/Meter} \qquad (7)$$

Scalar Electric Potential Equation

$$S = \frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla} \cdot \frac{\vec{V}}{c}\ \Phi \text{ Volts/Meter} \qquad (8)$$

Potential to Charge relation

$$\Phi = \frac{\text{Charge}}{\text{Capacitance}} \qquad \text{Volts}$$

These equations do not have a term for the magnetic field. The reason why is that the magnetic force that the magnetic field was created to describe now has to be described by 2 separate electric field equations from 2 different charges in different inertial reference frames mediated by the characteristics of the material. Then these three equations can then be coevolved to create an equation [as a special case] that describes the magnetic force from electric currents and magnets without having to the create a mythical field that science calls the 'magnetic field'.

In addition, we now only have two equations to work with. No more extra terms that we have to pretend that, they do not exist.

Equation (7) or the electric field equation now has an extra term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ that now correctly describes the increase in the electric field that is seen from a moving charge when viewed from a different inertial frame reference when the charge is viewed perpendicularly to the direction of the relative motion. This is seen as the magnetic field when the moving charge is in a conductor. This increase in the electric field is the result of the moving charges apparent density increase from the Lorentz contraction of the moving charges when the charges are viewed from a different inertial frame of reference.

Equation (8) is now in the correct units and is new. This potential is going to be seen as an electric potential, with an electric field, when it is viewed from different inertial frames of reference but not connected to the originating charge. The intensity of the electric field from this new potential will be dependent on the inertial frame of reference that it is viewed. This is the reason that the units for this potential are Volts/Meter. It still has to be multiplied by the velocity (Meters/Second) difference that the scalar is viewed from using the relative velocity difference that it was created from as its original velocity.

This is mathematically represented as:

Electric Field calculation from a Scalar Electric Potential

S	Scalar Electric Potential	Volt/Meter	
$\vec{v}$	Relative Velocity Difference	Meter/Second	
$\lvert\vec{v}\rvert$	Relative Speed Difference	Meter/Second	
$S_{\text{Intensity}}$	Decoupled Electric Potential Intensity	Volt/Second	(9)
$S\lvert\vec{v}\rvert = S_{\text{Intensity}}$		Volt/Second	(10)
t	Time (Time that the scalar is built up)	Seconds	
$(S_{\text{Intensity}})t = S_{\text{Decoupled Electric potential}}$		Volt	(11)
$\nabla S_{\text{Decoupled Electric potential}} = \vec{E}$		Volt/meter	(12)

Special Case:

The intensity of the Scalar Electric Potential as seen from the stationary frame of reference

$\vec{v}$ Relative Velocity Difference using $\vec{V}$ as Velocity Basis of "1" in M/S.

$S\lvert\vec{v}\rvert = S_{\text{Intensity}}$ Volt/Seconds $\quad \lvert\vec{v}\rvert = 1\,\text{M/S}$

$$S_{\text{Intensity}} = \left(\frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla}\cdot\frac{\vec{V}}{c}\Phi\;\frac{\text{Volt}}{\text{Meter}}\right)\left(1\frac{\text{Meter}}{\text{Seconds}}\right)\text{Volt/Seconds}$$

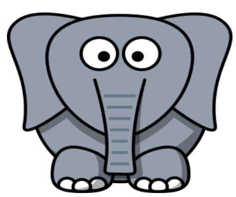
Note: For those who couldn't figure out where the Volt/Seconds were coming from....

This new result is a scalar and is a potential of an **unknown scalar field** with a number of features.

- The result of this equation is a scalar or potential.
- The scalar potential is coupled to point in space.
- This new scalar potential can be built up over time.
- This new potential can be ***decoupled*** from the moving charge that created it.
- This new potential displays an electric field when this new potential is viewed from different inertial frames of references than the one that it was created.
- The Scalar Electric Potential Intensity from the Scalar Electric Potential is dependent on the relative velocity difference of the inertial frames of reference that it was created in and the inertial frame of reference that it is viewed.
- The Decoupled Electric Potential is dependent on the Scalar Electric Potential Intensity multiplied by the amount of time that the Scalar Electric Potential Intensity has been built up.
- The electric field intensity seen from the Scalar Electric Potential is dependent on the gradient of the Decoupled Electric Potential.

In this derivation, the Scalar Electric Potential Intensity is multiplied by the time to demonstrate that it is a point in space that has a decoupled potential that can be built up over time. The Scalar Electric Potential could just as well multiply time and the results would be the same. However, the fact that the Decoupled Electric Potential could be built up over time as a potential (Voltage) would not be as obvious as it is in this derivation.

Missing Something?



What happen to u_0?

Now, that we have a conductor independent mathematical framework to describe the forces created from the interactions of electric fields from charges in relative motion. We do not need u_0 anymore to describe the forces from the charges in relative motion. That is unless these charge's electric fields are not being modified by or coupled to a material like a Copper wire.

Then we should then be able to mathematically get rid of $u_{0:}$

Electric Potential   Magnetic Vector Potential

$$V = \frac{Q}{4\pi\varepsilon_0 r} \text{ Volts} \quad \text{and} \quad \vec{A} = \frac{\mu_0 \vec{I}}{4\pi} \text{ Volt Second/Meter} \quad \varepsilon_0 \ \frac{\text{Coulombs}}{\text{Volt}\times\text{Meter}}$$

$$\mu_0 = \frac{1}{\varepsilon_0 c^2} \frac{\text{Volt} \cdot \text{Seconds}}{\left(\dfrac{Coulomb}{Seconds} \cdot Meter\right)} \quad \vec{I} = \frac{Q}{S} \text{ Coulomb/second} \quad \text{or} \quad \vec{I} = \vec{V}\frac{Q}{Meter}$$

$$\vec{A} = \frac{\mu_0 \vec{I}}{4\pi} = \frac{\dfrac{1}{\varepsilon_0 c^2}\dfrac{Q}{M}\vec{V}}{4\pi} = \frac{\vec{V}Q}{4\pi\varepsilon_0 c^2} = \frac{\vec{V}Q}{c 4\pi\varepsilon_0} = \frac{\vec{V}}{c}\frac{Q}{4\pi\varepsilon_0 c} \text{Volt Second/Meter}$$

If we rewrite the terms to make more sense…

$$\vec{A} = \left[\frac{\vec{V}}{c}\right]\left[\frac{Q}{4\pi\varepsilon_0 c}\right] \text{Volt Second/Meter}$$

$\vec{V} =$ Drift velocity of the electric current "IN A COPPER CONDUCTOR" when =>

One ampere is the constant current that will produce an attractive force of 2 × 10^{-7} newtons per metre of length between two straight, parallel *"COPPER"* conductors of infinite length and negligible circular cross section placed one metre apart in a vacuum.[2][10]

Then the "**One ampere is the constant current**" is defined as one Coulomb/second that defines Q to be equal to one Coulomb. Along with "**negligible circular cross section"** and **"of infinite length**" defines the physical shape of conductor to be an infinitely long cylinder.

If these conditions are not met, then our "**magnetic constant**" u_0 probably is not going to be as constant as one would like.

If these charges in different inertial reference frames are in a copper conductor and we use the current mathematical description for a magnetic field, all of sudden u_0 pops out of know where. It must be because u_0 is an artifact of the conductor. If the magnetic field is just a mathematical abstraction used to describe the forces between conductors and magnets, then u_0 must just be an artifact of the material used to create that abstraction.

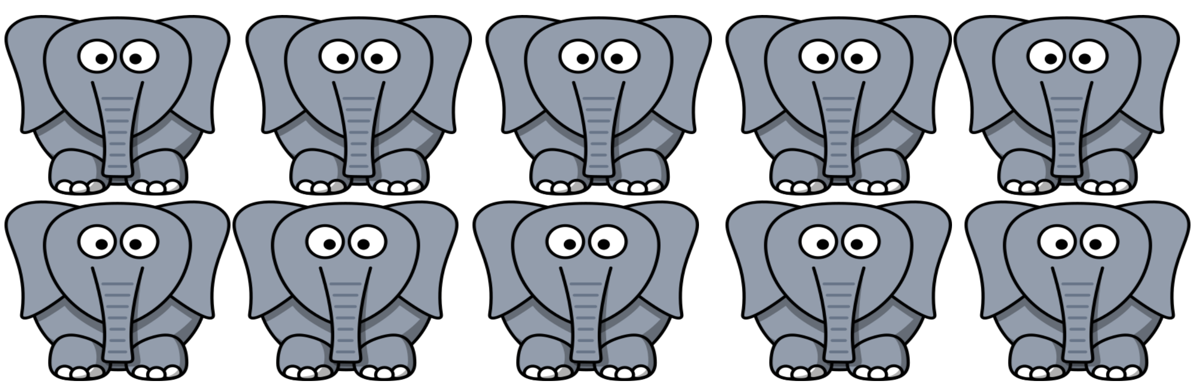
Then the questions start to arise are:

1. What if the conductor is a ribbon or a square what is the "**magnetic constant**" u_0 going to be?
2. What if the drift velocities of the charges are different what is the "**magnetic constant**" u_0 going to be?
3. What if the density of the moving charge is not uniform different what is the "**magnetic constant**" u_0 going to be?

None of these questions ends up being answered by today's vector equations without a lot fudging of the equations to get the correct answers. The fudges to the mathematics to get them to work should have been [at the very least] an indication to science that they were working with an incomplete set of equations to describe the forces from electric charges.

What does that mean?

1. Electromagnetics is only valid for electric currents in conductors, magnets and the components connected to conductors.
2. Electromagnetic radiation from chemical reactions, plasmas, stars, ionization, etc. has no magnetic component. We are mathematically describing this type of radiation incorrectly.
    a. Electromagnetic radiation is really two coupled electric fields in different inertial reference frames.
        i. Electromagnetic radiation from conductors is just one type of electromagnetic radiation based on two specific coupled electric fields in different inertial reference frames created in conductors.
        ii. Electromagnetic radiation from chemical reactions, stars, e.c.t. must be able to have a different magnetic component that has different relative velocity differences.
        iii. The coupling of these fields is material based.
    b. Electric only radiation is possible
    c. Scalar Electric radiation is possible.
        i. The speed of Scalar electric radiation has a speed much greater than the speed of light if not infinite.
        ii. Scalar electric radiation cannot be shielded by magnetic shielding.
3. The speed of light limitation of electromagnetic radiation is relative velocity dependent of the originating material.
4. Electro-Scalar-Electric radiation is possible and would be undetectable with today's technology.
5. Scalar Electric Potentials created at a point in space in an inertial reference frame that allows matter at that point to break the light speed barrier.
6. ***We just started with the obvious meanings from these equations.***



New Physical Effects

The Magnetic Scalar Potential that was derived from Maxwell's derivation has not been directly measured and only in 1960 has it even been proven to shift the phase of electromagnetic radiation. The Scalar Electric Potential is measurable in the New Electrodynamics Derivation and its electric field effects have been documented since the 1980's in a number of case studies.

Scalar Electric Potential Equation

$$S = \frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla} \cdot \frac{\vec{V}}{c}\,\Phi \quad \text{Volts/Seconds} \qquad (9)$$

This new scalar electric potential from equation (9) is an electric potential that is coupled to a point in space in an inertial reference frame. This potential is the same electric potential of Volts that is coupled to a particle like an electron or proton but is instead coupled to a point in space. This new scalar electric potential will follow the rules of superposition with other scalar electric potentials created from the same inertial reference frame. However, the electric fields from these potentials created in different inertial reference frames will not follow the rules of superposition. Electric fields created by electric charges in different inertial reference frames in a conductor do not follow the rules of superposition and are the basis for the magnetic field.

The units of Volts/Second imply that this potential can be built up over time along with its electric field. This is a point in space in an inertial reference frame that has an electric field that is dependent on the inertial reference frame that the point is space is viewed.

The $\vec{\nabla} \cdot \frac{\vec{V}}{c}\,\Phi$ term in the equation (9) is a potential just like the electric potential.

When this new potential is viewed from different inertial frames of reference than it was created in, the effects of relativity will modify this potential in the same way an electric charge is modified. This potential is an electric potential that adds to the electric potential of the moving charged element in the direction of the motion of the moving charged element. This potential will add to the charged elements potential when the charged element is approaching a point. This is seen as an increase in the electric field as a moving charged object is approaching a point. This potential will subtract from the charged elements potential when the charged element is receding from a point. This is seen as a decrease in the electric field as a moving charged object is receding from a point.

$$\Phi_{\text{Receading}} = \Phi - (\vec{\nabla} \cdot \frac{\vec{V}}{c}\, \Phi)t \text{ Volts} \qquad \Phi_{\text{Approaching}} = \Phi + (\vec{\nabla} \cdot \frac{\vec{V}}{c}\, \Phi)t \text{ Volts}$$

$$\vec{E} = \vec{\nabla}(\Phi - (\vec{\nabla} \cdot \frac{\vec{V}}{c}\, \Phi)t) \text{ Volt/meter} \qquad \vec{E} = \vec{\nabla}(\Phi + (\vec{\nabla} \cdot \frac{\vec{V}}{c}\, \Phi)t) \text{ Volt/meter}$$

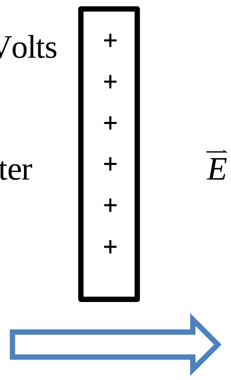
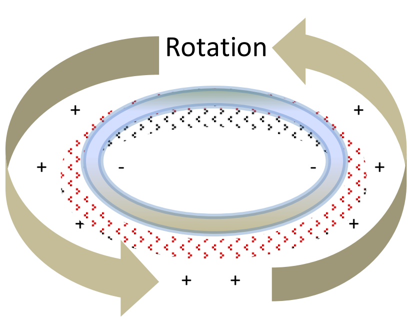


Figure 8

Figure 8 is a representation of a moving positively charged bar from the stationary inertial frame of reference that is moving to the right. When the electric field of the positively charged bar is measured with a static electric field meter (a *non-reciprocating* electric field meter) from the stationary frame of reference it sees a complex electric field. This complex electric field is composed of the static electric field from the potential of the charge and the added electric field component from the potential of the dot product of the static potential and its relative velocity when viewed by an electric field meter in the direction of motion. In this example, the electric field meter positioned to the right of this object would measure an electric field that is slightly greater than it would if the object was stationary. By the same effect an electric field meter positioned to the left would measure an electric field that is slightly less than it would if the object was stationary. The result of this effect is a longitudinal electric field that is seen in the stationary frame of reference for the moving charged bar.

The term "*t*" in the equations in figure 7 is "time". The units Volts/Second for the Scalar Electric Potential implies that the terms $\frac{\partial}{\partial t}\frac{\Phi}{c} + \vec{\nabla} \cdot \frac{\vec{V}}{c}\, \Phi$ in equation (8) can be built up at a point in space. A number of special cases can amplify the scalar electric potential. One special case is when a moving charged object is accelerated perpendicularly to the direction of motion. When a charged object is accelerated perpendicular to its motion, the trailing (receding) scalar ends up not completely offsetting the leading scalar.

This effect is seen in a rotating positively charged **non-conducting** ring as an increase in the electric field over time around the outside faces of the charged ring. This effect is also seen as a decrease in the electric field over time around the inside faces of the charged rotating ring.



The effects from this scalar is easy to demonstrate from a brass disk as shown in figure 9.

3 inch brass Disk

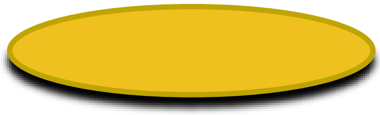


Figure 9

The Electric field from the faces of this brass disk when there is an equal number of free electrons to unpaired protons is:

$\vec{E}(\perp) = -\nabla\times\frac{\vec{V}}{c}\Phi - \nabla\Phi$ Volts/Meter

$\vec{E}(x, y) = \pm\nabla\Phi$ Volts/Meter

The random movments of the electrons in the disk forces most of the mobile electrons to the face and the edges of the disk and gives the disk a slightly negative electric field that is observed from the faces of the disk.

The electric field changes from this disk when it is in relative motion the electric field from the scalar electric potentials that is observed from the stationary frame of reference.

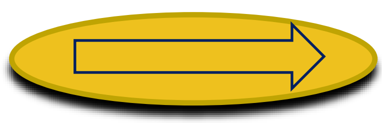
$+\vec{\nabla}\cdot\frac{\vec{V}}{c}\Phi$  $-\vec{\nabla}\cdot\frac{\vec{V}}{c}\Phi$

Figure 10

The is an example of where the amplification of the electric field from this new scalar is possible since the scalar is coupled to a point in space to an inertial reference frame vector.

The electric field from the leading scalar potential will produce an electric field from the front (in reference to its relative velocity) of the edge of the disk as a sum of all the approaching scalar potentials across the disk to create an electric field as viewed from the stationary reference frame.

The electric field from the trailing scalar potential will produce an electric field from the back of the edge of the disk as a sum of all the receding scalar potentials across the disk to create an electric field as viewed from the stationary reference frame.

This is easily demonstrated with an ammeter if it is allowed to measure a current profile to ground from this electric field that is created from this scalar.

In figure 11 at step (1) we momentarily grounded the center of the stationary disk to 0 volts (earth ground). This connects the disk to our stationary reference frame. By grounding disk in the center of the disk the electric charges at the edges will stay at the edges.

If the ground is then removed and the disk is then accelerated to a speed greater than 5 m/s. Then in steps (2), (3) and (4) an electrical connection is made to the disk while it is moving with a stationary contact connected to a stationary picoammeter that is also connected to 0v or ground. If the electrical contact to the disk starts at the leading edge of the disk and allowed to move across the disk as the disk moves by the stationary contact until it gets to the trailing edge of the disk we get a very special current profile. This process is shown below:

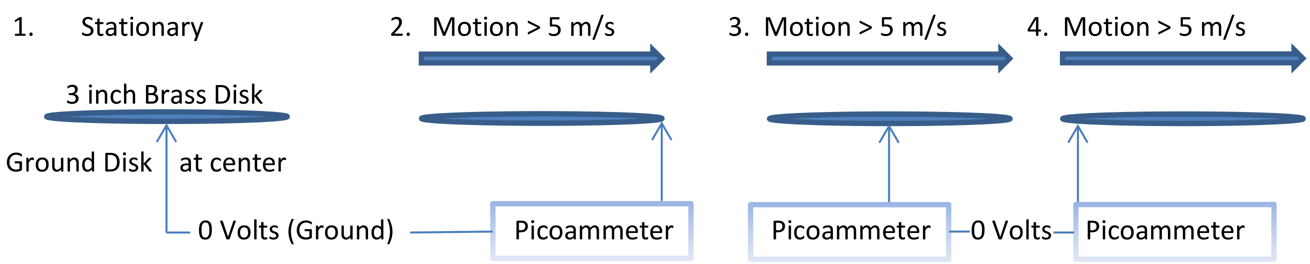
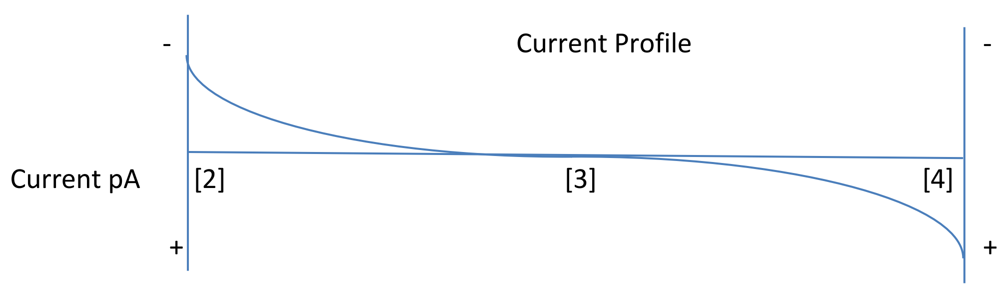


Figure 11

If the Electric Scalar Potential is 0 as the Lorentz gauge and Coulomb gauge imply then the current profile is going to be 0 pA at points 2, 3, and 4. Instead we get the following current profile shown below.



Since the Electric Scalar Potential is real we have a leading negative electric field from the brass disk and a trailing positive electric field that is a direct effect of the electric field from the Electric Scalar Potential. This Electric Scalar Potential when it is viewed from the stationary reference frame view by a stationary picoammeter shows us how these potentials amplify by the potentials summing across the disk.

So it is left to the reader to attempt this experiment, if they still have doubts about reality of the electric scalar potential. It is a very simple experiment to perform if care is taken not to allow a charge to build up on the disk.

An electron moving through a conductor will also create a longitudinal electric field from the difference in the electric field of the negative electrons that are approaching and receding a positive ion. The positive ions will see a longitudinal electric field from the electrons that are approaching that have a slightly greater negative electric field from the moving electron's static electric field and the added increase in the potential from the electric scalar. The positive ions will also see a longitudinal electric field from the electrons that are receding that have a slightly less negative electric field from the moving electrons static electric field and the decrease in the potential from the electric scalar. This causes the positive ion matrix to experience a longitudinal force that is in the opposite direction to the negative electron current flow.

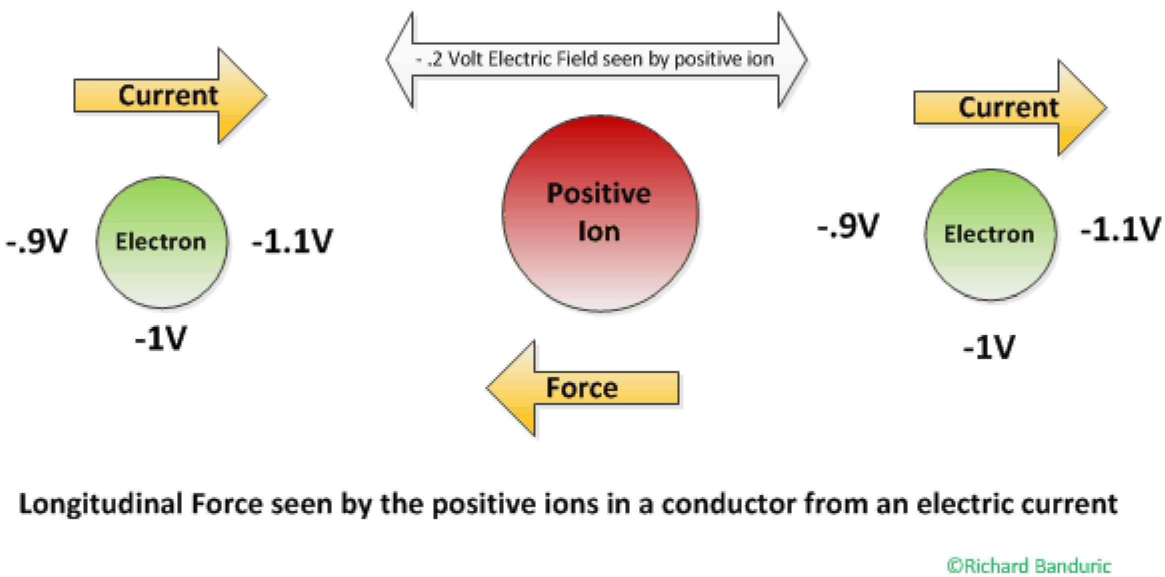


Figure 12

This effect is diagramed in figure 12. This effect has been confirmed more than once as written about in "THE EUROPEAN PHYSICAL JOURNAL D" in the article "An experimental confirmation of longitudinal electrodynamic forces by N. Graneau, T. Phipps Jr, and D. Roscoe".

Creating a Scalar Electric Potential

To decouple a scalar electric potential all that someone has to do is accelerate a charge perpendular to its motion. We could do that with a coil of wire that is flowing an electric current. Except for the fact that a conductor will allow electrons to move in response to the scalar to keep the electric field in the conductor at 0 that effectivily shorts out the electric scalar potential. Then there is the fact that electric currents only flow at speeds of 1×10^{-4} m/s to 1×10^{-5} m/s. Any electric scalar potential from these speeds is going to be very small.

A better solution is to charge a ring with charges that are coupled to the ring and rotate it. If you positively charge an insulated ring with a material that has low mobility negative charges you will have a ring that will except a charge and will not allow the charges to move to naturalize a scalar electric potential. The disadvantage is that it is difficult to get a lot of charge on the ring unless the ring is a capacitor with a negative interior ring. That has its own issues that are too complex to go into in this document.

One of the difficulty is we still need to charge the ring from a source that is not connected to ground thru its source impedance. Then there is the issue of using conductors to apply the charge to the ring. If there is any conductor that is outside the rotating rings inertial reference frame, to conductor will observe any electric field changes on the ring and will allow the mobile electrons to move to neutralize any electric field changes to keep the electric field in the conductor at zero.

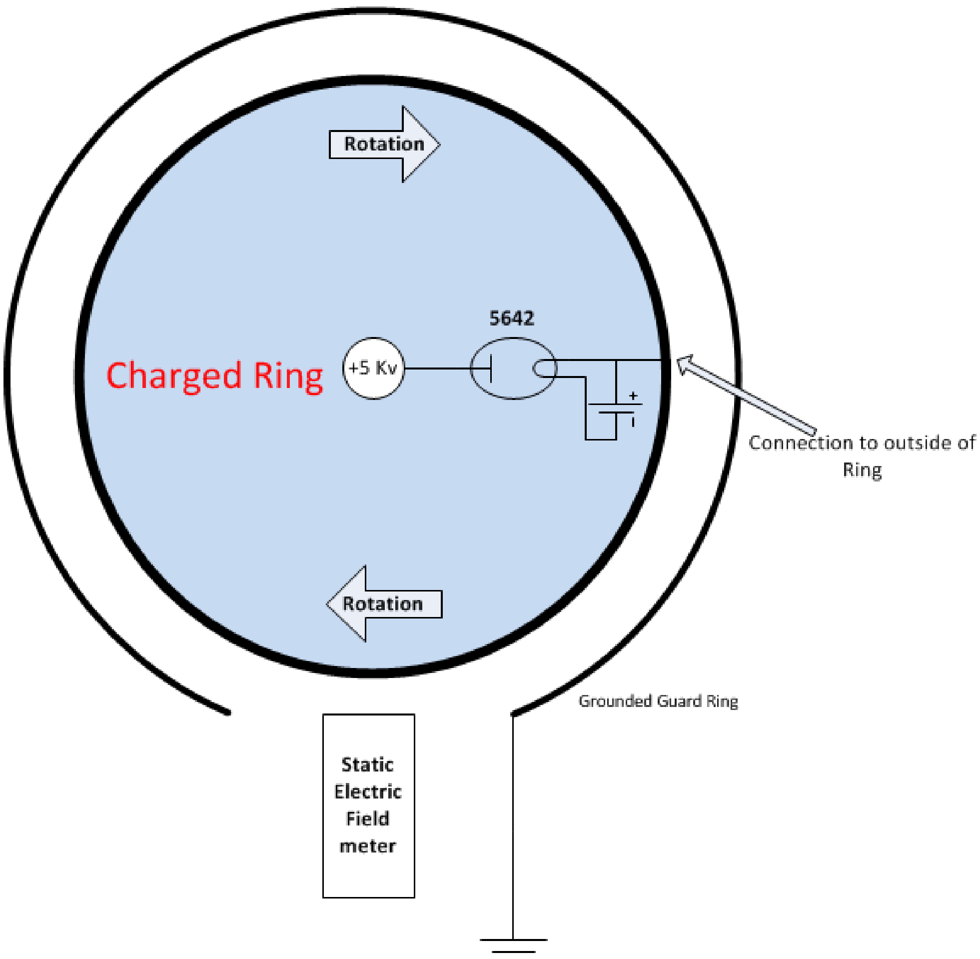
The first trick is to use an electrostatic power supply that has an infinite source impedance to charge the disk. There are other tricks that allow someone to use a modern power supply, but then again, these tricks are out of the scope of this document.

The next trick is to use a tube diode that has its output conductor that is physically separated from the input conductor. Then again, the output conductor has to be in the same inertial reference frame as the ring so it is imbedded in the ring. In addition, a number of little tricks like the funny connection to the ring as shown in figure 13 helps. A semiconductor diode will not work as a replacement for the tube diode.

Then a guard ring in figure 13 will allow the earth ground to be a reference for our static electric field meter that we will have to use to measure the scalar electric potential. Modern reciprocating electric field meters are designed to give the user a stable static or low frequency electric field measurement and as such are designed to null out scalar electric field effects. These types of modern electric field meters will not effectively measure the electric fields from scalar electric potentials.

The block diagram that has all the information that someone would need to generate a scalar electric potential and be able to measure the electric field from this potential is diagramed in figure 13.

Rotating Charged Ring Experiment



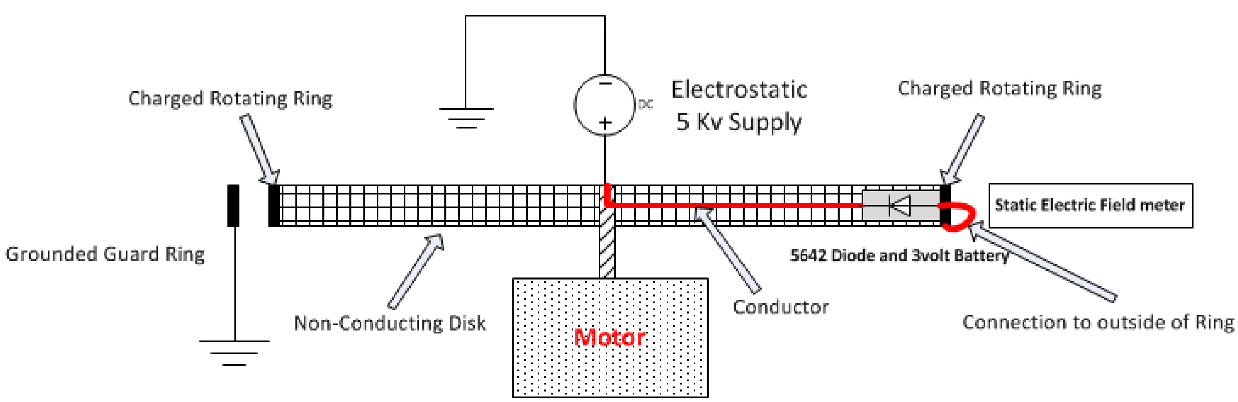


Figure 13

The electric field changes from the rotating ring are diagramed below. This experiment can be done with a conducting ring if the experimenter takes care not to "**SHORT OUT"** the Electric Scalar Potentials. The following electric field changes are seen at the edge of the rotating ring.

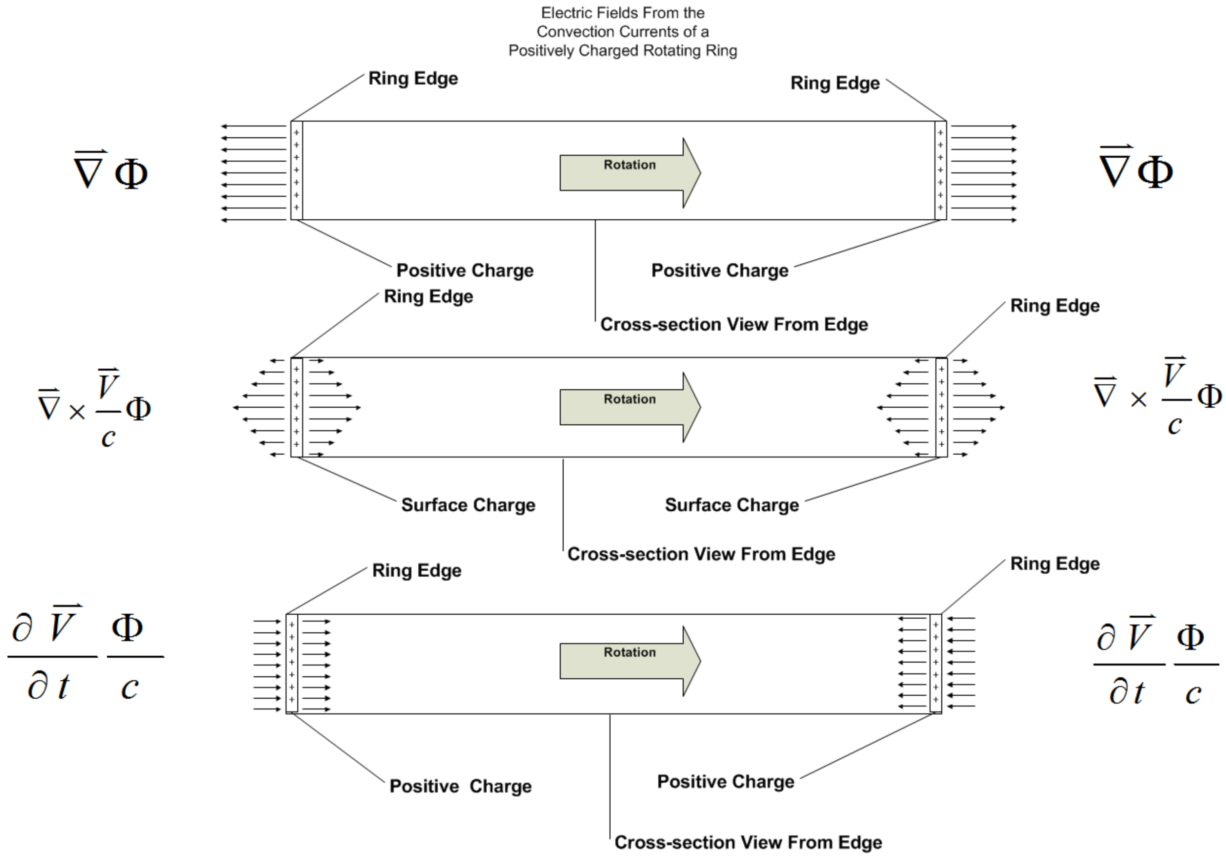


Figure 14

The electric scalar potential that is seen on the inside and outside of a rotating ring will add to the positive potential on the outside and subtract from the static positive electric potential on the inside of the ring.

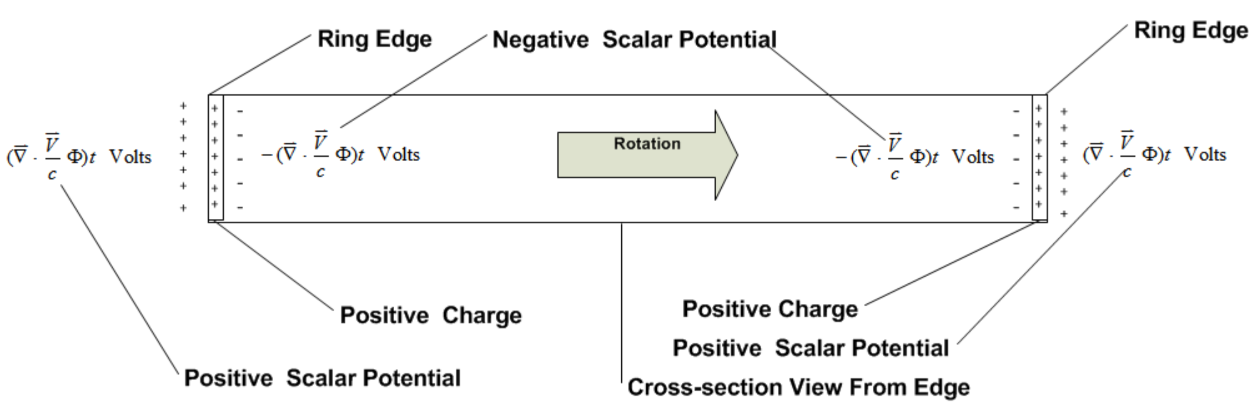


Figure 15

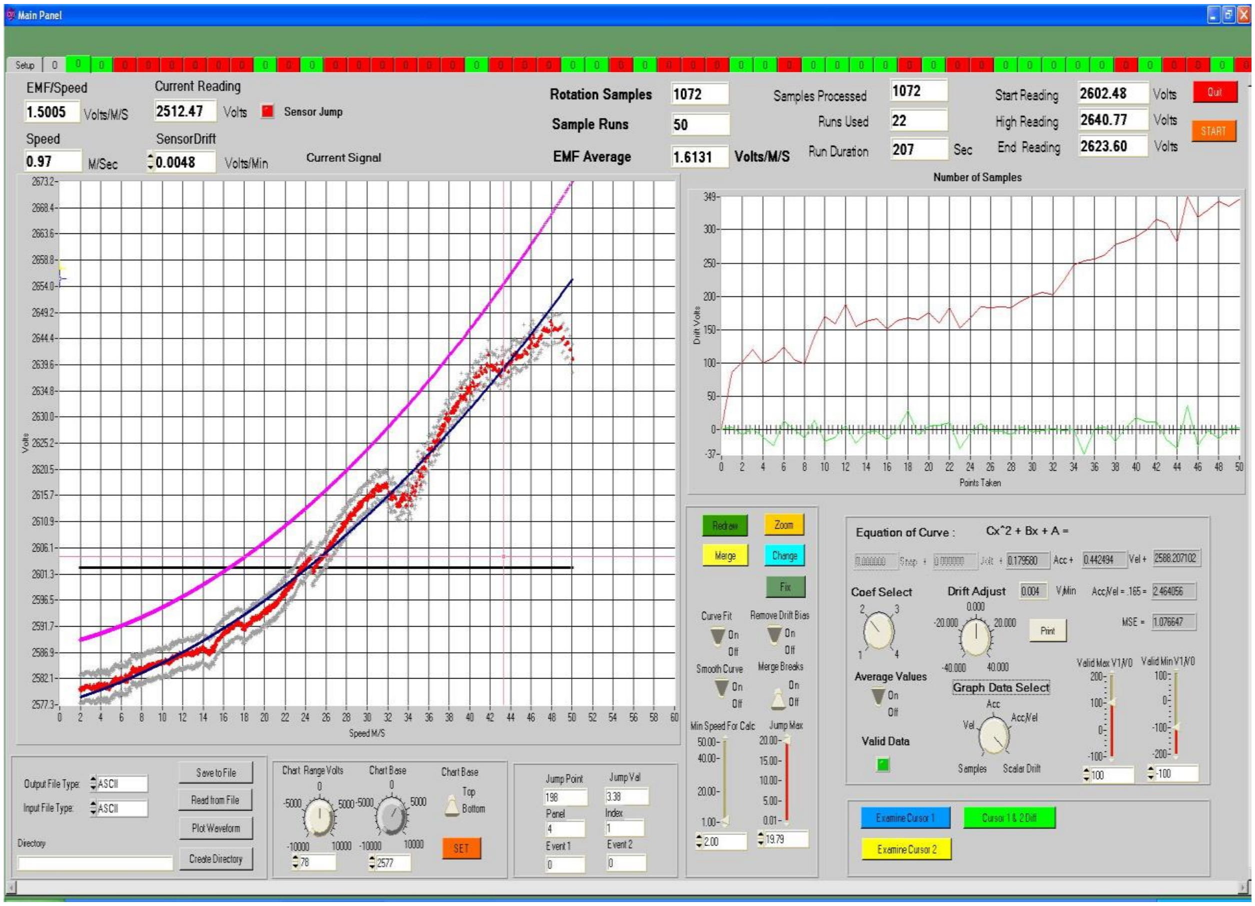


Figure 16

Above is the display of an automated test system output that characterizes the relativistic electric fields from different materials. The left graph is a graph of voltage observed from an electric field meter that is place perpendicular to the face of the rotating ring. The electric field meter is referenced to earth ground and is positioned at the center of the ring. The X-axis on the left graph is the speed of the face of the ring in front of the electric field meters' sensor. The Y-axis on the left graph is the voltage that the electric field meter reads from the face of the ring.

The right graph is a graph of how the voltage that is observed from the electric field meter changes over time. The X-axis is the number of test trials where the rotating rings potential is measure for the different rotation speeds. Each trial takes up to 10 min to get all the readings. The Y-axis is the voltage that is observed by the electric field meter over a period of 20 hours. Then the green trace at the bottom of the graph is the recalibration error signal for testing of the sensor.

The rotating ring is a ribbon of different types of materials that are wrapped around a non-conducting disk. The ribbon is a 1-inch tall by 32 inches long strip that is wrapped around a non-conducting rotating ring that we described in figure 13. The electric field changes that are observed are diagramed in figures 14 and 15. The ribbon is coated with high resistance coating.

The charge distribution on this conductor and the static electric field from this conductor when it is not rotating will be the same as the positive capacitor plate ground with the stationary ground ring acting as the other plate. This rotating ring and guard ring forms a capacitor with a capacitance of about 100 pf.

Electrical Field observed from the face of the ring when it is not rotating

$$\Phi_E = \oiint_S \vec{E} \cdot d\vec{A}$$

$$\Phi = E2A = \frac{\sigma A}{\varepsilon_{rel}} \qquad \varepsilon_{rel} > \varepsilon_0$$

$$E = \frac{\sigma}{2\varepsilon_0}$$

The left graph in Fig. 16 is the increase in the electric field that is seen at different ribbon speeds in m/s. This increase in the electric field is composed of two components from the terms $-\frac{\partial \vec{V}}{\partial t}\frac{\Phi}{c^2} \; -\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in equation (7). At low speeds, the increase in the electric field is mostly from the term $-\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$. At 50 M/S, the potential read by the electrostatic meter has increased by 70 volts. The red plot on the right graph is the increase in the electric field that is seen on the outside of the disk over time from the term $\vec{\nabla} \cdot \frac{\vec{V}}{c}\Phi$ in equation (8). In this run the electric field from this material increased the potential seen by the electric field meter on the outside of the ring by 350 volts over about 20 hours of rotation. The green plot on the right graph is the sensor error voltage. The drift voltage from this type of sensor is normally 0.0 ± 5.0 volts over the same period of time.

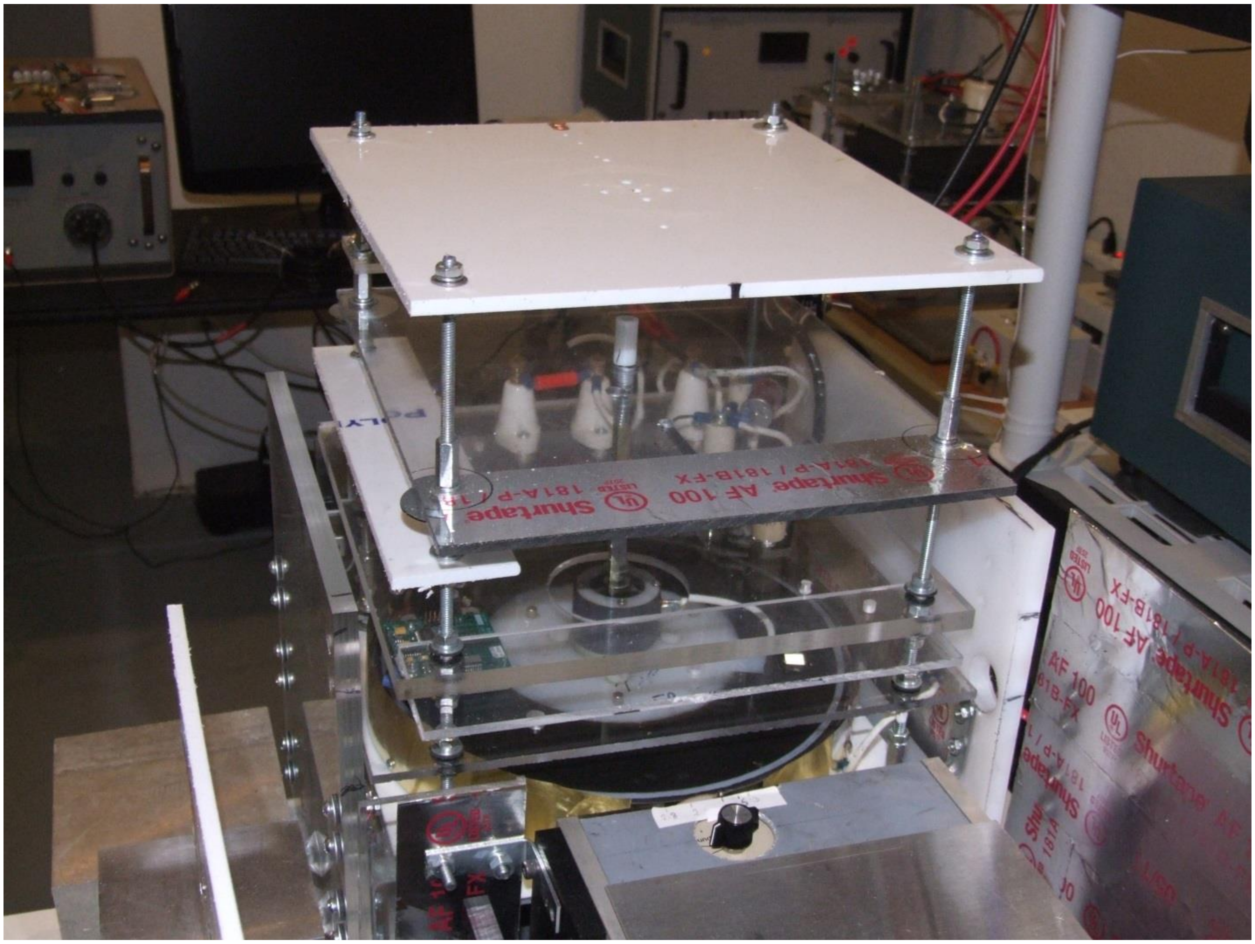


Figure 17

This is a picture of the “Rotating Ring Test System” that was used to get the data shown in the previous screen shot.

Geometric Amplification

A conductor has the requirement that the static electric field inside the conductor to be near zero. In a charged flat conducting sheet, the charge has a distribution of the mobile negative electric charges in the sheet to keep the electric field near zero inside the sheet. That means that most of the mobile negative charges will be near the edge of the sheet. This redistribution of the mobile negative carriers creates an electric field that is perpendicular to the surface of the sheet. The electric field that is seen from the flat conducting sheet is shown below:

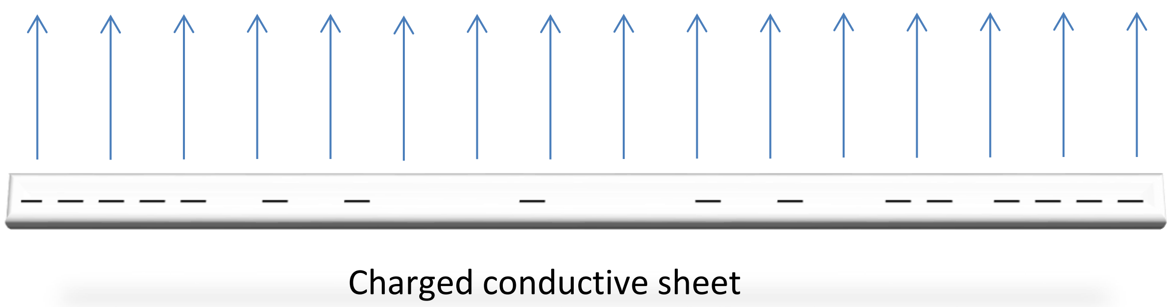


Figure 16

However, if this sheet were a plate of a capacitor the plate would have the same electric field but a different charged distribution in the plate. Since now, our physical conditions would force the electrons to space themselves out evenly across the sheets.

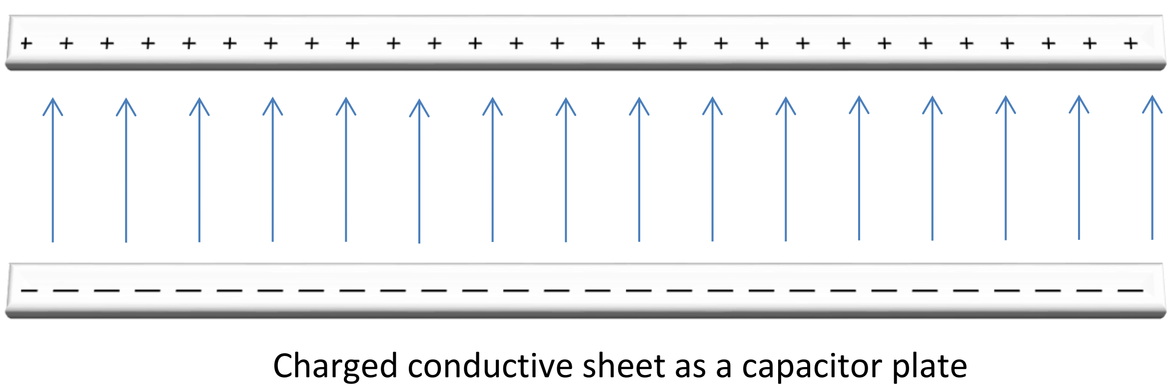


Figure 17

Mathematically these two different physical conditions create the same electric field due to requirement that the electric field be zero in the conductor. Today the electrical engineer would use a simpler plane integral for both of these physical conditions since we know that the electric field is going to be uniform across the face of the sheet because of this physical condition. Mathematically engineers do not take into account this redistribution of the charges in the conductor and use a simpler equation for the electric field from both of these conditions:

Electrical Field Over a capacitor plate

$$\Phi_E = \oiint_S \vec{E} \cdot d\vec{A}$$

$$\Phi = E2A = \frac{\sigma A}{\varepsilon_0}$$

$$E = \frac{\sigma}{2\varepsilon_0}$$

However, this is only valid for the plate of a capacitor. This simplified equation has the assumptions built into it that only a capacitor plate would have. We will have to calculate the true charge distribution for a conductive sheet. This distribution will change depending on charged objects that are near this sheet.

To determine the charge distribution from this conductive sheet we now have to use the mathematical operation of convolution of the equation of the electric field from a non-conductive sheet and a constant where we set the electric field to constant and vary the charge density.

Electrical Field equation convoluted with a constant

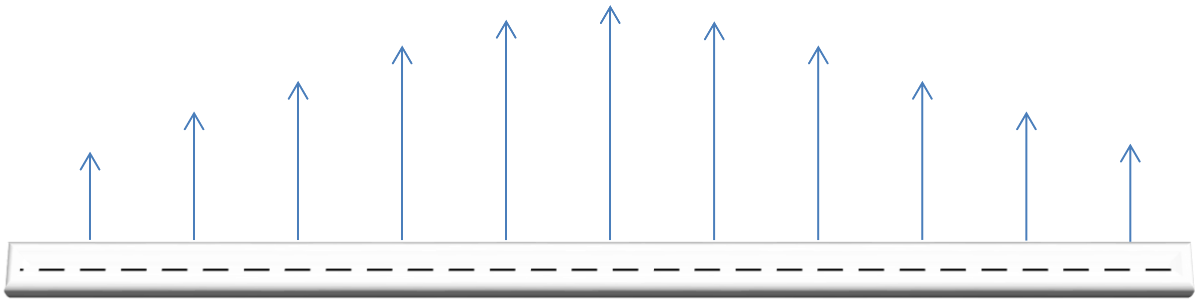
$$E(x,y) * K = \frac{\sigma(x,y)}{\varepsilon_0}$$

This requires that we derive the electric field from an evenly charged non-conductive sheet first.

There is no redistribution of the mobile negative charges on charged insulators, since there are no mobile charges. Therefore, the requirement that the electric field to be zero inside the insulator is not met for charged insulators. The integral now has to be done as if the charges were isolated charges arranged in a sheet.

This is at odds with the current mathematical framework used today to describe the electric field from non-conducting sheets. Today an engineer or physicists would use the same set electric field equations for a charged conductive sheet and a non-conductive sheet. If there was a set of isolated individual charges arranged in a plane that were close to one another then mathematically we would derive a much different electric field from this set of individual charges arranged in a plane than a charged conductive plane.

Therefore, we get different electric field from a non-conducting sheet if it has a constant charge density. The electric field from a charged non-conducting sheet would look like figure 18.



Uniformly charged non-conducting sheet

Figure 18

The electric charge in or on an insulator will **NOT** redistribute to keep the electric field in the insulator to be near zero. A uniformly insulated charged sheet is the same as a sheet of disconnected point charges that now follow the rules of superposition. If the charge distribution is constant, the electric field at the center of the flat charged surface is going to be greater that the electric field near the edges due to the increase in the electric potential at the center of the disk. This is the consequence of the non-perpendicular components of the individual charges electric fields for the charges at the edge of the sheet reinforcing the electric fields of the charges near the center of the sheet.

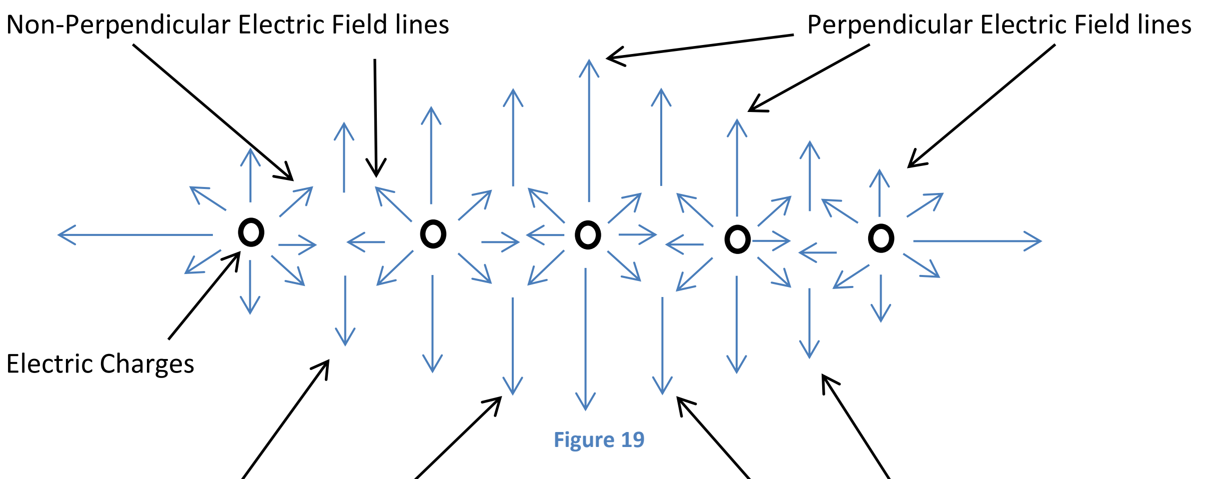


Figure 19

Resulting re-enforced electric field Lines of the vertical component from the non-perpendicular electric field lines.

The horizontal components of the non-perpendicular electric components of the individual charges amplify the electric field at the edges of the sheet. While the electric field from the horizontal components at the center of the sheet are zero.

These are two examples of geometric amplification of the static electric field from a uniformly charged insulating flat sheet like a charged plastic sheet like polypropylene that is dependent on the view of the charged sheet.

Mathematically this is a double integral of the potentials of the charges on the sheet.

Electrical Field Over a uniformly charged insulated sheet

Charge density = ρ Distance from center of sheet = d 1/2 Length $= L$ Area of sheet = $2L \times 2L$

$$\Phi_E = \int_{-L}^{L}\int_{-L}^{L} \vec{E} \cdot dA$$

$$E(d) = \frac{\rho d}{4\pi\varepsilon_0}\int_{-L}^{L}\int_{-L}^{L} \vec{E} \cdot dA$$

$$E(d) = \frac{\rho d}{4\pi\varepsilon_0}\int_{-L}^{L}\int_{-L}^{L} \frac{1}{\left[x^2 + y^2 + d^2\right]^{\frac{3}{2}}} dydx$$

.....

$$E(d) = \frac{\rho}{2\pi\varepsilon_0}\left\| \left[Tan^{-1}\left(\frac{\sqrt{2L^2 + d^2}}{d}\right) - Tan^{-1}\left(\frac{d\left(d^2 + 3L^2\right)}{\left(L^2 - d^2\right)\sqrt{2L^2 + d^2}}\right)\right] + \frac{\pi}{2}\right|$$

The complete derivation is below.

http://links.uwaterloo.ca/math227docs/set7.pdf.

This same equation in Cartesian coordinates is below.

$L = 1$

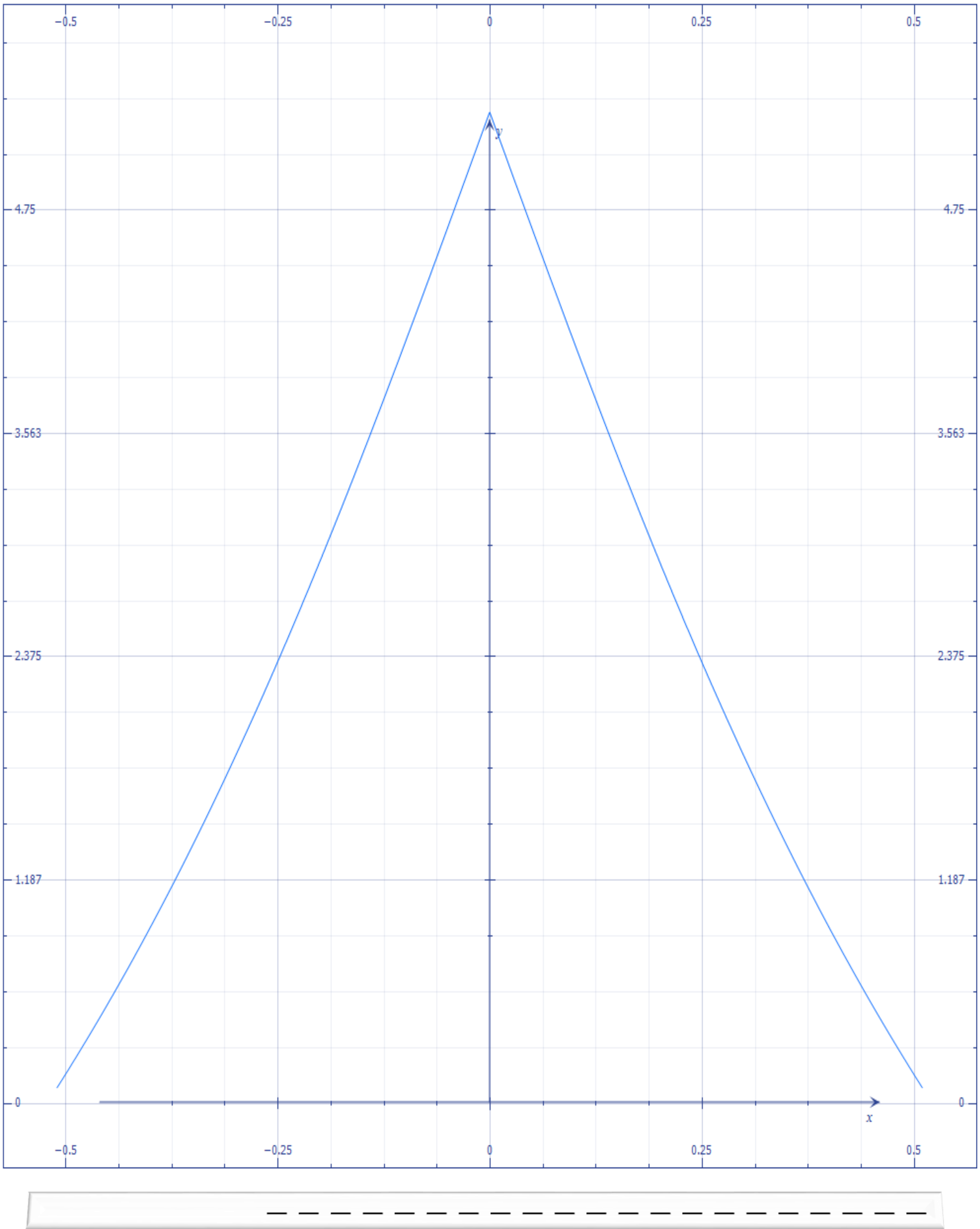
The sheet is square and the size is constant.

$$E(x,y) = \frac{\rho}{2\pi\varepsilon_0}\left\| \left[Tan^{-1}\left(\frac{\sqrt{2 + x^2}}{x}\right) - Tan^{-1}\left(\frac{x\left(x^2 + 3\right)}{\left(1 - x^2\right)\sqrt{2 + x^2}}\right)\right]\right\| + \left\| \left[Tan^{-1}\left(\frac{\sqrt{2 + y^2}}{y}\right) - Tan^{-1}\left(\frac{y\left(y^2 + 3\right)}{\left(1 - y^2\right)\sqrt{2 + y^2}}\right)\right]\right\|$$

The electric field is going to look the same when viewed from all four sides of the sheet. Just one side plotted as a 2D plot of the electric field of the non-conductive sheet with a uniform charge density when viewed from the edge of the sheet along the X-axis is below.

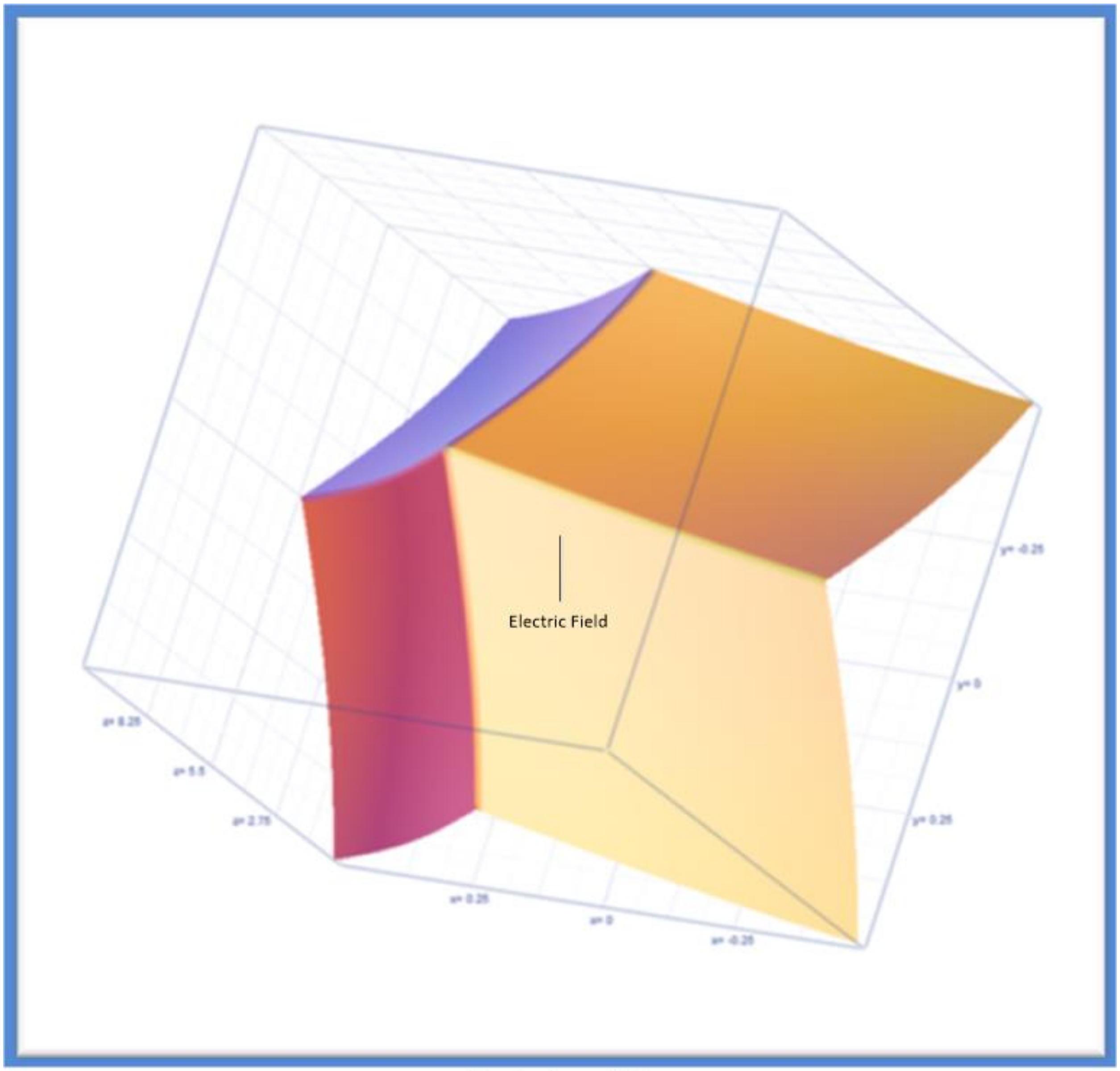
$$E(x) = \frac{\rho}{2\pi\varepsilon_0}\left\| \left[Tan^{-1}\left(\frac{\sqrt{2 + x^2}}{x}\right) - Tan^{-1}\left(\frac{x\left(x^2 + 3\right)}{\left(1 - x^2\right)\sqrt{2 + x^2}}\right)\right]\right\|$$

Plot of Electric Field from a uniformly charged non-conductive sheet



The electric field intensity is greatest at the center of the sheet from this equation. This increase in the electric field at the center of the sheet is the mathematical description of geometric amplification.

3D Plot of Electric Field from a uniformly charged non-conductive sheet



Uniformly Charged Sheet

Figure 20

The X-axis and Y-axis is the face of the sheet. X =zero and Y=zero is the center of the sheet. The Z-axis is the electric field intensity. The view is from above at an angle so that all the faces are visible.

To find out what the charge density of the electrons in a conductive sheet we then set the electric field to be constant and allow the charge density to be variable. Then we get the following equation:

The Charge Density of a Conductive Sheet pesenting a constant Electric Field

$$E(x,y)=\frac{\rho(x,y)}{2\pi\varepsilon_0}\left[\left|\left[Tan^{-1}\left(\frac{\sqrt{2+x^2}}{x}\right)-Tan^{-1}\left(\frac{x\left(x^2+3\right)}{\left(1-x^2\right)\sqrt{2+x^2}}\right)\right]\right|+\left|\left[Tan^{-1}\left(\frac{\sqrt{2+y^2}}{y}\right)-Tan^{-1}\left(\frac{y\left(y^2+3\right)}{\left(1-y^2\right)\sqrt{2+y^2}}\right)\right]\right|\right]$$

$$E(x,y)=\text{ Constant }=1$$

$$\rho(x,y)=\left|\frac{2\pi\varepsilon_0}{\left[\left|\left[Tan^{-1}\left(\frac{\sqrt{2+x^2}}{x}\right)-Tan^{-1}\left(\frac{x\left(x^2+3\right)}{\left(1-x^2\right)\sqrt{2+x^2}}\right)\right]\right|+\left|\left[Tan^{-1}\left(\frac{\sqrt{2+y^2}}{y}\right)-Tan^{-1}\left(\frac{y\left(y^2+3\right)}{\left(1-y^2\right)\sqrt{2+y^2}}\right)\right]\right|\right]}\right|$$

2D Plot of Charge on a Charged Conductive Sheet from the X axis view

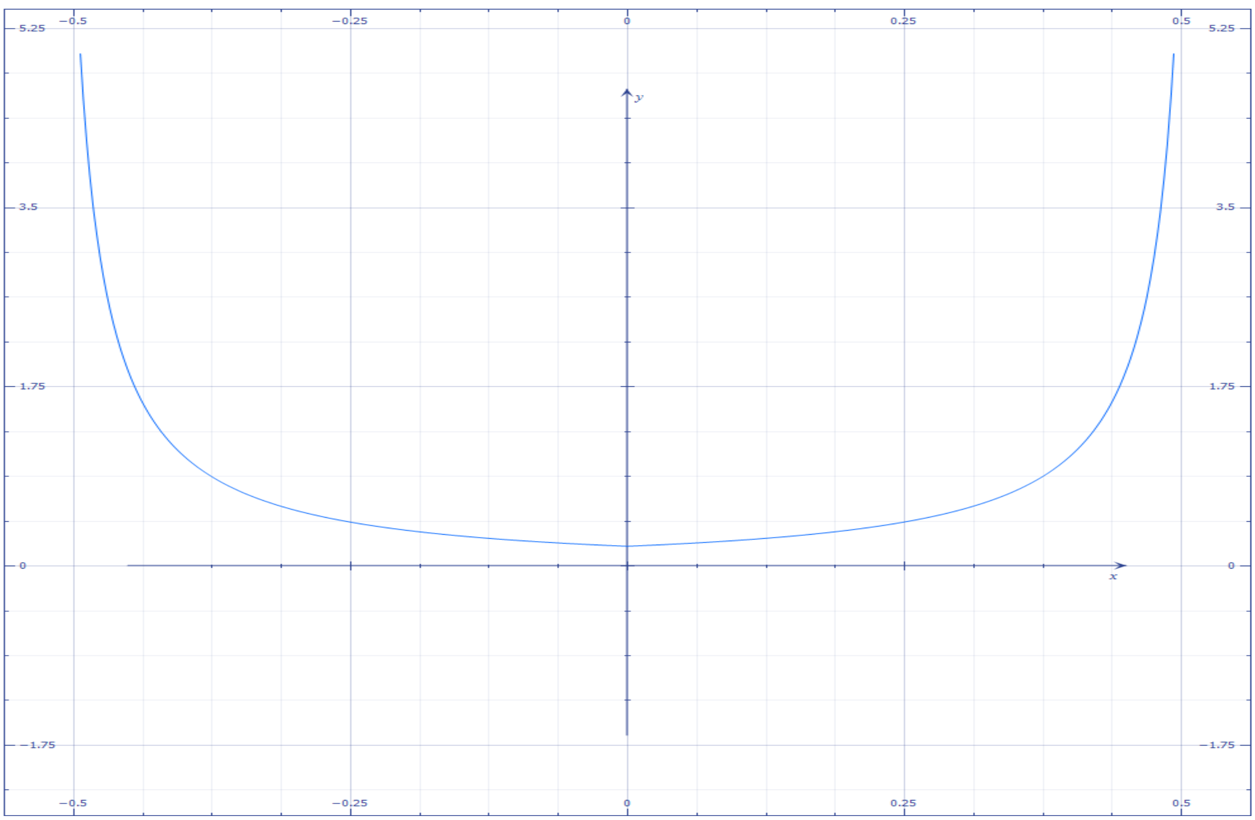


Figure 21

3D Plot of Charge Density on a Charged Conductive Square Sheet

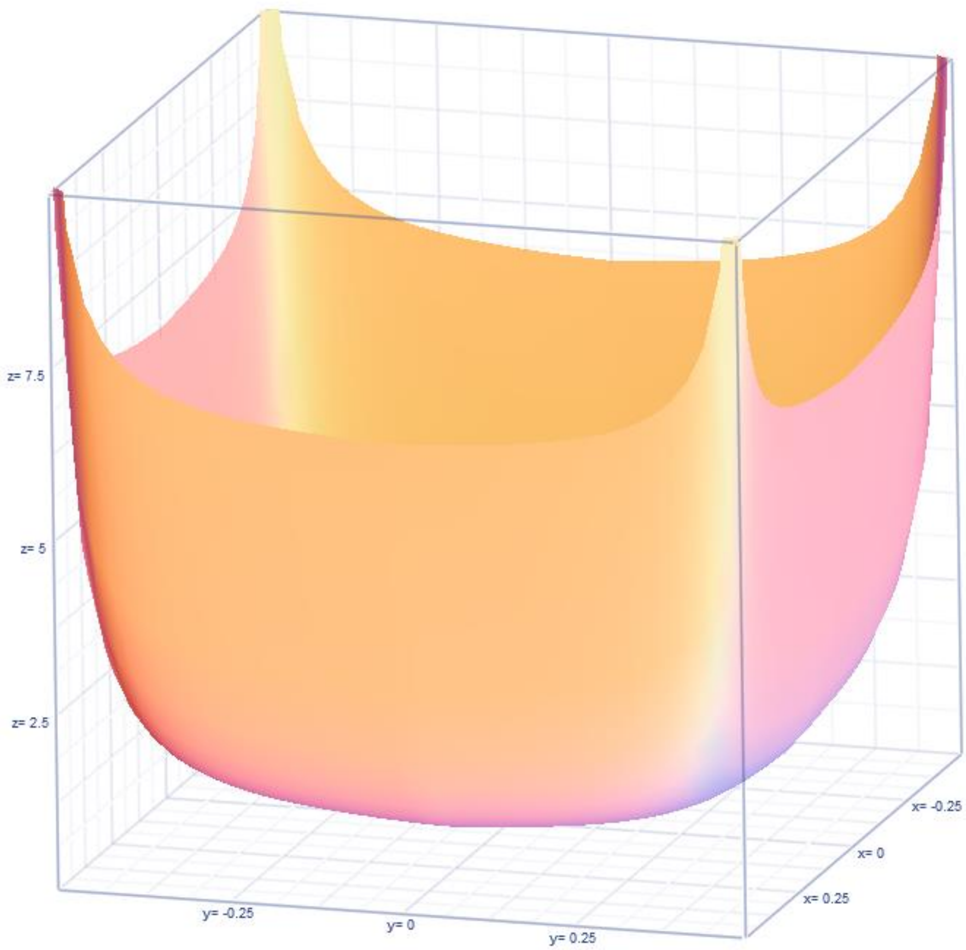


Figure 22

The X-axis and Y-axis is the face of the sheet. X =zero and Y=zero is the center of the sheet. The Z-axis is the charge density. The view is from above and from one side so that all the peak charge densities are visible.

This plot shows that the charge density is highest at the edges and corners of our conductive square sheet. This plot is assuming that there are no other charged elements nearby to sheet that would affect our charged distribution.

These differences in the electric fields and charge densities from a charged conductive and non-conductive sheet influence how these different sheets will amplify their electric fields due to relative motion.

Geometric amplification of the changes to the electric field from the effects of relativity (the complex electric field) is possible. In fact, the complex electric field that is observed from the relative velocity of the charges when viewed from a different inertial frame of reference is modified similarly for conductors and insulators. The requirement that the electric field to be near 0 in its inertial frame of reference is always met since the velocity of the conductor in its inertial frame of reference is always 0. This keeps the mobile negative charges from redistributing and affecting the complex electric field if the charged object is in the same inertial frame of reference.

This allows a uniform electric field to change and be amplified depending on the charged objects relative velocity to an electric field with a much different shape. This is true only if the elements of the conductor do not cross an inertial frame of reference. If elements of a conductor do cross into a different inertial frame of reference, then the sections of the conductor that are in the different inertial frames of reference will attempt to keep the electric field near 0 through all the sections of the conductor. This effect will tend to “**SHORT OUT”** the amplification of the complex electric field***.***

Charged moving conductors crossing inertial frames of reference are the major reason that the geometric amplification of relativistic electric fields is not observed in modern electric equipment today.

Isolated charged conductors may or may not see geometric amplification of the complex electric field depending on their shape. A moving charged curved surface will usually have no geometric amplification while a moving charged flat surface will.

An example of a shape that will have geometric amplification of the complex electric field is a charged moving plastic sheet like polypropylene with a static charge on it. When this sheet is viewed perpendicular to the direction of motion from a different inertial frame of reference the complex electric field will change in the same was as an insulated charged sheet would as shown in the equation below.

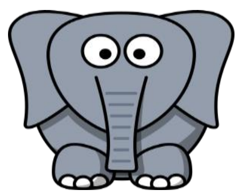
$$E(x,y) =$$

$$\frac{\rho}{2\pi\varepsilon_0}\left\|\left[Tan^{-1}\left(\frac{\sqrt{2+x^2}}{x}\right) - Tan^{-1}\left(\frac{x\left(x^2+3\right)}{\left(1-x^2\right)\sqrt{2+x^2}}\right)\right]\right\| + \left\|\left[Tan^{-1}\left(\frac{\sqrt{2+y^2}}{y}\right) - Tan^{-1}\left(\frac{y\left(y^2+3\right)}{\left(1-y^2\right)\sqrt{2+y^2}}\right)\right]\right\| +$$

$$\frac{\rho\left(\frac{\vec{V}_x}{c}\right)}{2\pi\varepsilon_0}\left\|\left[Tan^{-1}\left(\frac{\sqrt{2+y^2}}{y}\right) - Tan^{-1}\left(\frac{y\left(y^2+3\right)}{\left(1-y^2\right)\sqrt{2+y^2}}\right)\right]\right\| \text{ This Term is from the Relative Motion in the X Axis}$$

A conducting sheet will also increase at the center but since most of the charges are at the ends of the sheet, the geometric amplification of the complex electric field will depend on the charge density at each point on the sheet. That will then include another double integral that is done for the charge density.

Then there is the elephant in the room that was pointed out by Einstein in 1905 that no one admits that it is there.



Moving charges outside of a conductor do not produce the magnetic force that can be described by a magnetic field. Yet if you were to even imply today to any electrical engineer or physics PhD that the numerous chapters describe a magnetic field being generated from an isolated moving charge like an electron beam or proton beam in graduate level textbooks is wrong….

This is at odds with what is generally being taught today. All most all-undergraduate or graduate text books from graduate level physics and electrical engineering courses that will ***assume*** that the sheet has the simplest representation of the electric field for a conductor or non-conductive moving sheet.

Electrical Field over a sheet

$$\Phi_E = \oiint_S \vec{E} \cdot d\vec{A}$$

$$\Phi = E2A = \frac{\sigma A}{\varepsilon_0}$$

$$E = \frac{\sigma}{2\varepsilon_0}$$

Then they will ***assume*** that the moving sheet will produce a magnetic field that will now attract a magnet or another electric current from a wire. The moving sheet is moving towards you the reader or out of the page:

Magnetic Field

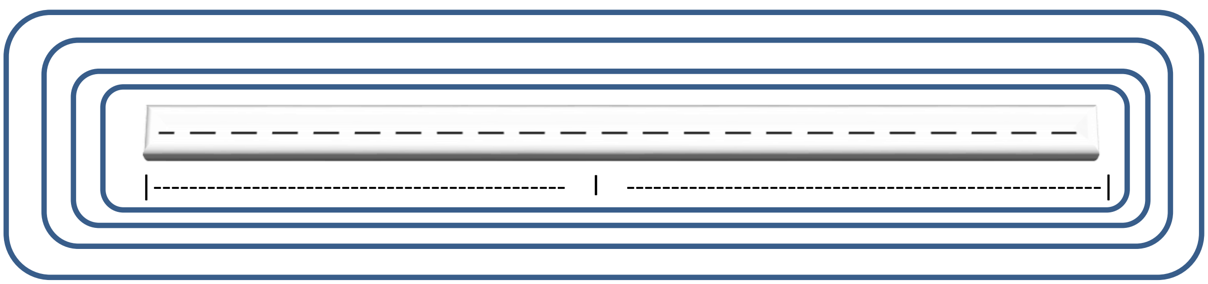


Figure 23

Then the magnetic field from a negatively charged sheet moving into or out of the page would be calculated as:

Magnetic Field over a moving charged sheet

$$\oint \overrightarrow{B_z} \cdot d\overrightarrow{l_x} = \mu_0 \overrightarrow{I_y}$$

$$J = j_0 \left(\frac{A_{mperes}}{l} \right)$$

$$2B_a = \mu_0 \overrightarrow{I_y} = \mu_0 j_0 l$$

$$B = \frac{\mu_0 j_0}{2}$$

$$B = \frac{\mu_0 A_{mperes}}{2l}$$

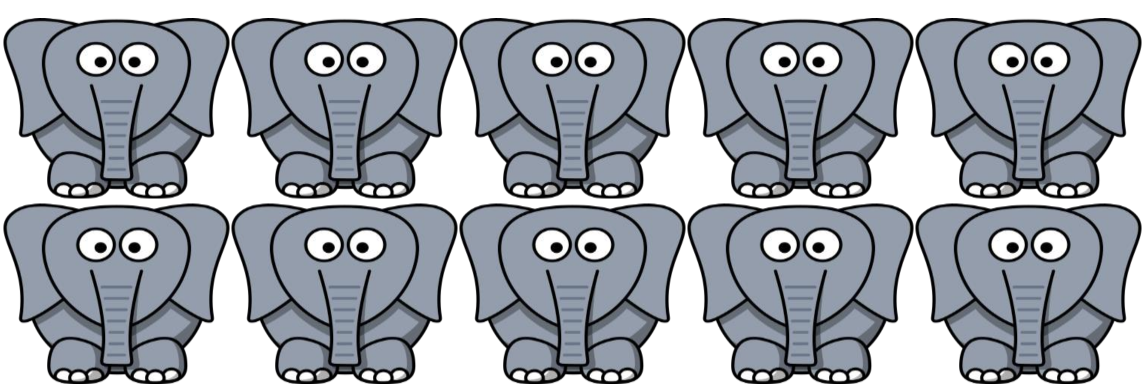
This derivation is done many places including the YouTube video:

https://www.youtube.com/watch?v=56ozmuMH1qA&list=RD56ozmuMH1qA

It should be pretty obvious now that we don't have two separate charges in two different inertial frames of reference in the same object as such we can't generate a magnetic force that the magnetic field is defined from. There is not going to be a magnetic field being generated from a moving charged non-conductive or conductive sheet.

However, this charged moving sheet will still respond to the magnetic field from a conductor with an electric current. The force on the sheet will be ½ of what a sheet of wires conducting an electric current would observe if arranged in a similar shape as a charged sheet. *That is if the charged sheet is not smooth…*

Nevertheless, these same set of derivations for the magnetic field have been used for over 100 years to describe magnetic fields from electrical convection currents that do not exist. This misapplication has colored our word view of the true nature of the forces around us.



Complex Electric Field Amplification

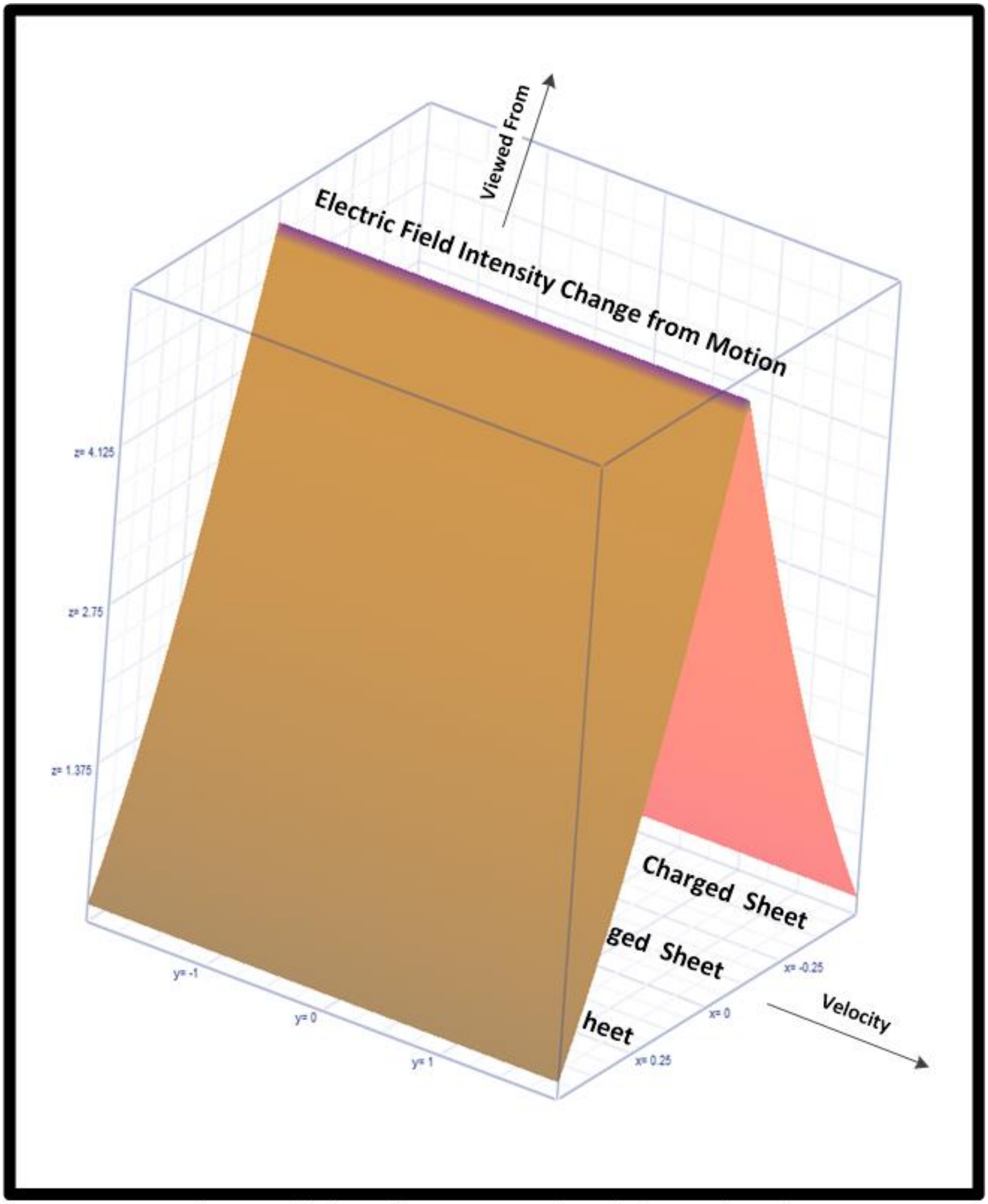
The new extra term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in the electric field equation (7) describes the increase in the complex electric field that is seen by an observer in a different inertial frame reference when the charge is viewed from a perspective that is perpendicular to $\vec{V}$. This term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ is capable of being amplified in the same manner as a charge on an insulator. This geometric amplification is not affected by the requirement that the electric field be near zero in a conductor if the conductor is in the same inertial frame of reference. The electrons in a conductor that have a relative velocity to the observer will not redistribute themselves in response to the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ that the observer in a different inertial frame of reference sees from the velocity of the charged object. The reason is that the charges have a relative velocity of '0' to themselves so the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in the charges inertial frame of reference is '0'. Nevertheless, it is not '0' in different inertial frames of reference. This gives the effect where different observers will see a different total electric field when its static electric field is viewed from different inertial frames of reference.

The relative velocity term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ will amplify itself from a moving charged flat sheet when viewed from a view that is perpendicular to the direction of motion of the charged sheet. This is the consequence of the non-perpendicular components of the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ from the individual moving charge's electric fields for the charges at the edge of the sheet reinforcing the electric fields of the charges near the center of the sheet. This amplification will be different from the amplification from a charged conductive sheet since the charge density is different from the static charges on a uniformly charged insulator.

The Mathmatical Term for the Electric Field Change from the Relative Motion on the X Axis is

$$E(x,y) = \frac{\rho\left(\frac{\vec{V}_x}{c}\right)}{2\pi\varepsilon_0}\left\|\left[Tan^{-1}\left(\frac{\sqrt{2+y^2}}{y}\right) - Tan^{-1}\left(\frac{y\left(y^2+3\right)}{\left(1-y^2\right)\sqrt{2+y^2}}\right)\right]\right\|$$

The electric field is diagramed on the next page:



Electric Field Change from a Moving Charged Sheet to the right

Figure 24

This type of geometric amplification of the electric field from its relative motion is not observed from curved surfaces such as a sphere.

This particular type of geometric amplification has been reported in the case study:

```
7.7 CASE STUDY - LARGE PLASTIC WEB ELECTROSTATIC PROBLEMS, RESULTS AND
   CURE, D. Swenson, 3M Company
   Tremendous static charge generation on a plastic web causes unique
   physical phenomena and special problems. Solution was simple and cost
   effective.
```

A summary of this case study is at http://amasci.com/weird/unusual/e-wall.html

This type of geometric amplification is diagrammed on the next page.

Electric Field from a U Shaped uniformly charged moving non-conducting plastic sheet

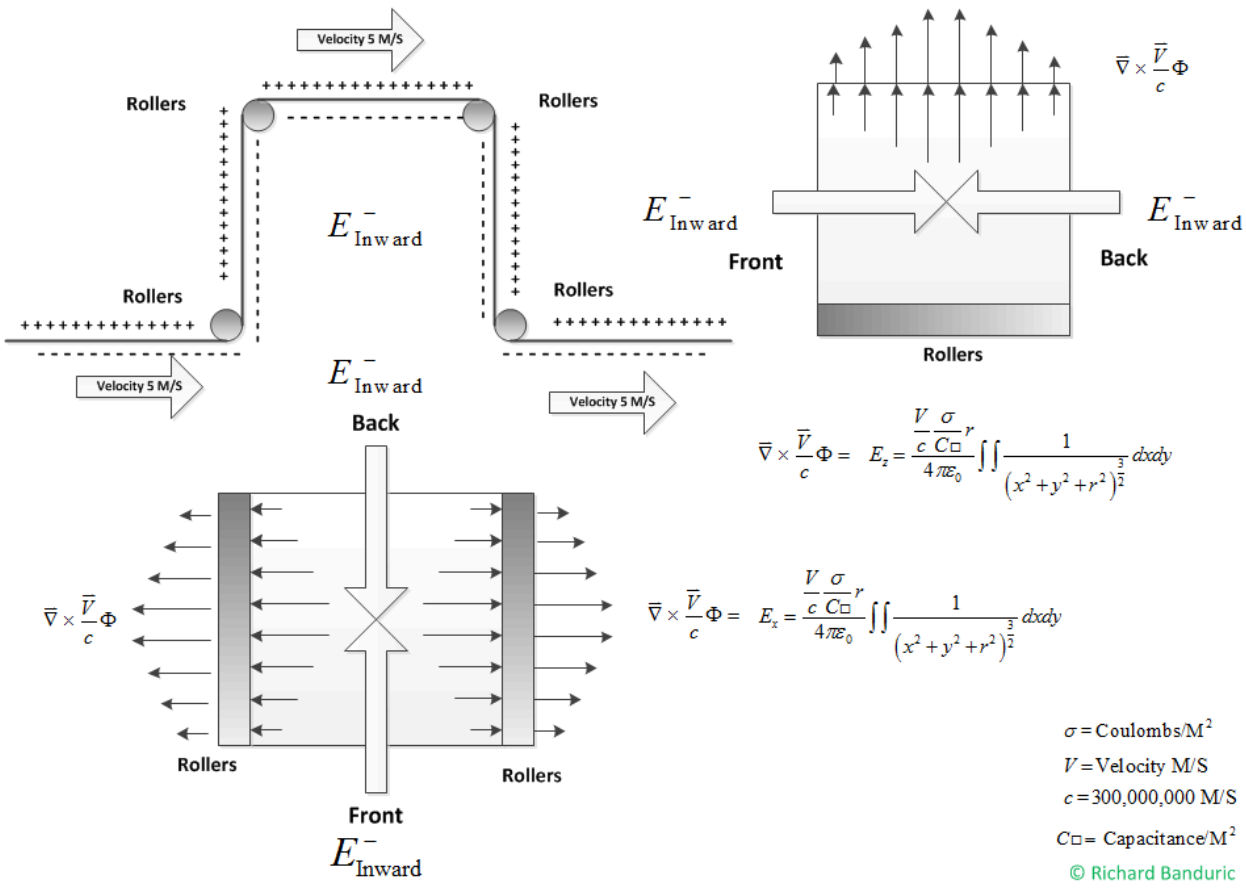
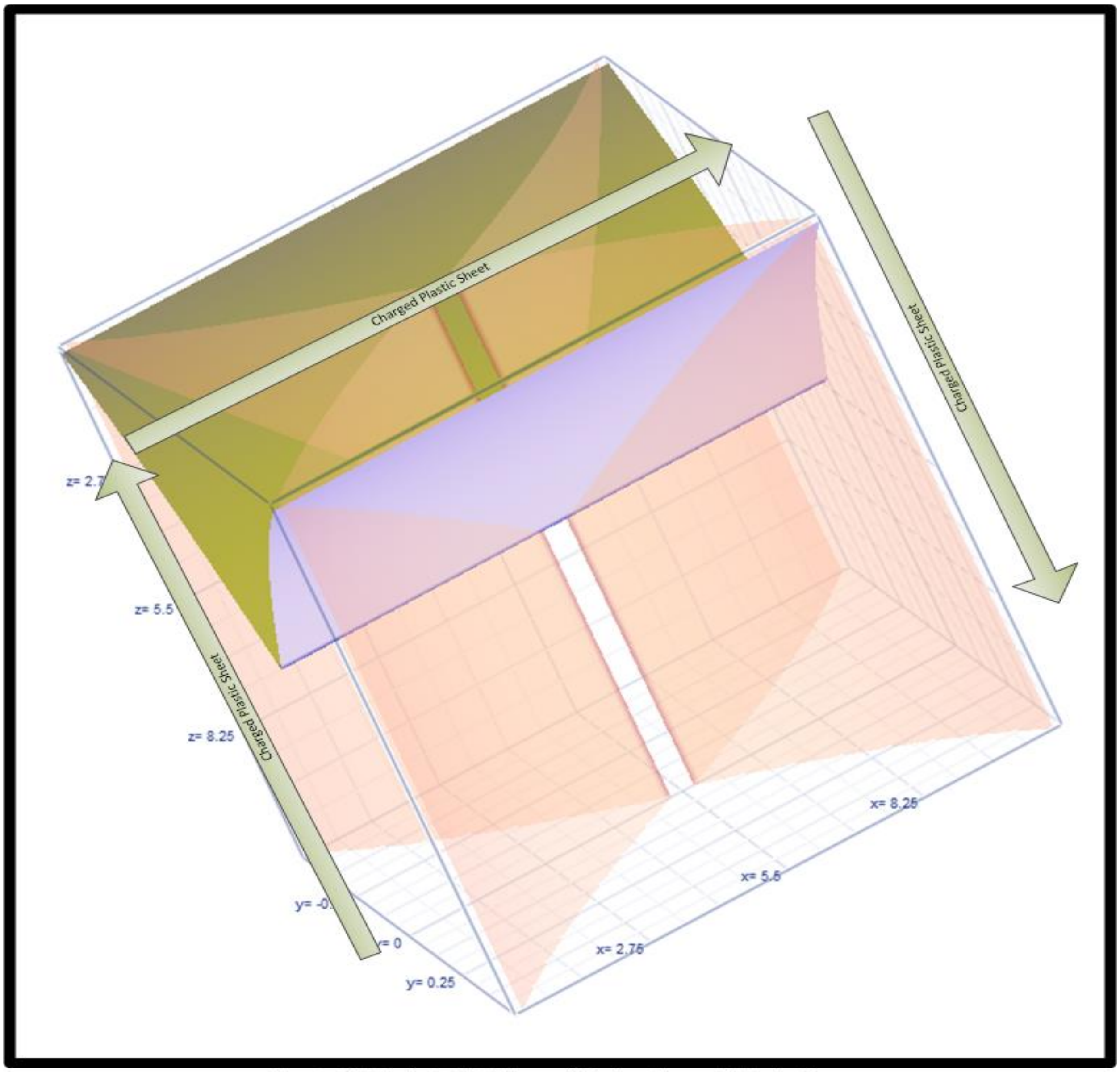


Figure 25

This type of amplification was seen as the appearance of a new electric field E^{-}_{Inward} inside the tunnel of moving uniformly charged plastic sheet. This new electric field was the result of the increase in the relativistic component $-\overline{\nabla} \times \dfrac{\overline{V}}{c}\Phi$ of the total electric field at the center of the moving charged sheets from their relative motion. This resulted in a negative electric field component that is seen pointing into the tunnel that will create an outward force to any negatively charged object that tries to enter the tunnel. This force would then appear to be an "electrostatic Wall" near the center of the moving sheet. If the charged object were conductive, like a person, then the negative charges would migrate way from the center of the sheet inside the person. This would give the person a positive charge on the front of the person that is closest to the center. This results in a flypaper effect where the person has to rotate to unstick himself or herself from the apparent invisible wall to exit from the tunnel.

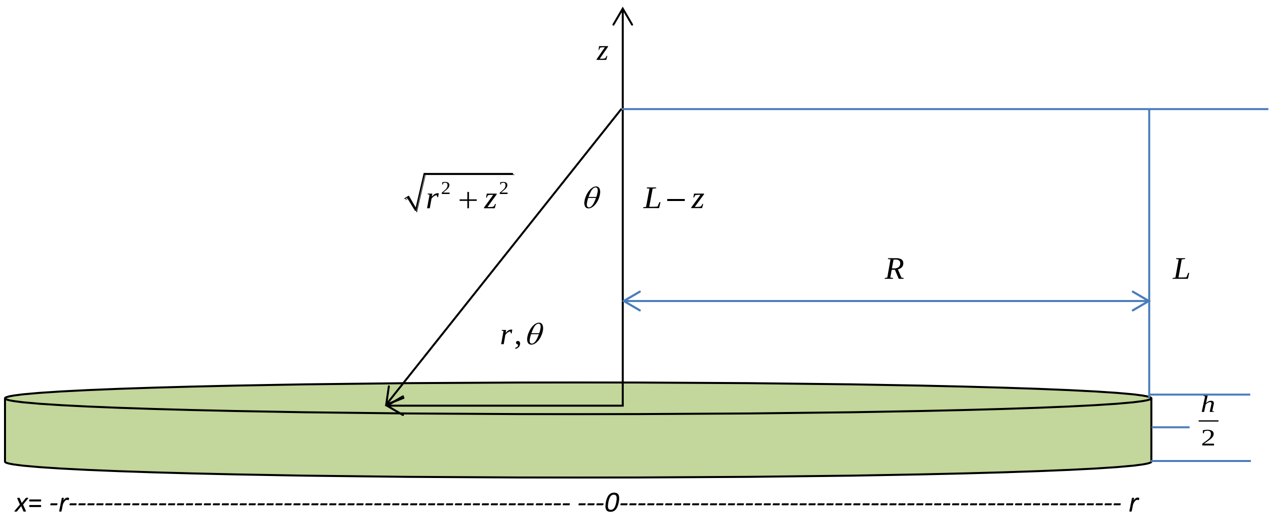


Electric Field of a 3 Sided Tent of Moving Charged Plastic Sheet

Figure 26

Then there is the "***Solution was simple and cost effective***." of ***"Just ground it!"*** and no one had to explain that the current electrometric view of the world might be wrong along with keeping the production of plastic sheets on track. But of course, a discovery that might have totally changed the world that we live in got swept under the rug and no one had to look bad trying to explain something that no one was even going believe anyway, even today…

This type of geometric amplification is also observed with any type of smooth charged flat surfaces. A rotating charged smooth uniformly charged disk is one example diagramed below:



L = 1 for simplicity

$\sigma = \frac{Q}{\pi R^2}$ Coulombs/meter^2

The first step is to calculate the electric field along the z-axis at the center of the disk.

A positively charged **conductive** surface we have to take into account the thickness of the disk.

$$E(z) = \int_{-\frac{h}{2}}^{+\frac{h}{2}} \int_0^R \frac{\sigma}{2 \cdot \varepsilon_0 (r^2 + (1-z)^2)} \cdot r \cdot \cos\theta \cdot dr \cdot dz$$

$$E(z) = \frac{\sigma}{2 \cdot e_0 \cdot h} \int_{-\frac{h}{2}}^{+\frac{h}{2}} \left(\frac{1-z}{(1-z)^2} - \frac{1-z}{\sqrt{R^2 + (1-z)^2}} \right) \cdot dz$$

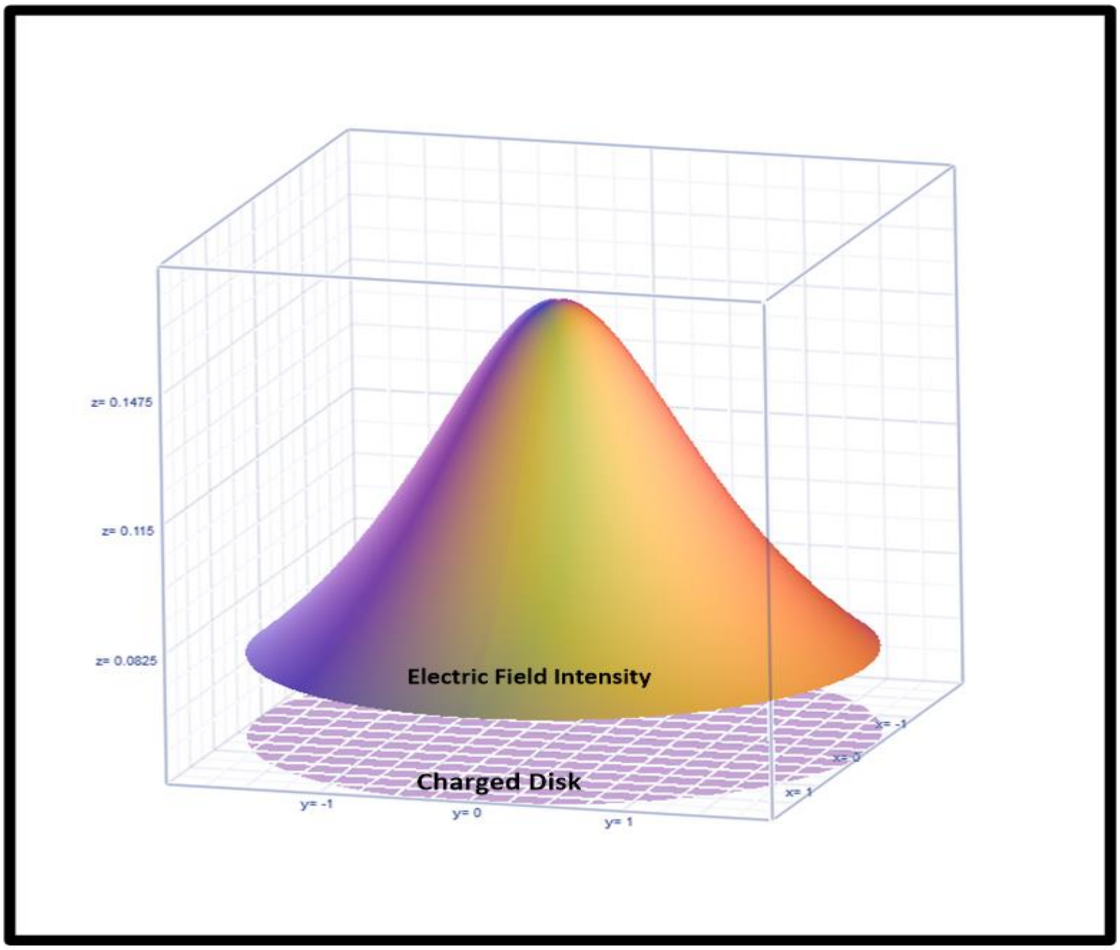
For a negatively charged smooth surface all the charge is at the surface so h = zero

$$E_{center}(z) = \frac{\sigma}{2 \cdot \varepsilon_0} \left[1 - \frac{z}{\sqrt{z^2 + R^2}} \right] \check{z}$$

The electric field caused by a disk of radius R with a uniform fixed positive surface charge density $\boldsymbol{\sigma}$ and total charge Q, at a point P. Point P lies a distance x away from the center of the disk, on the axis through the center of the disk.

$$E_x(z) = \frac{\sigma}{2 \cdot \varepsilon_0}\left[1 - \frac{z}{\sqrt{z^2 + \frac{R^2}{x^2}}}\right]\check{z}$$

Plot of the Electric Field from above the charged disk is:



Electric Field From a Uniformly Charged Disk

Figure 27

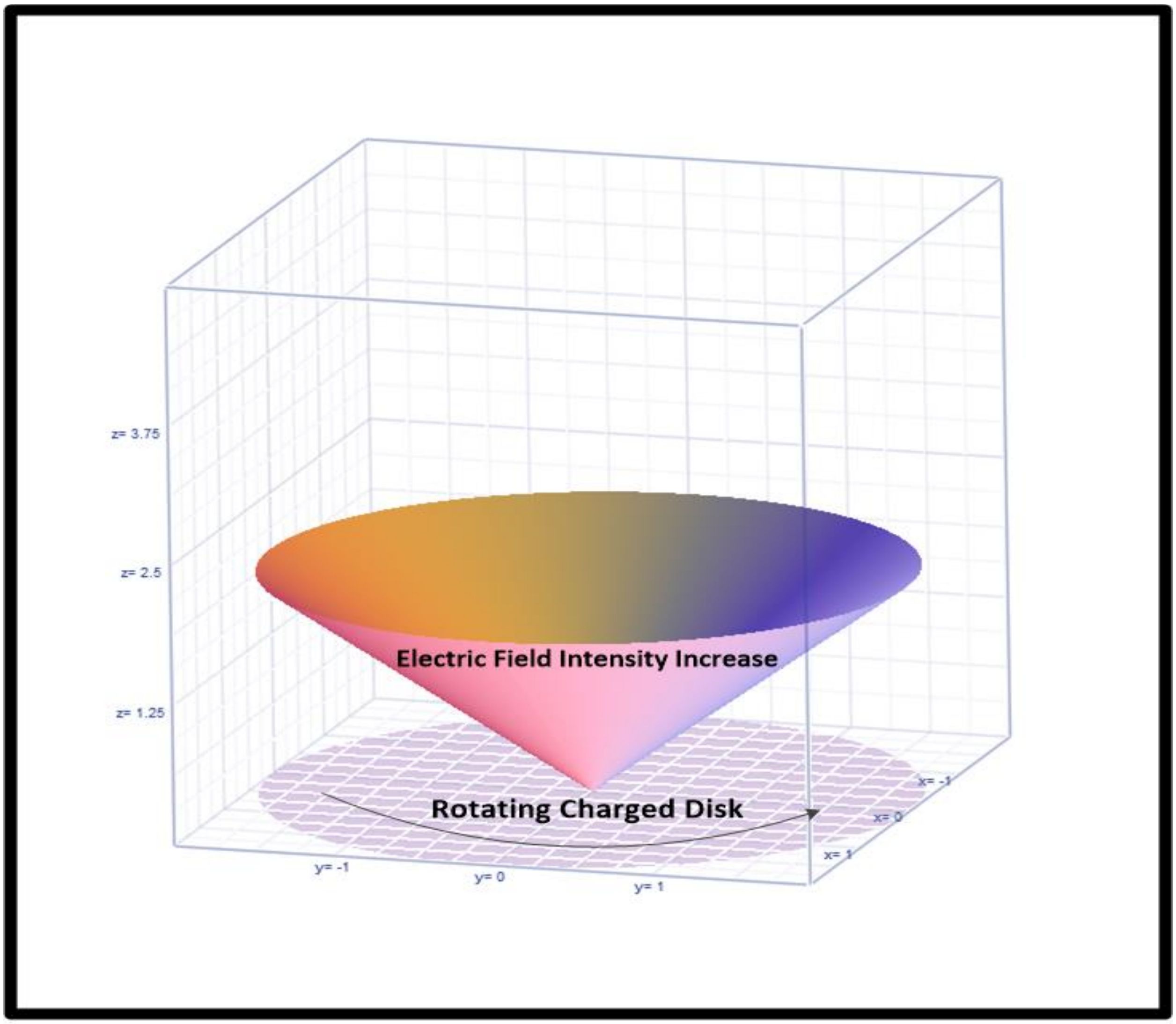
When this disk is rotated, the charges on the outside will have a relativistic electric field component of $\overline{\nabla} \times \frac{\vec{V}}{c}\Phi$ that increases the electric field intensity that is observed from the charges on the disk that is greatest at the edges of the disk.

Electrical Field Change from rotation of a uniformly charged insulated disk

Charge density = ρ Radius of disk = r Distance from disk = d Relative velocity = $\vec{V}$

$$E(r) = \left(\frac{2\pi r}{c}\right)\left(\frac{\rho d}{2\pi\varepsilon_0}\right) = \frac{r\rho d}{c\varepsilon_0}$$

The electric field change that is observed from above the rotating charged disk is:



Electric Field Change from a Rotating Uniformly Charged Disk

Figure 28

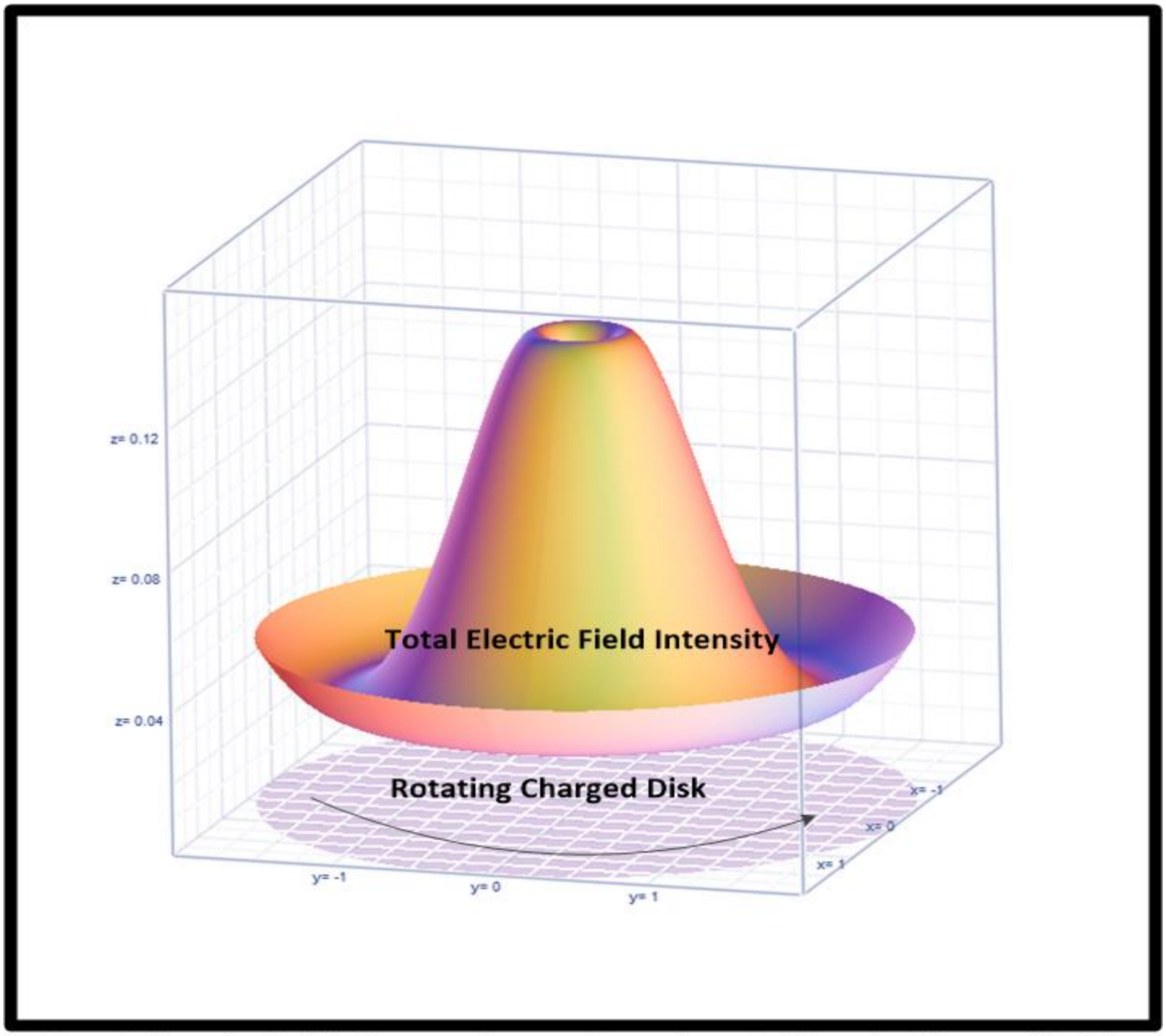
When the static electric field from the rotating charged disk is merged with the changes to the electric field difference when the disk is rotating the electric field that is observed from the disk is mathematical represented below:

Electrical Field Over a uniformly charged rotating insulated disk

Charge density = ρ Distance from center of disk = r Distance from disk = d

$$E(r) = \frac{\rho d}{2\pi\varepsilon_0}\left(\frac{1}{\left(\sqrt{r^2+1}\right)}\right) + \frac{r\rho d}{c\varepsilon_0}$$

The electric field change that is observed from above the rotating charged disk is:



Total Electric Field Change from a Rotating Uniformly Charged Disk

Figure 29

These equations are not taking into account the surface characteristics of the disk or the type on charges on the disk. If the disk is mirror smooth, then the lined-up potentials from the charges will geometrically amplify these electric field changes near the edges by an even greater amount similar to a line charge.

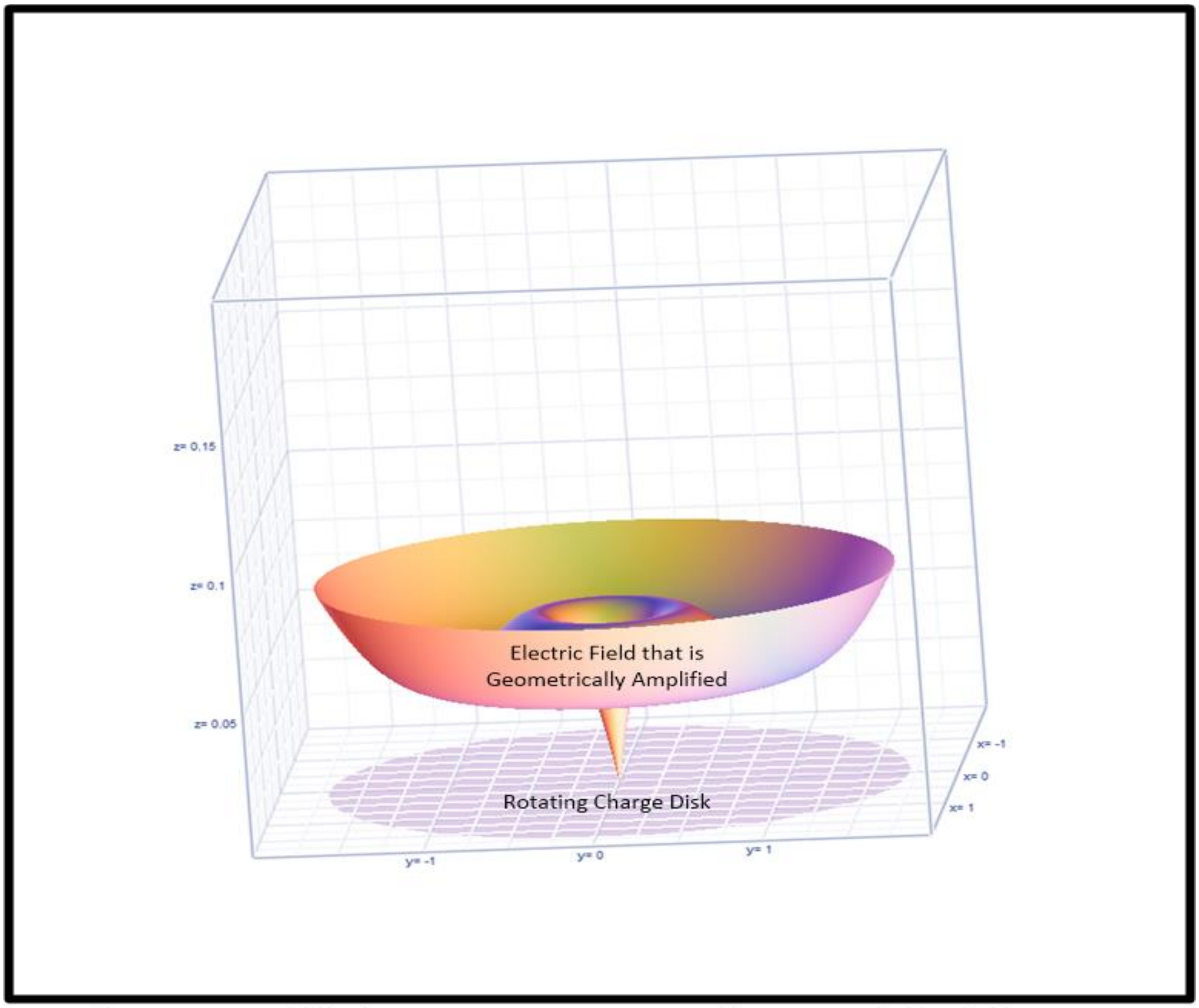
When this disk is rotated, most of the negative charges near the edges of the disk will have the highest velocities and the greatest change in their relativistic electrical fields. A disk with a smooth surface conductive coating will then see geometric amplification from the relativistic electric field component $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ from their neighboring charges while a rough surface conductive coating will not.

Electrical Field Over a uniformly charged rotating Smooth insulated disk

Charge density = ρ Distance from center of disk = r Distance from disk = d Rotations/Sec = R

$$E(r) = \frac{\rho d}{2\pi\varepsilon_0}\left(\frac{1}{\left(\sqrt{r^2+1}\right)}\right) + \frac{r\rho d}{c\varepsilon_0} + \left[\frac{\rho\left(\frac{2\pi Rr}{c}\right)}{2\pi\varepsilon_0}\left[\left[Tan^{-1}\left(\frac{\sqrt{2+r^2}}{r}\right) - Tan^{-1}\left(\frac{r\left(r^2+3\right)}{\left(1-r^2\right)\sqrt{2+r^2}}\right)\right]\right]\right]$$

The new term that is going to amplify the electric field that is dependent on rate of rotation of the disk. The faster the disk turns the greater the amplification of the electric field near the edges of the disk. This geometric amplification is only dependent on how immobile the charges are on the disk and how smooth the disk is.



Electric Field that is Geometrically Amplified from a Smooth Non-conducting Rotating Disk

Figure 30

This plot of a 9-inch rotating disk rotating at 10,000 RPM shows how much of a change in the electric field that can be observed from the stationary reference frame when a smooth nonconductive disk amplifies these electric changes from relative motion. If another 9-inch stationary charged nonconductive disk without a smooth surface is placed near the face of this disk, each of the disks will observe different electric fields because electric fields from charges in different inertial reference frames do not follow the rules of superposition. This is the basis for the magnetic field if these two different charges were contained in a conductor. This will produce a different set of forces on these disks that can be used to propel a spacecraft.

If two ***electrically isolated*** charged disks with different surface characteristics [they can be different surface types or shapes or sizes] will see different total electric fields from each other when rotated against each other. If these two disks are rotating against each other and are mechanically connected in an assembly, then the two-different relativistic electric fields that the static electric fields see on the two rotating disks will create a total force on the assembly that is not completely offset by the opposing forces seen on the other rotating disk. This effect was documented in the **European Patent 0486243A2 "Machine for Acceleration in a Gravitational Field." Filed Nov. 11, 1991, granted May 20, 1992** because of acceleration charges in a "gravity well". The effect was real but the reason was incorrect. The effect was caused by the interaction of two different relativistic electric fields against their electric static electric fields. Not the result of accelerating charges in a "gravity well". In this case, the difference in the sizes of the flat faces of the cylindrical electrodes was the source of the different relativistic electric fields that produced the forces reported.

European Patent 0486243A2

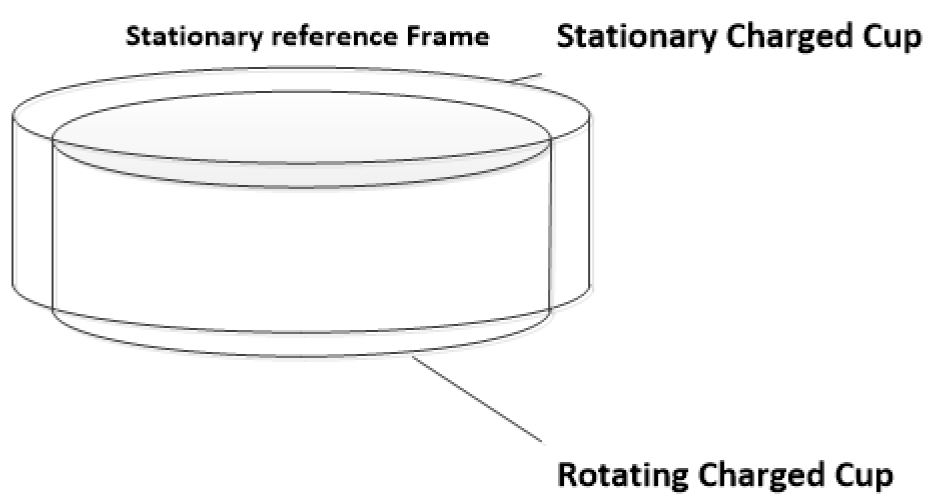


Figure 31

When the disks are charged and stationary, the two faces of the charged cups will form a capacitor with the charges that are uniform across the face with an electric field that is described by the following equation.

Electrical Field Over the Faces of the Cups

$$\Phi_E = \iint_S \vec{E} \cdot d\vec{A}$$

$$\Phi = E2A = \frac{\sigma A}{\varepsilon_0}$$

$$E = \frac{\sigma}{2\varepsilon_0}$$

That is until one of the cups start to rotate and the two faces of the cups are in relative motion to each other. If these cups are electrically isolated, as the patent requires then the electric fields from these two cups will not follow the rules of super position just as the rules of superposition do not apply to an electric current when the magnetic force is observed from the current.

Electrical Field Change from rotation of the charged faces of the cups

Charge density = ρ Radius of disk = r Distance from disk = d

$$E(r) = \left(\frac{2\pi r}{c}\right)\left(\frac{\rho d}{2\pi\varepsilon_0}\right) = \frac{r\rho d}{c\varepsilon_0}$$

These electric field changes are diagramed below:

Motional Electric Field of face of Top Cup

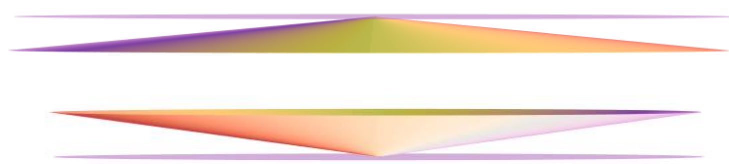


Figure 32

Motional Electric Field of face of Bottom Cup

The static electric field of the top face will observe an electric field change from the bottom-rotating cup that is going to be slightly smaller than the electric field change from the top face of the cup that the bottom cup observes. This is not even considering that the rotating face has an electric field difference from the centripetal acceleration of the charges that the stationary face does not have.

To observe these types of electric field changes from the two charged cups have to be electrically isolated by independent sources that have infinite source impedances like that is presented by an electrostatic generator.

The cups used in this patent were made with conductive materials that limited the forces from this device as the charges moved in response to the other cups electric field changes. If these cups were made of a nonconductive material, the effect would have been much greater and more easily observed.

Electric Fields from Conductive Surfaces

Today we use conductive elements to move electric force from point A to B that is created by power sources that have low impedances. The same properties that make conductive elements the optimum method to transfer electric power also make them the reason that we do not observe relativistic fields from charges in relative motion. Instead, we see a small subset of forces of relativistic field interactions from charges in relative motion that is mediated by the conductor. Today we have named this small subset of forces the magnetic force that is mediated by the magnetic field.

A charged conductive element will keep the electric field inside of it at zero in its inertial reference frame. This is true even if the conductive element crosses inertial reference frames. A sheet moving in the same inertial reference frame the sheet will experience electric fields changes that are similar to a nonconductive sheet.

The Static Electric Field from a Smooth Negatively Charged Non-Rotating *Conductive* Disk.

$$\vec{E} = \vec{\nabla}\Phi$$

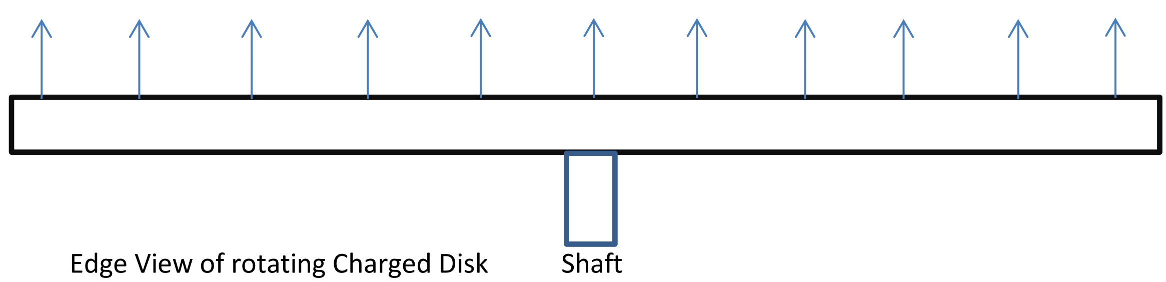


Figure 33

The electric field from a stationary charged conductive disk will distribute the charges across the disk to keep the electric field in the disk at zero. This will produce an electric field that is perpendicular to the flat surface. Yet the charge distribution will not be constant in the disk.

To calculate the charge distribution, we can use the equation:

$$E_x(z) = \frac{\sigma}{2 \cdot \varepsilon_0}\left[1 - \frac{z}{\sqrt{z^2 + \frac{R^2}{x^2}}}\right]\check{z}$$

Where the electric field is set to a constant value k_e and the charge density is our variable.

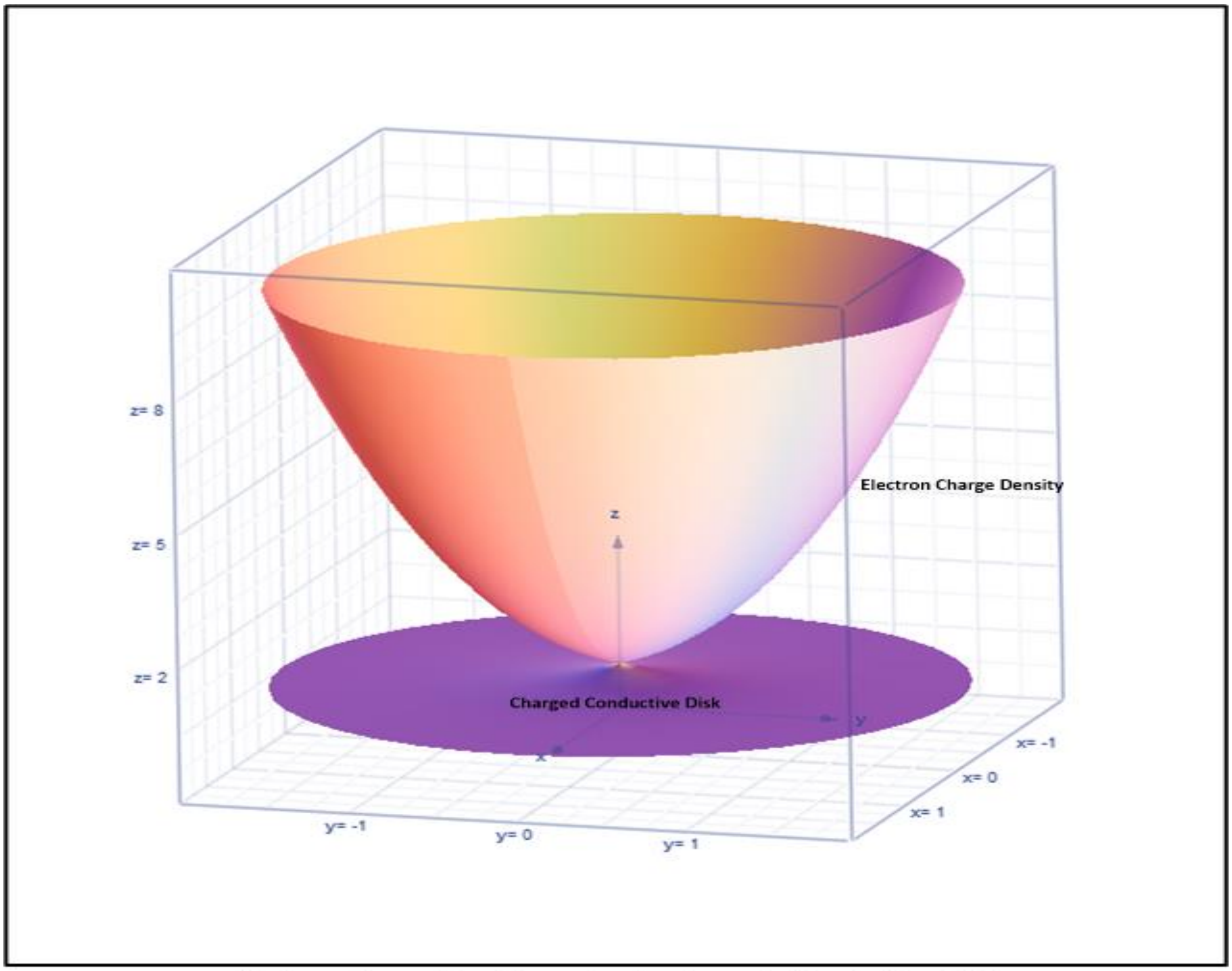
$$k_e = \frac{\sigma(x)}{2 \cdot \varepsilon_0}\left[1 - \frac{z}{\sqrt{z^2 + \frac{R^2}{x^2}}}\right]\check{z}$$

If we set z=1 and R=1 to simplify the math.

$$k_e = \frac{\sigma(x)}{2 \cdot \varepsilon_0}\left[1 - \frac{1}{\sqrt{1^2 + \frac{1^2}{x^2}}}\right]$$

$$k_e \left|\left(x + \sqrt{x^2+1}\right)\sqrt{x^2+1}\right| = \frac{\sigma(x)}{2 \cdot \varepsilon_0}$$

$$\sigma(x) = 2k_e \cdot \varepsilon_0 \left|\left(x + \sqrt{x^2+1}\right)\sqrt{x^2+1}\right|$$



Electron Charge Density on the Surface of a Conductive Disk

Figure 34

The graph of the charge density of the mobile electrons on the surface of the disk is greatest at the edges. When this charged conductive disk, is rotated, most of the charge will move at the greatest velocity that is different from a uniformly charged non-conductive disk.

However, the conductive disk will allow the mobile charges to migrate around the disk to keep the electric field observed from the face of the disk uniform or perpendicular even while it is rotating.

The Electric field from a Rotating Smooth Charged *Conductive* Disk.

$\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ Electric field increase is from this term from the charges at the edge of the Disk

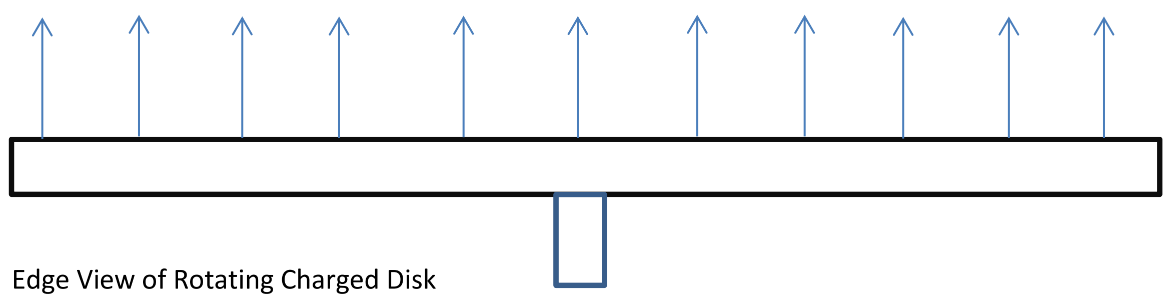


Figure 35

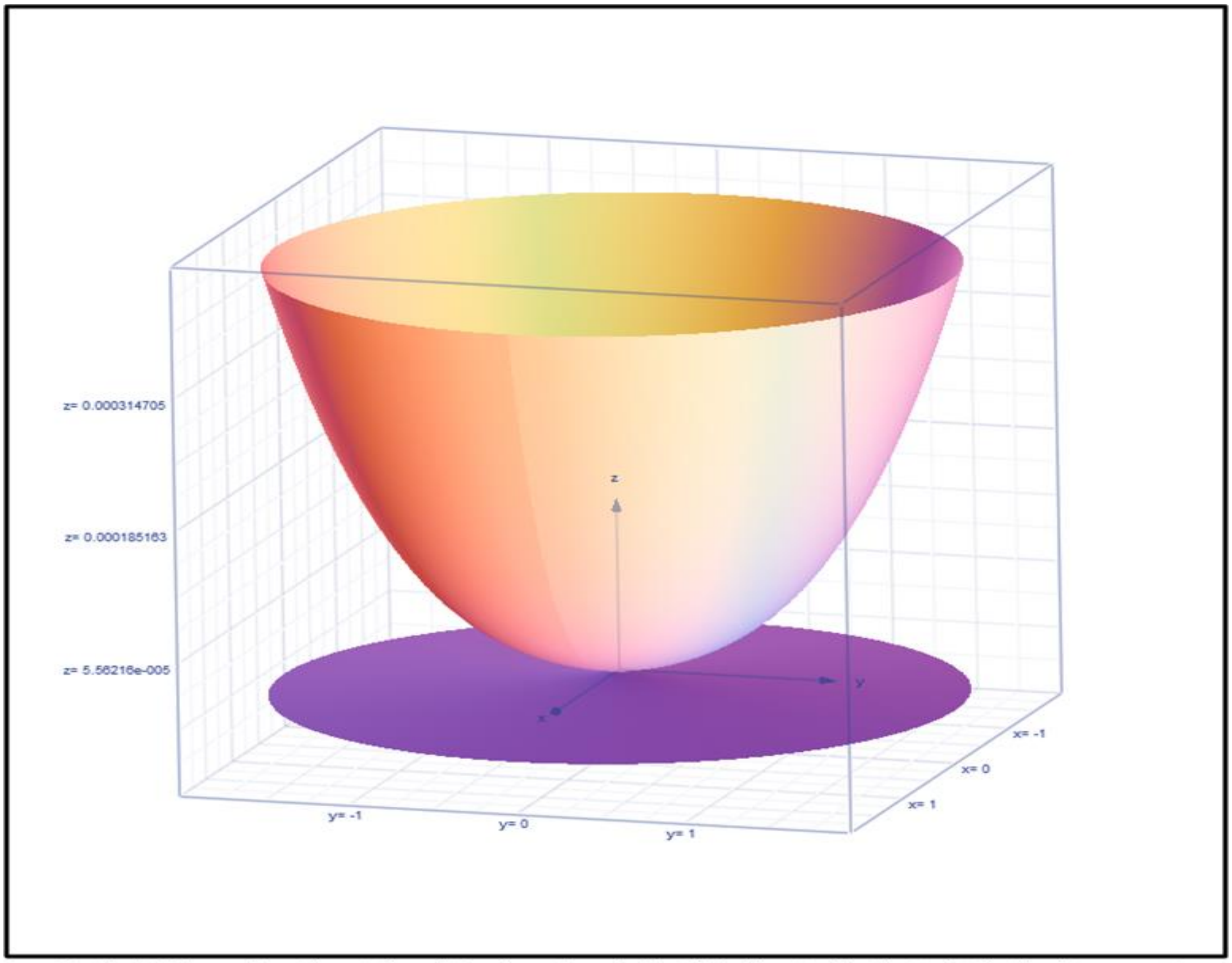
If the conductive disk limits the charges ability to migrate, then the conductive disk will have an even greater electric field change than a uniformly charged non-conductive disk.

Then the electric field change due to the rotation w_{cyc} as cycles/second of the disk is:

$$E(r) = \frac{2\pi r w_{cyc}}{c} \cdot \sigma(r)$$

If we calculate the electric field changes due to the rotation of the disk by including the charge distribution without the redistribution of the mobile charges being considered:

$$E(r) = \frac{2\pi r w_{cyc}}{c} \cdot\ 2k_e \cdot \varepsilon_0 \left(\left(x + \sqrt{x^2+1}\right)\sqrt{x^2+1}\right)$$



Electric field change from the rotation of the charged conductive Disk without taking the Redistribution into account

Figure 36

If there is a way to immobilize the charges on a conductive disk so that they cannot move radially then we start to observe the same kind of electric field changes that a non-conductive surface has. One way is to separate each radial section into rings. This allows the rings to have different electric field intensities as the rings get to the outside of the disk. Another way is to have a microstructure in the only allows the charge to move with the electric field changes radially outward. The amplitude of the relativistic electric field from the rotation of charges on the disk is greatest near the edge of the rotating disk.

The electric field changes can be used to stop the charges from moving around by creating the only path for redistribution that is against these electric field changes. Number techniques can be used to minimize the redistribution that includes power source impedance modifications and the structures that the charges reside in/on.

Measuring Complex Electric Fields

Today we use conductive elements to move electric force from point A to B that is created by power sources that have low impedances. The same properties that make conductive elements the optimum method to transfer electric power also make them the reason that we do not observe relativistic fields from charges in relative motion. Instead, we see a small subset of forces that is relativistic field interactions from charges in relative motion mediated by the conductor that today we have named the magnetic field.

However, we can observe these electric field changes from a rotating disk if we make sure that the charges in different inertial reference frames are not allowed to move in response to the electric field changes from their neighbors in the different inertial reference frames. Even then, the changes are very small for velocities that do not approach the speed of light. So, some method must be used to amplify these changes.

As shown in the previous examples in Figures 20, 24 and 26 a charged uniformly charged non-conductive smooth sheet in relative motion, which has the charges in the same inertial frame of reference, will give the greatest geometric amplification from relative motion. Today a non-smooth or smooth charged conductive or non-conductive sheet in relative motion would be assumed to generate a magnetic field (that no one has ever measured with a magnetometer). The type or polarity of the charge or the smoothness of the sheet or the mobility of the charges would be mathematically modeled generate the same magnetic field.

Fig. 27 is an example of the electric fields from a stationary or nonrotating charged disk with a uniformly charged smooth conductive coating on it. A uniformly charged smooth coating will amplify these changes as a line charge amplifies the electric field changes. However, a conductive disk will allow the mobile electric charge to redistribute to keep the electric field in the smooth conductor at zero that redistributes the changes across the disk.

If this charged conductive disk is rotated, the electric field will now show small increases as the disk is accelerated to higher rotational speeds. This is due to the small amount of time for the charge to redistribute itself to keep the disks conductive surfaces internal electric field at zero. Then the electric field will return to the same shape as it had when it was not rotating. Nevertheless, the disk will now have an electric field that is greater in intensity than it had when it was not rotating.

This electric field increase is assuming that the charges on the disk are not connected to a conductor that is in the stationary reference frame. If there is a conductor connected to the stationary reference frame, then some of the charge will migrate onto that conductor reducing the electric field change even more.

In addition, these electric field changes assume the potential source of the charges is not outside the disk or have any kind of source resistance. Charging a rotating conducive disk with a modern power supply in the stationary reference frame, with a connection to ground will keep these electric field changes from being observed by an electric field meter.

To be able to measure these electric field changes from a charged element in relative motion has the same kind of limitations. Using the ground as a reference point for the static electric field meter will now have to include how a large 8000-mile conductive sphere and the isolated charged element in relative motion interact. If an isolated charged element in relative motion is near this conductive sphere, the charge on this sphere will move in response to the changes and interfere with the measurement.

Then there is the instrument used to measure these electric field changes. Modern electric field meter like a reciprocating meter nulls small changes in the electric fields to an internal reference that will null electric field changes from charges in motion.

This make measuring these kinds of electric changes difficult to measure unless a number of mitigation strategies are used. Figure 39 documents some of these techniques to minimize these effects. The first thing to notice is the use of an electrostatic power supply.

An electrostatic power supply like a Wimshurst influence machine that has infinite source impedance is the type of source supply that can be used to power charged elements. This is important in that the charge from the source is electrically decoupled from the reservoir that the charge is extracted from. If there is any kind of source resistance, then there is path for the charge to redistribute in response to the electric field changes.

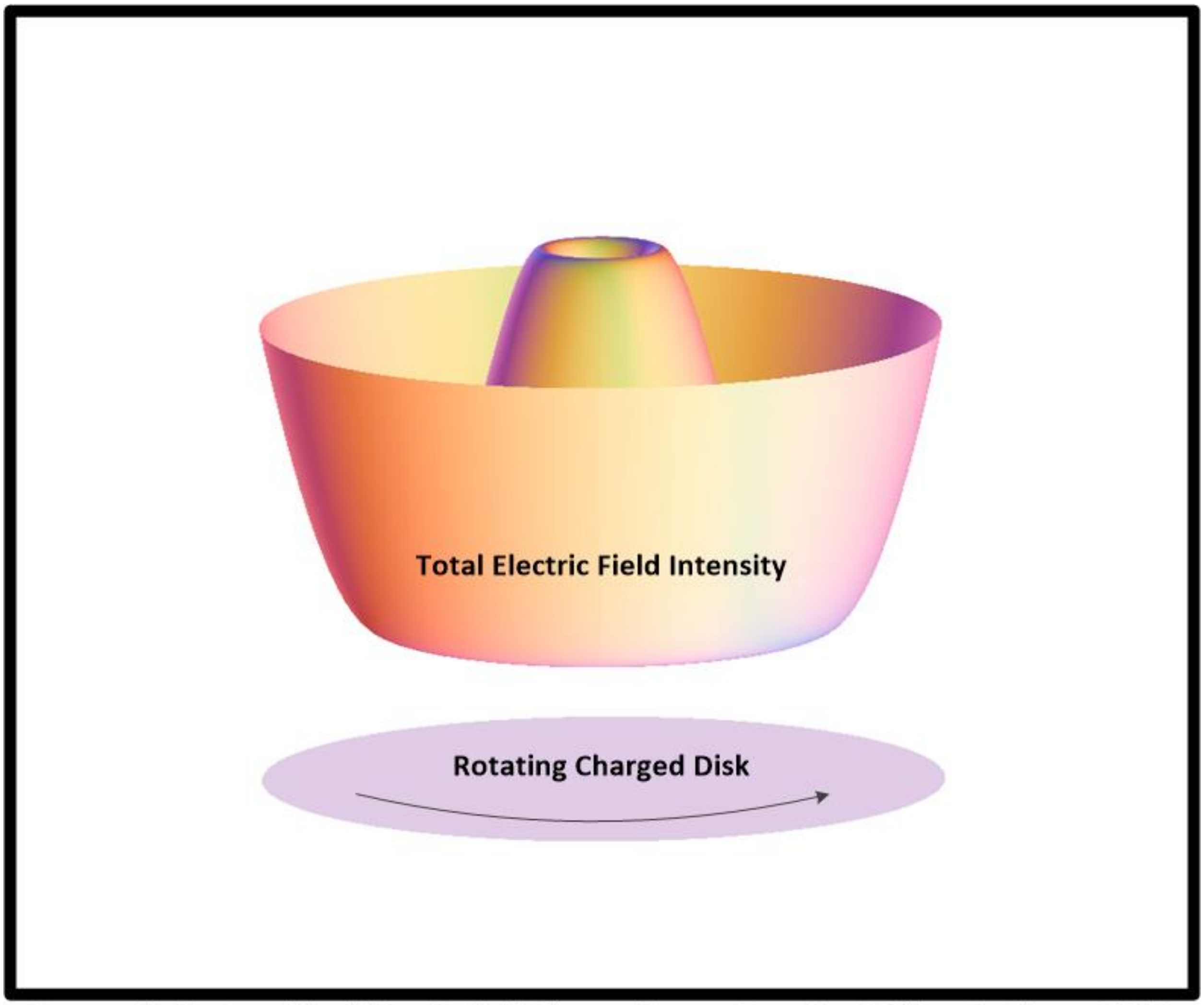
Nevertheless, the charge still has to get to the charged element using conductors. So, a high voltage tube is used to decouple the conductor from the charged element. The reason that a tube has to be used is the input and output elements in the tube are physical disconnected each other. A semiconductor diode does not its inputs or outputs physically disconnected so are unsuitable in this application.

Then there is where the connection to the disk from the output side of the diode. The position on the disk is also important to observe these changes.

The use of static electric field meters is also important. These are non-reciprocating meters that have to be made to have low drift characteristics to be useful.

Then there is the electrostatic shield that is not shown in this document. The electrostatic meter and the ground of the power source have to be physically connected together at a point that is decoupled from the shields ground connection.

If these issues are resolved, the electric field changes from charged elements in motion are relatively easy to measure.

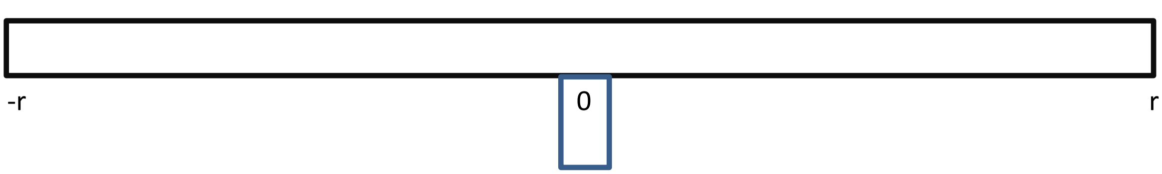


Geometrically Amplified Electric Field Change from a Rotating Uniformly Charged Disk

Figure 37

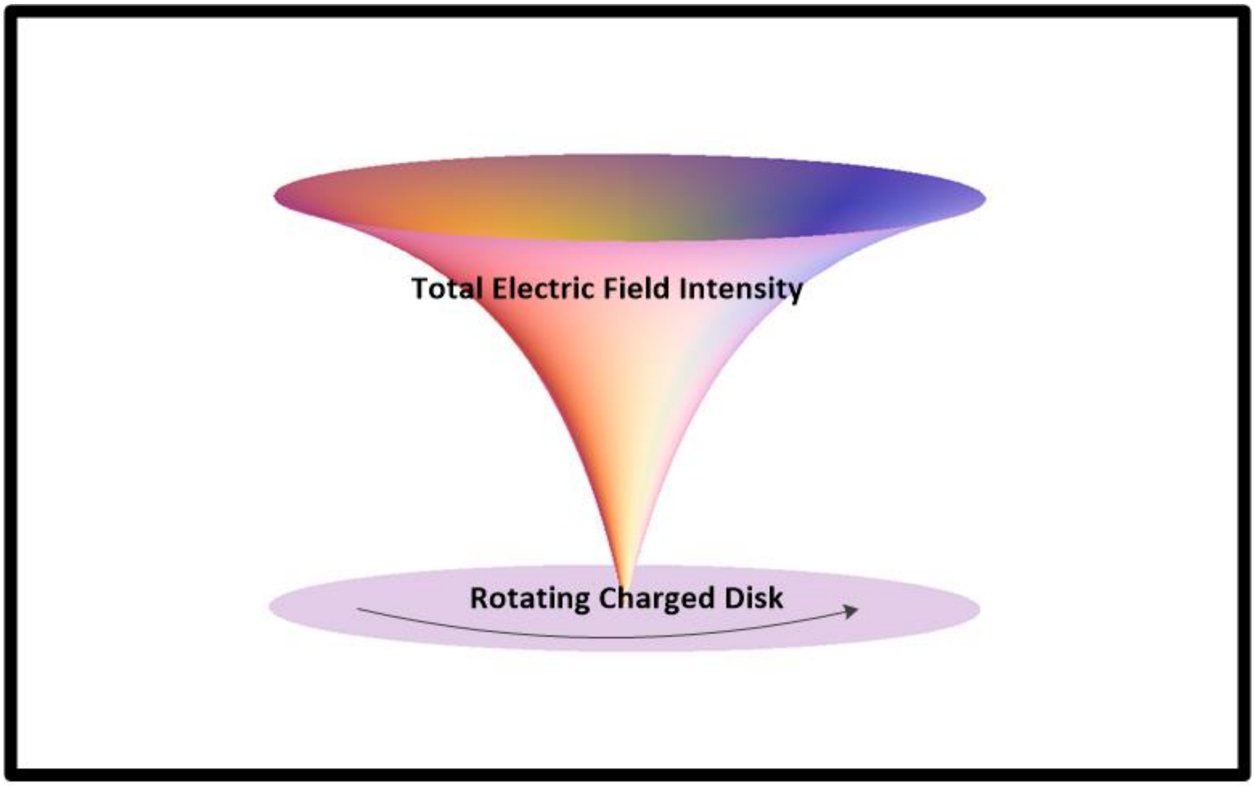
Figure 37 is a typical electric field from an electrically isolated charged rotating smooth non-conductive disk. This is an example of geometric amplification where the electric field at the edges is the same intensity as the electric field is in the center of the disk that is relatively easy to obtain. This is the same type of amplification that a line charge would experience. Since the amplification is only observed in the perpendicular motion of the charge only the integration of the potential of a line charge, where the potential increases at on end is a good approximation of the potential that creates our electric field changes.

2πr (Rad/Sec) -- 0 --2πr (Rad/Sec)



Charge density = ρ Radius of disk = r Velocity = v

$$E_z = \frac{(v/c)\rho}{2\pi\varepsilon_0}\int_0^r 1/\left(1+r^2\right)^{3/2} dr$$



Geometrically Amplified Electric Field Change from a Rotating Uniformly Charged Disk

Figure 38

This electric field change is much different from the electric field changes from figure 28. This electric field will not follow the rules of superposition and will merge from an electric field from a nonrotating electric field just as the electric field from the moving charges in a conductor do not follow the rules of superposition to give us the magnetic force that the magnetic field is defined from.

The following diagram is of a test system that was used to characterize the electric field changes from a rotating disk. Two sensors are used to get the cross product and dot product changes.

This type of amplification is only observed from mobile negative charges on smooth surface. Positive charges are immobile as such cannot be forced to line up on a smooth surface.

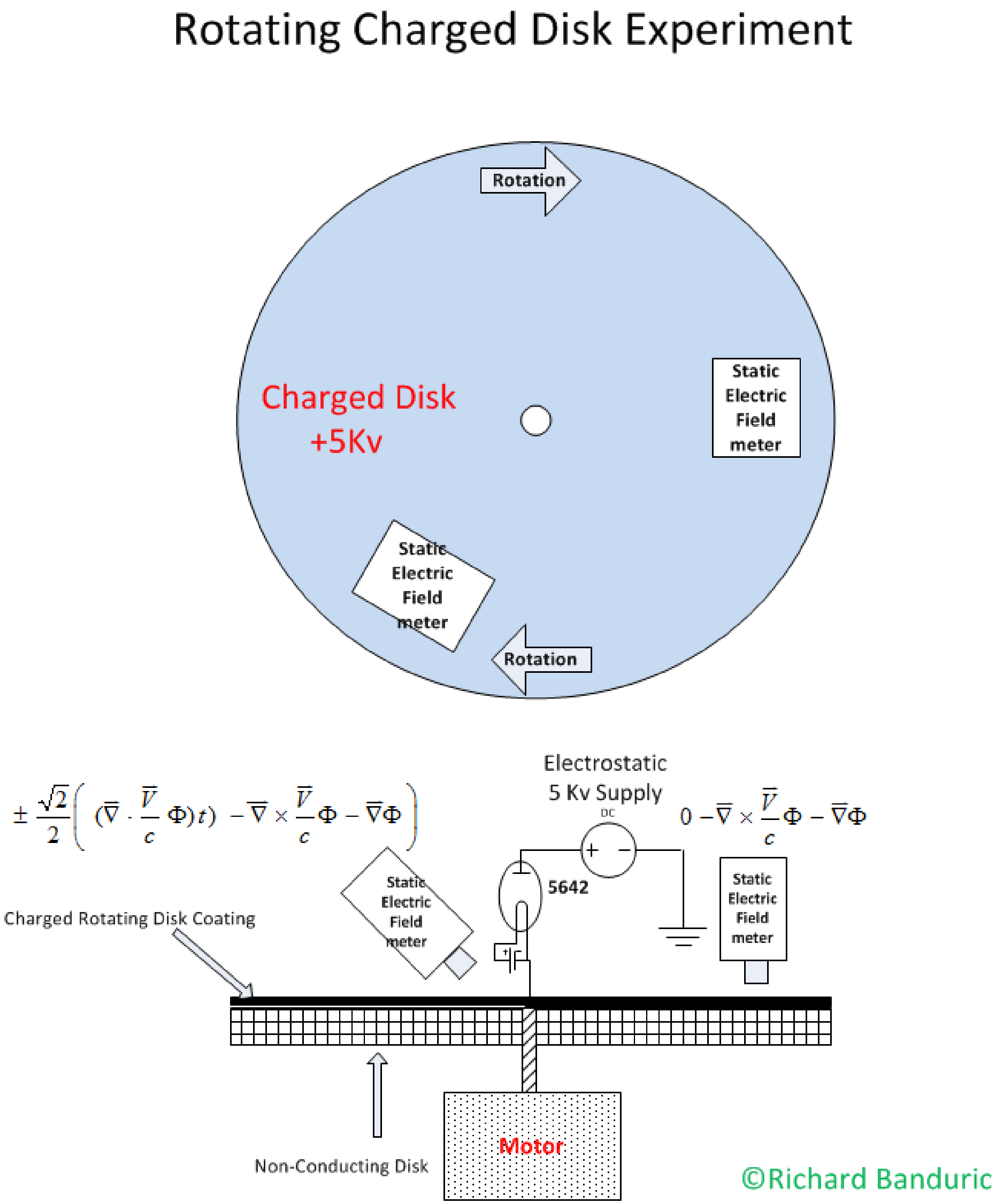

Rotating Charged Disk Experiment
Rotation
Charged Disk
+5Kv
Static Electric Field meter
Static Electric Field meter
Rotation
Electrostatic
5 Kv Supply
DC
$\pm \frac{\sqrt{2}}{2}\left((\vec{\nabla} \cdot \frac{\vec{V}}{c} \Phi)t) - \vec{\nabla} \times \frac{\vec{V}}{c}\Phi - \vec{\nabla}\Phi \right)$
$0 - \vec{\nabla} \times \frac{\vec{V}}{c}\Phi - \vec{\nabla}\Phi$
5642
Charged Rotating Disk Coating
Static Electric Field meter
Static Electric Field meter
Non-Conducting Disk
Motor
©Richard Banduric

Figure 39

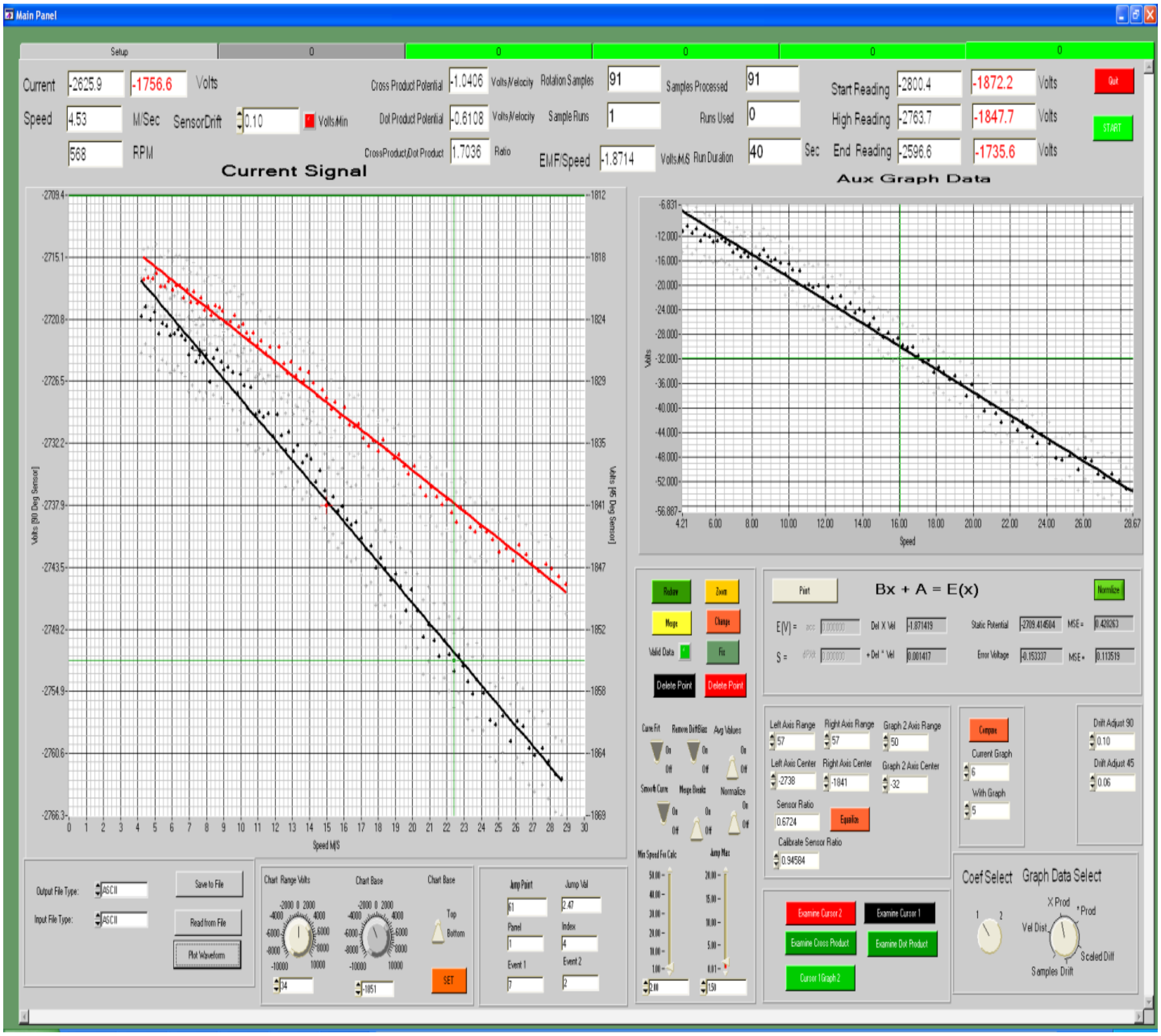


Figure 40

Above is the display of an automated test system output that characterizes coatings on rotating disks. The type of coating that is being tested is a smooth conductive coating. The left chart is the plot of the electric field intensity read as a negative potential above a charged rotating disk. The horizontal axis is the rotation speed of the rotating charges on the disk that is seen near the edge of a 9-inch rotating disk. The black plot is the increase in the electric field seen above the disk for different speeds as seen from the stationary frame of reference. The electric field sensor for the black plot is positioned directly above the surface of the disk. The red plot is the electric field from the same type of sensor rotated 45 degrees to the face of the disk. The black legend is on the left and the red plot's legend is on the right.

Having these two plots, we can now extract the cross product and dot product components from the complex electric field of this coating.

The right plot is the plot of the cross product electric field component of this coating. At 30 m/s this component is - 50 volts. This increase in the electric field (The potential on the disk is – 2730 Volts) is the result of the geometric amplification from the term $\vec{\nabla} \times \frac{\vec{V}}{c}\Phi$ in the electric field equation (7). This is from a disk with a dielectric constant of 1 and a self-capacitance of 8 pf. Using the self-capacitance to calculate the electric potential increase without geometric amplification the electric potential increase would be [30 (m/s) /300000000 (m/s) x 3000 volts = .0003 volts] with a charge of 24 nC at 3000 volts. But the amplitude of the cross product of the charge and velocity of the complex electric field is dependent on the amount of charge in motion and not on the potential. The automated test system has a charge isolation plate that increases the capacitance from 8 pf to 100 pf and that increases the charge on the disk to 300 nC. Using the test systems 100 pf to calculate the electric potential increase without geometric amplification the electric potential increase would be [100/8 x .0003 volts = .00375 volts]. Still this potential increase is much less, than the values that we are getting from the geometric amplification of this negatively charged smooth surface which give us -50 volts at 30 m/s. This disk now has a geometric amplification of -50/.00375 = 13,333 or a **gain** of 13,333.

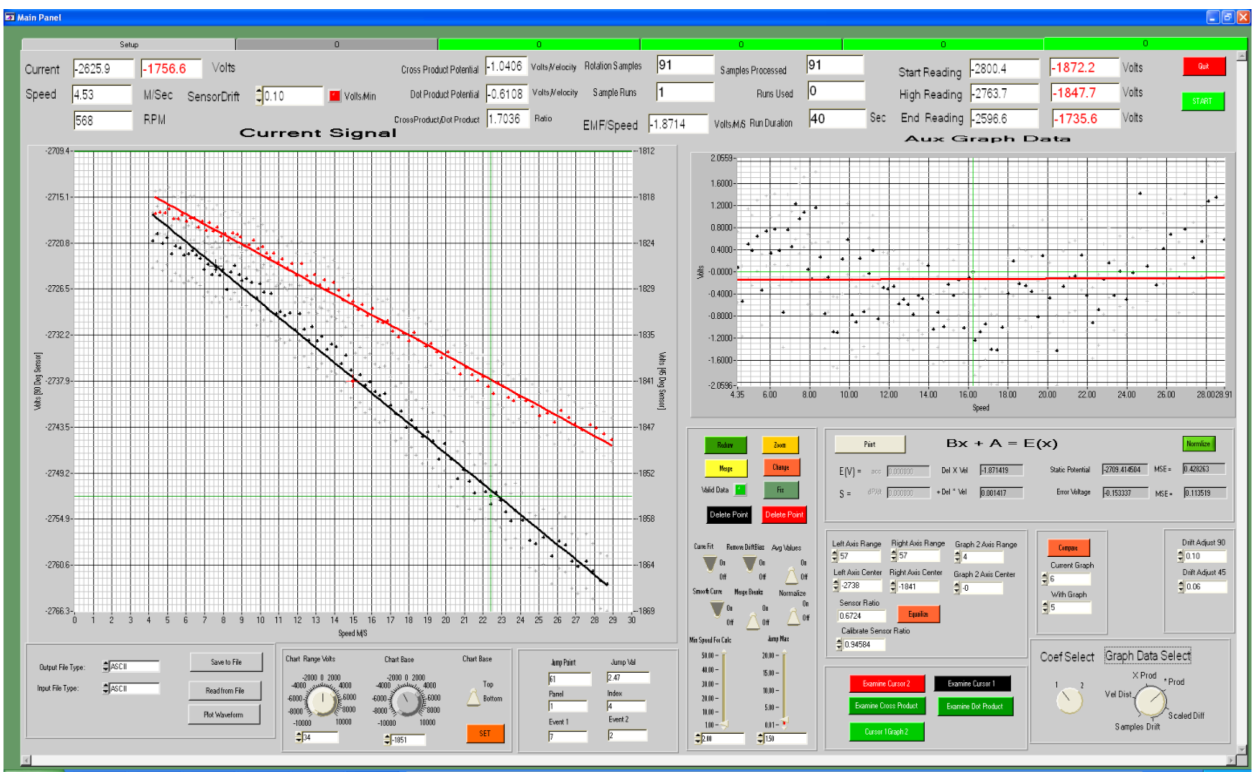


Figure 41

This same output now has right graph displaying the dot product from this smooth rotating coating. Rotating smooth conductive disks will only have dot product geometric amplification that produces a complex radial electric field component at the very edges of the rotating disk. The flat faces of the disk do not have any complex electric field component from the dot product as seen on the right graph.

The relativistic electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ in equation (8) on a smooth conducting disk is going to be near zero as shown on the right graph. This is the result of most of the negative charge residing on the top layer of a smooth conductor. This results in the electrons shielding each other from the increase and decrease in their complex electric fields due to their relative motion from the scalar potential.

The relativistic electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ in equation (8) can also be amplified from the macro geometric structures. One macro structure that allows the relativistic electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ in equation (8) is a conductive disk that is not smooth. A rough coating now allows the electric field from the electric scalar potential to be seen as a decrease in the complex electric field from charges that are receding from a point and as an increase in the complex electric field from the charges that are approaching a point. For a rotating disk, this field is seen as a tangential electric field that resists the rotation of a rotating disk.

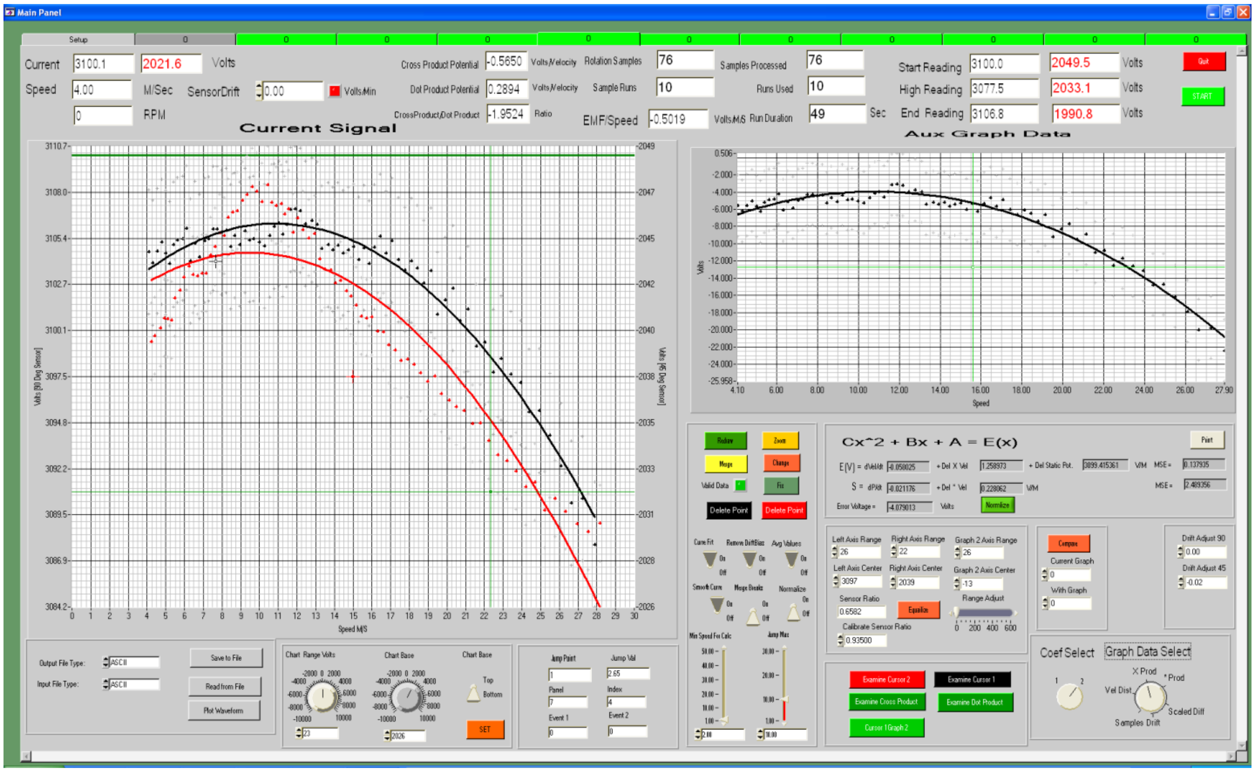


Figure 42

Above is the display of a rough high resistance conductive coating. This kind of coating has a very different complex electric field. The left graph is now showing no positive geometric amplification. In fact, from this type of coating, we are seeing a drop in the potential of 30 volts or a gain of less than one. This effect is seen whenever a disk has gain from the complex electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$. The right graph is the cross-product component of the complex electric field. If this disk is rotated against the previous smooth disk, then there is a complex electric field of 30v + 50V = 80 volts available to create an axial force. These disks would have a distance between them of about 1 mm so our axial force is going to be the same force that you get from a charged 9-inch ring with a static potential of 3 Kilovolts against an electric field of 1000 mm * 80 volts or 80,000 volt/meter. When this disk is rotated against a smooth disk, the smooth disk will see a positive axial force and this disk will see a negative axial force that will add to each other's axial forces to give a total axial force of 10s of mN.

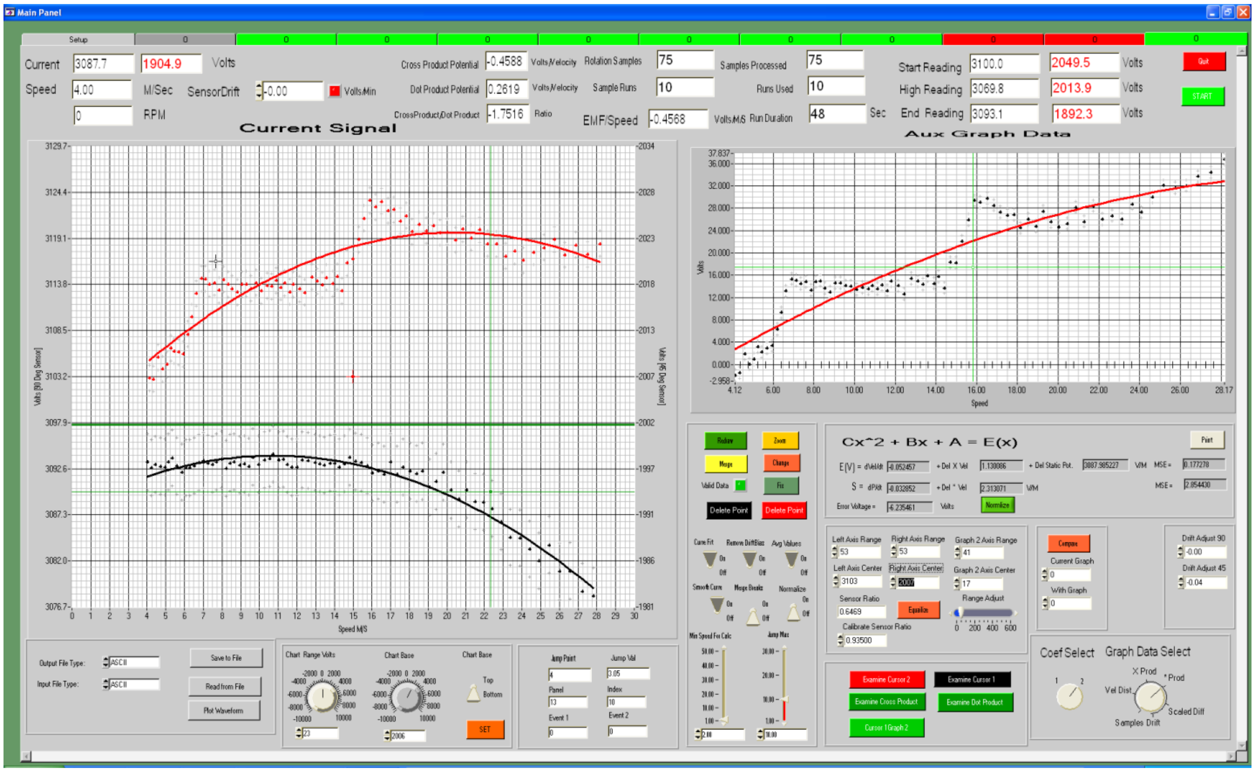


Figure 43

Above is the display of a rough conductive coating's complex electric field component from the potential $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ on the right graph. This time it is not zero. This is a graph of the charges that are approaching the angled test sensor. Now we observe an increase in the potential of the approaching charges of 25 volts at 30 M/s.

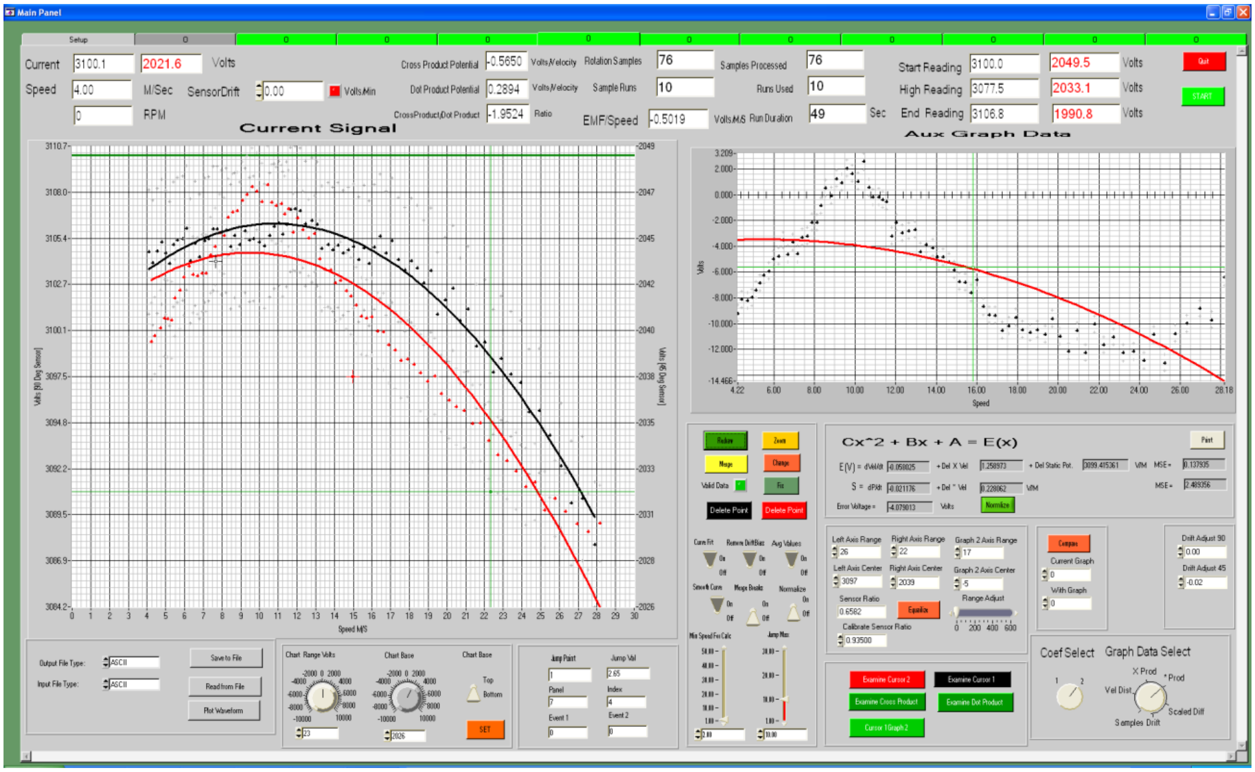


Figure 44

This is the graph of charges that are receding from our sensor. The charges that are receding from the sensor have a slope that is opposite of the approaching charges. This time we see a decrease in the scalar potential of about 10 volts. The difference between the approaching charges and receding charges generates a tangential complex electric field that the smooth disk sees as a drag force is +25v – (-10v) = 35 volts/meter. If the smooth disk is rotated against this disk, then they're going to be a drag force on the smooth disk from this complex electric field. Again, the distance between the disks is about 1 mm so the drag force is being created from the interaction of a static potential of 3 Kilovolts against an electric field of 1000mm * 35volts = 35,000 volts/meter.

There is going to be **NO AXIAL REACTION FORCE** to our axial force observed by our disks if these two types of disks are rotated against one another. Instead there is going to be a **ROTATIONAL REACTION FORCE** of 10s mN from the complex electric field component $\vec{\nabla} \bullet \frac{\vec{V}}{c}\Phi$ that the motor sees as an additional **DRAG** force instead.

Below is an example of an assembly of a rotating disk against a fixed disk that has these two different types of coatings applied to them. These two different types of disks with two different types of surfaces will produce very different complex electric fields. If these two types of coatings are applied to the faces of a non-conducting disks and they are charged and rotated against each other in the assembly shown below an axial force is seen with the reaction force that is seen as a drag force.

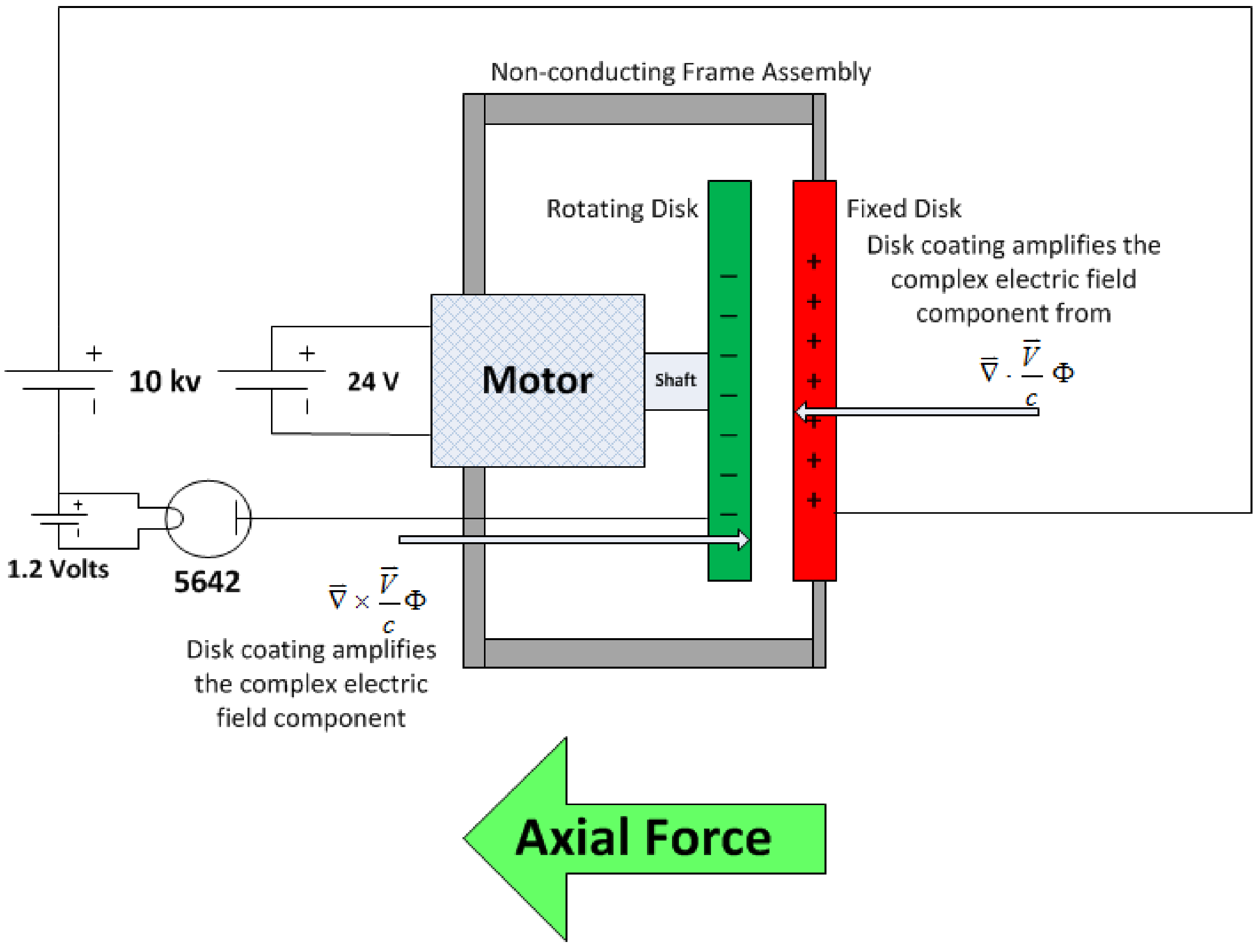
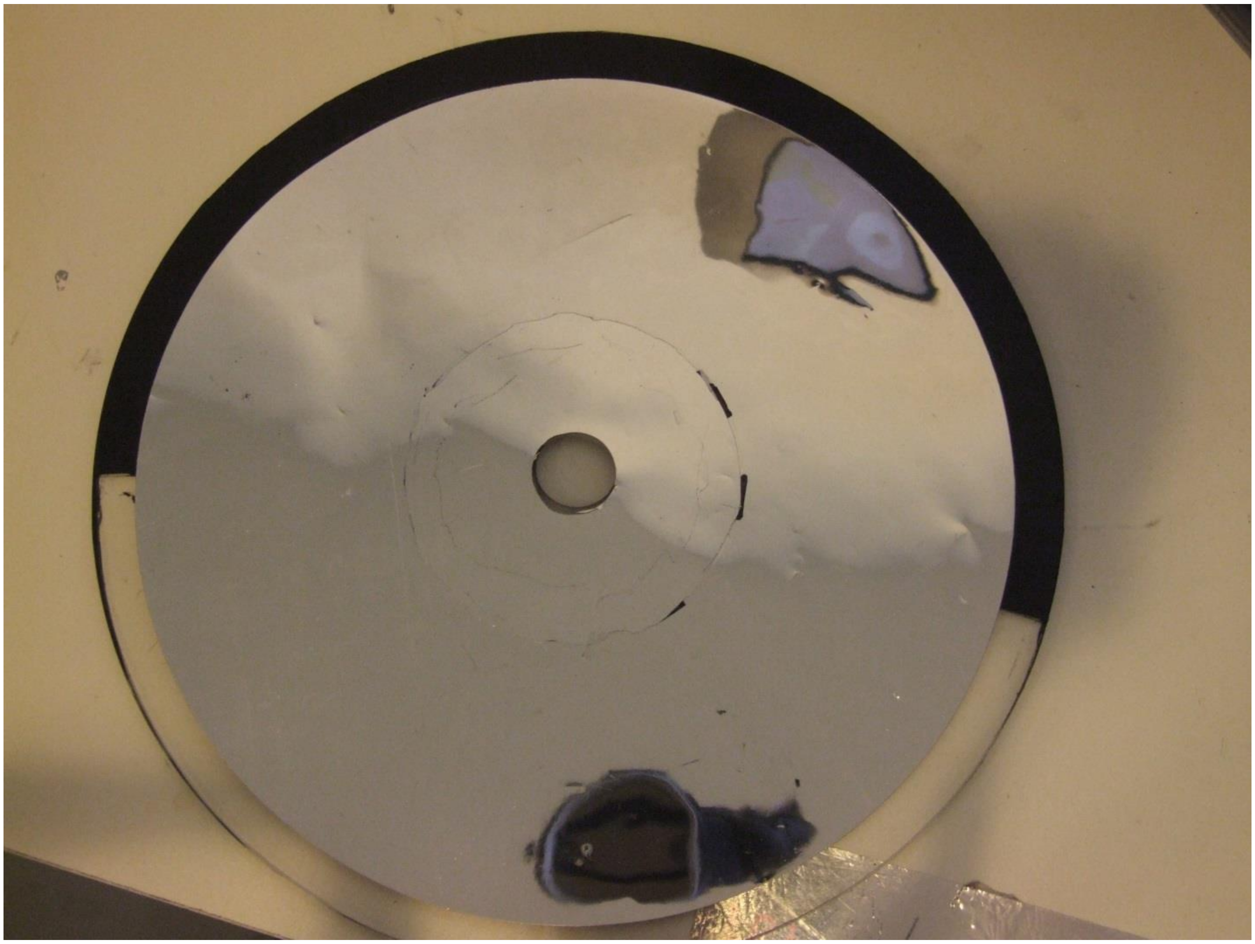


Figure 45

The key to making this device work is keep the charged elements from leaking any charge and keeping the connection to the rotating disk as short as possible*. It is really important to keep the conductor from the plate of the tube 5642 as short as possible that is in the stationary frame of reference. Plus, the point that this connection is made to the disk must be made at the point of minimum electric field change from the rotation of the disk.*

Do not use the shaft of the motor as the connection point to the rotating disk!

A number of important aspects of this design are not being presented in this document.



Smooth Conductive Disk Insert

Picture of the smooth conductive coating disk insert used in the 1st example.

This is a 1st generation coating.

<u>A number of important aspects of this disk are not being displayed in this document.</u>

Black Conductive Disk

Picture of the “black” coating that generates a large dot product component of the complex electric field that was used for the 2nd test.

This is a 1st generation coating.

A number of important aspects of this disk are not being displayed in this document.

The above picture is an example of a “state of the art” Nano-composite coating material that has a high cross product with a high dielectric constant that is going into our latest devices.

This is a 4th generation coating.

<u>A number of important aspects of this disk are not being displayed in this document.</u>

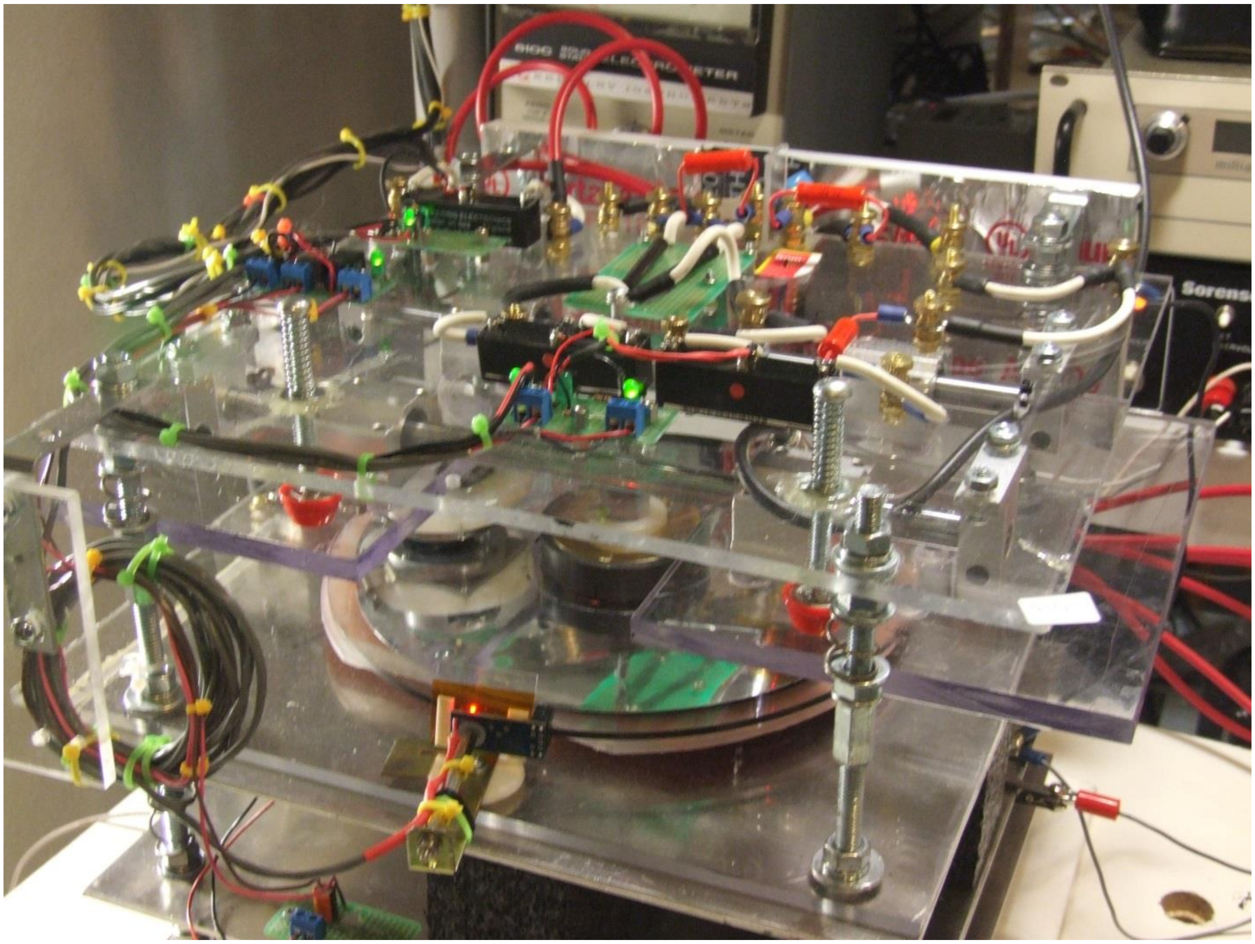


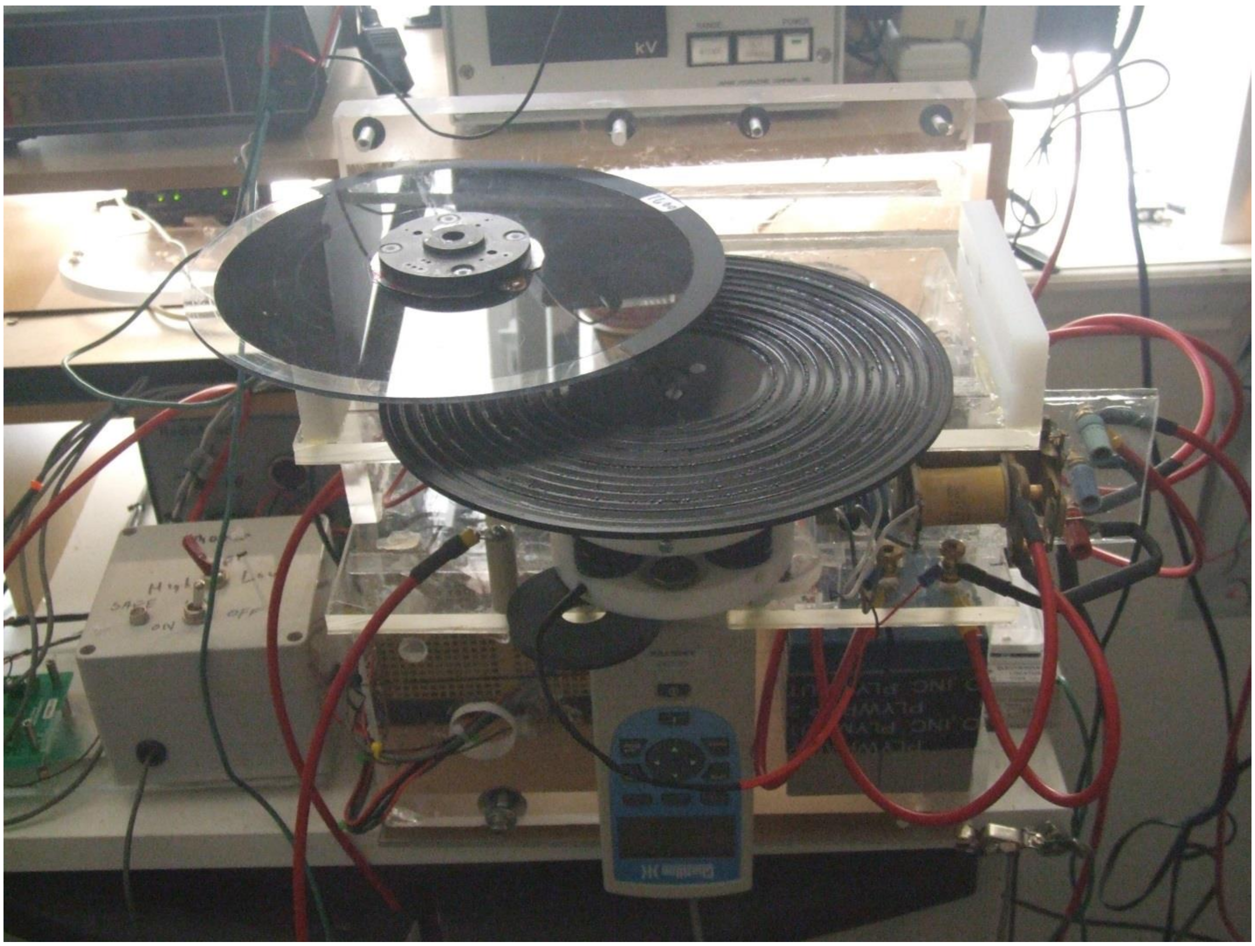
Figure 46

The above picture is the automated test system head that was used to characterize these examples.

<u>A number of important aspects of this test system are not being displayed in this document.</u>

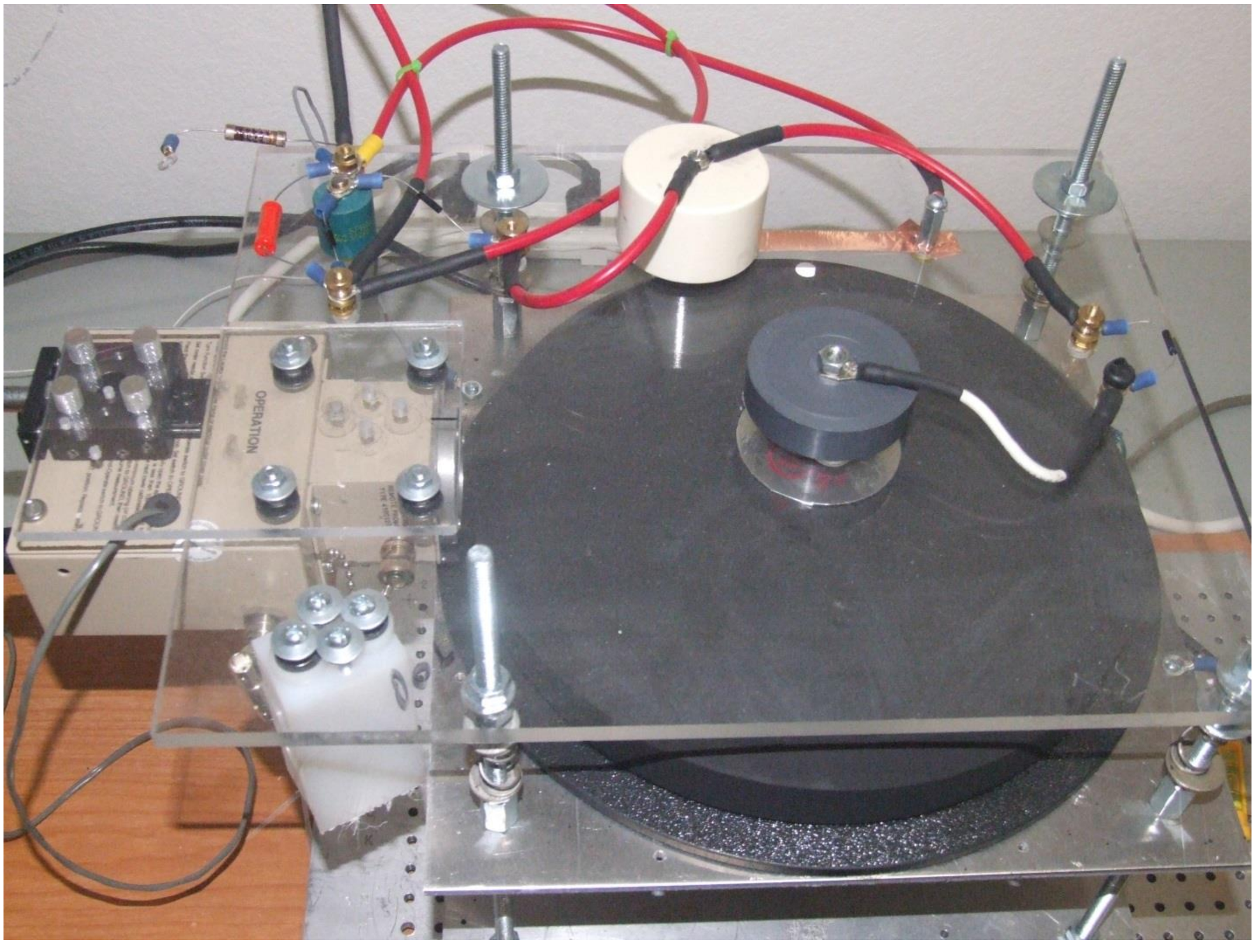
Creating Thrust

The method for generating thrust from the preceding example of two charged disks that are rotated against another is just one method. But any type of charged assembly of elements that have different complex electric fields in different inertial frames of references that interact with the static electric fields of the other isolated charged elements in a different inertial frame of reference will work. Our US patent application 20140009098 has a number of different examples in it. The preceding example of a charged fixed disk and a rotating charged disk with two different types of coatings is are being tested today. The example in the preceding section is just one way to out of many that could be used. The test station below is is such an example that was used to test coated 9 inch disks.



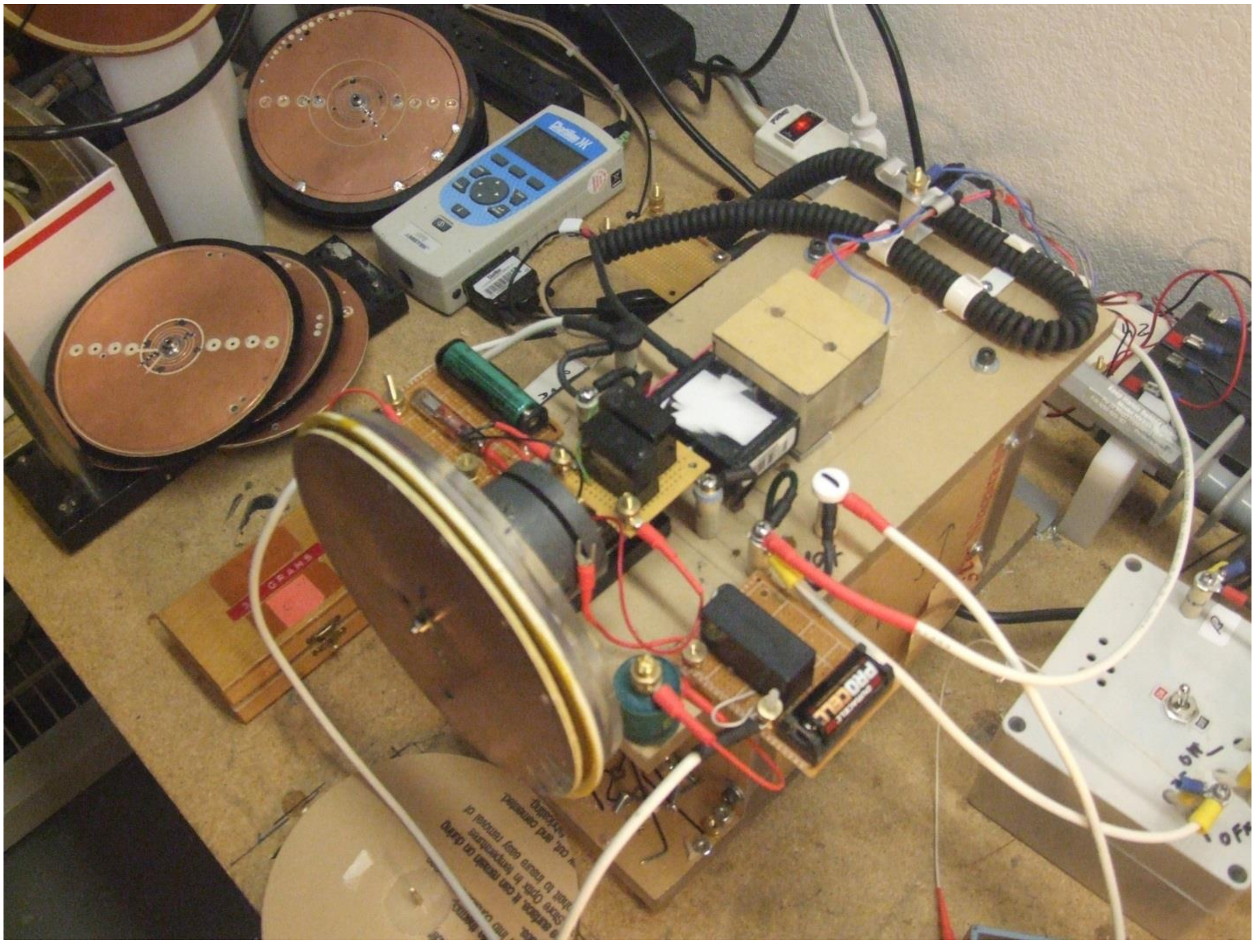
The test fixture is about to be loaded with a dot product disk that generates a radial field when its rotated. The bottom disk is designed to take advantage of the radial electric field that forms from this kind of disk to generate a thrust from. This test fixture is used to test disks from the 9 inch electric field tester to characterize the axial and drag forces from different combinations of disk coatings.

Another complex electric field that can be used to generate a thrust is the complex electric field change caused the centripical acceleration of rotating charges on an angled capacitor plate. The test fixture below is used to characterize this electric field component.



The next test fixture is the fixture to characterize the disks for thrust performance that are going to be used for the prototype testing with 6 inch disks.

<u>A number of important aspects of these test systems are not being displayed in this document.</u>



This test fixture is rotating a copper cross product disk against a charged sealed dot product composite fixed disk to determine their thrust and drag performance parameters.

<u>A number of important aspects of this test system are not being displayed in this document</u>.

The Future

The interaction of static electric fields and relativistic Electric fields to create thrust are just the beginning of this new technology. The examples and the screen shots are of real results from real coatings that are being produced **TODAY** and not some theoretical prediction. Displacement Field Technologies Inc. are looking for partners to advance this technology and create the infinite number of different types of devices that can be made from propulsion devices to devices that will nullify the centrifugal forces on rotating devices.

The prototype that is soon the be marketed is just a demo device that is going to be a precursor to devices with greater lifting forces and lower power consumption figures. The ultimate goal is to produce propulsion devices that can lift a 1000 Kg [10 Kilo Newton] at a power consumption of 1 Kilowatt or less. These devices are going to be able to be used at sea level or in the vacuum of space. These devices will have no need for propellant and would be powered from any electric power source from batteries to solar cells.

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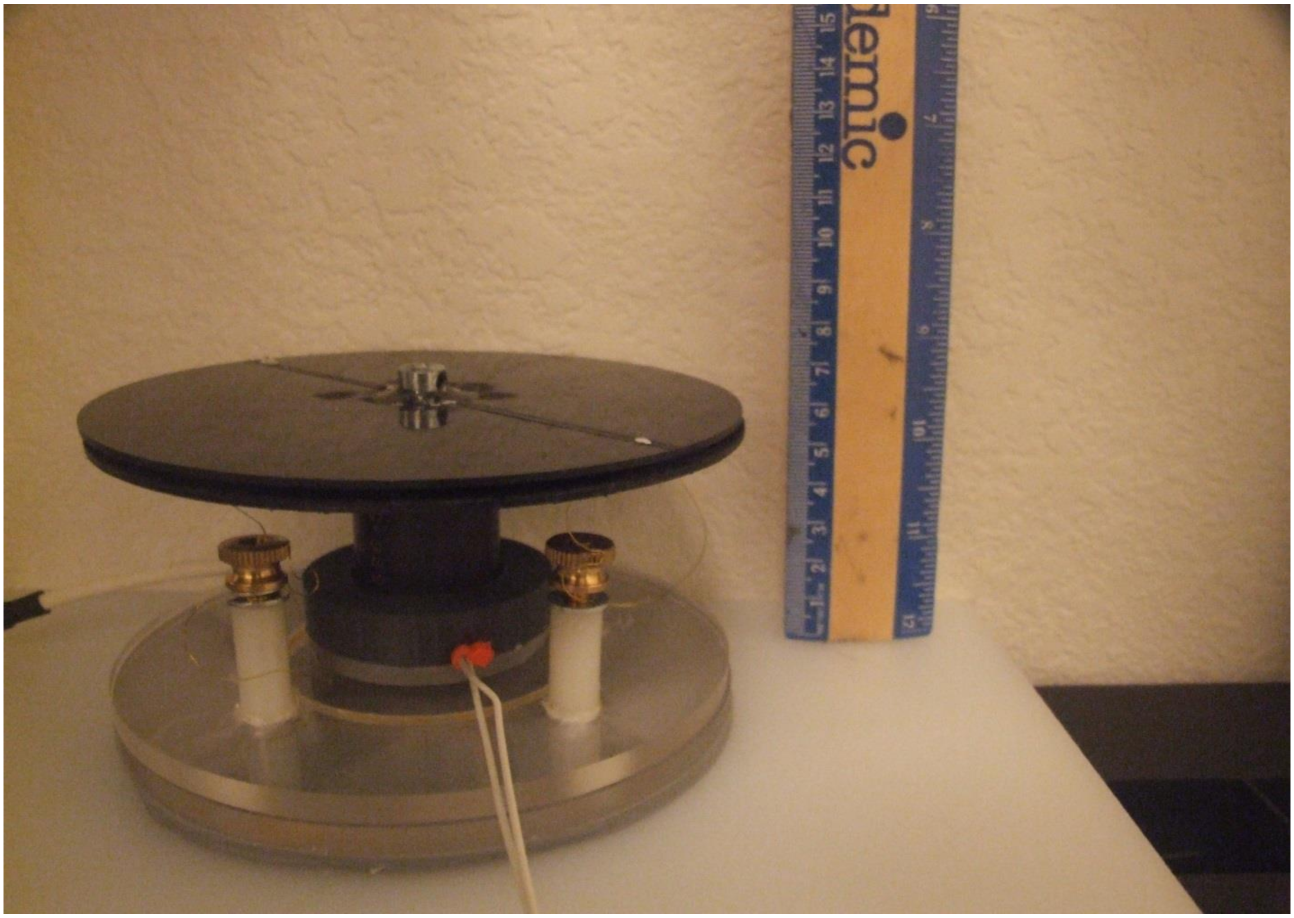
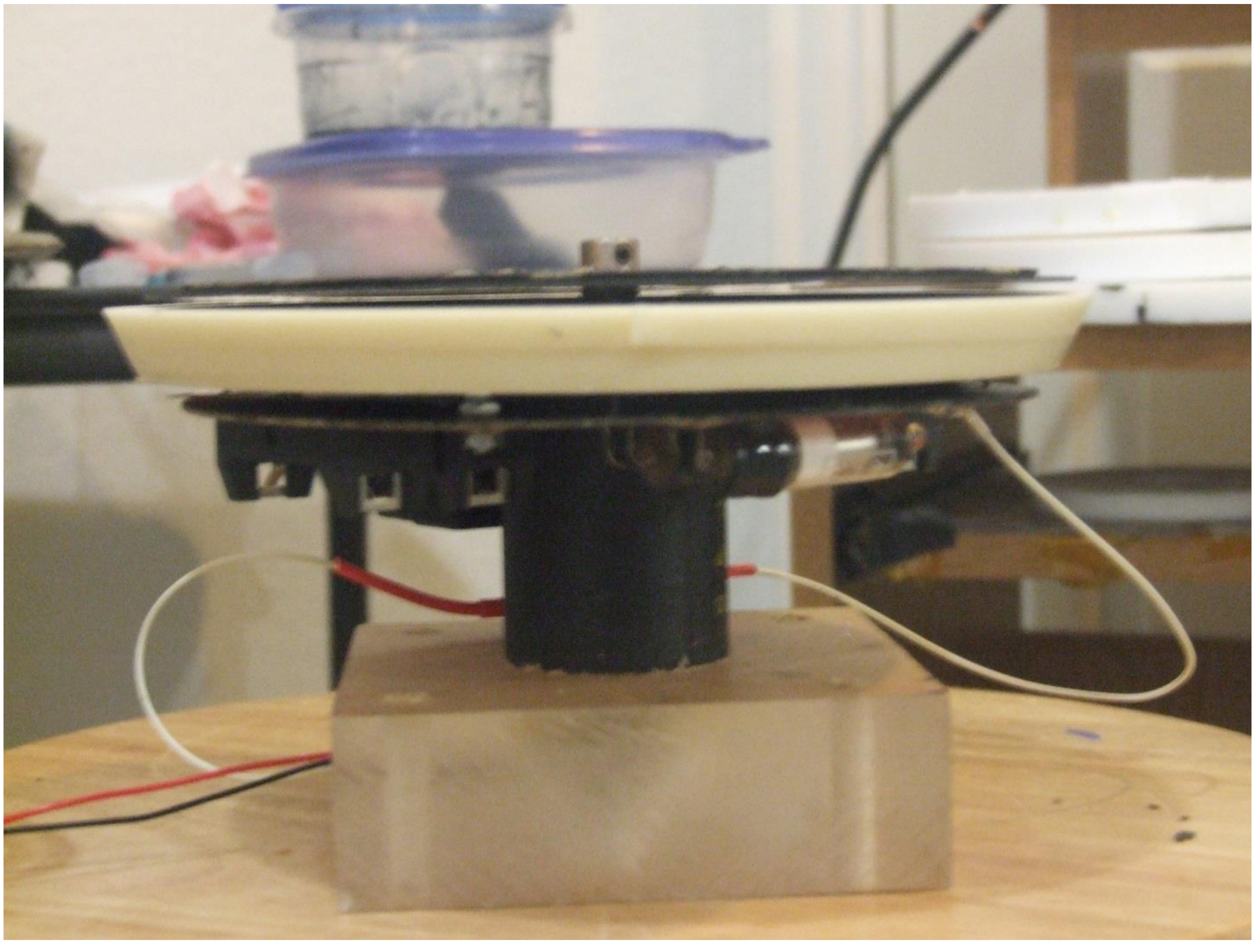


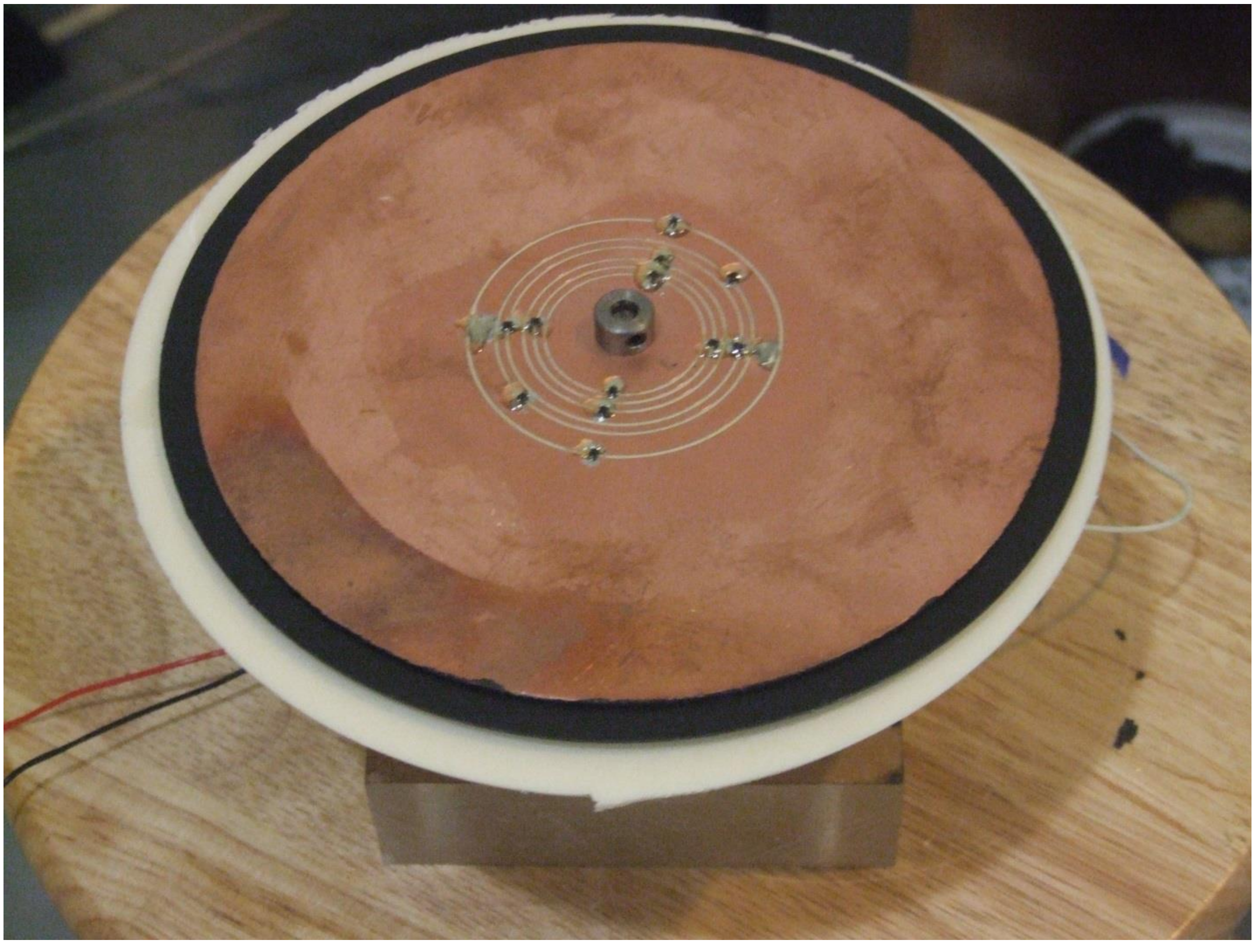
Small 3-inch Static Displacement Drive Prototype

A number of important aspects of this device are not being displayed in this document.



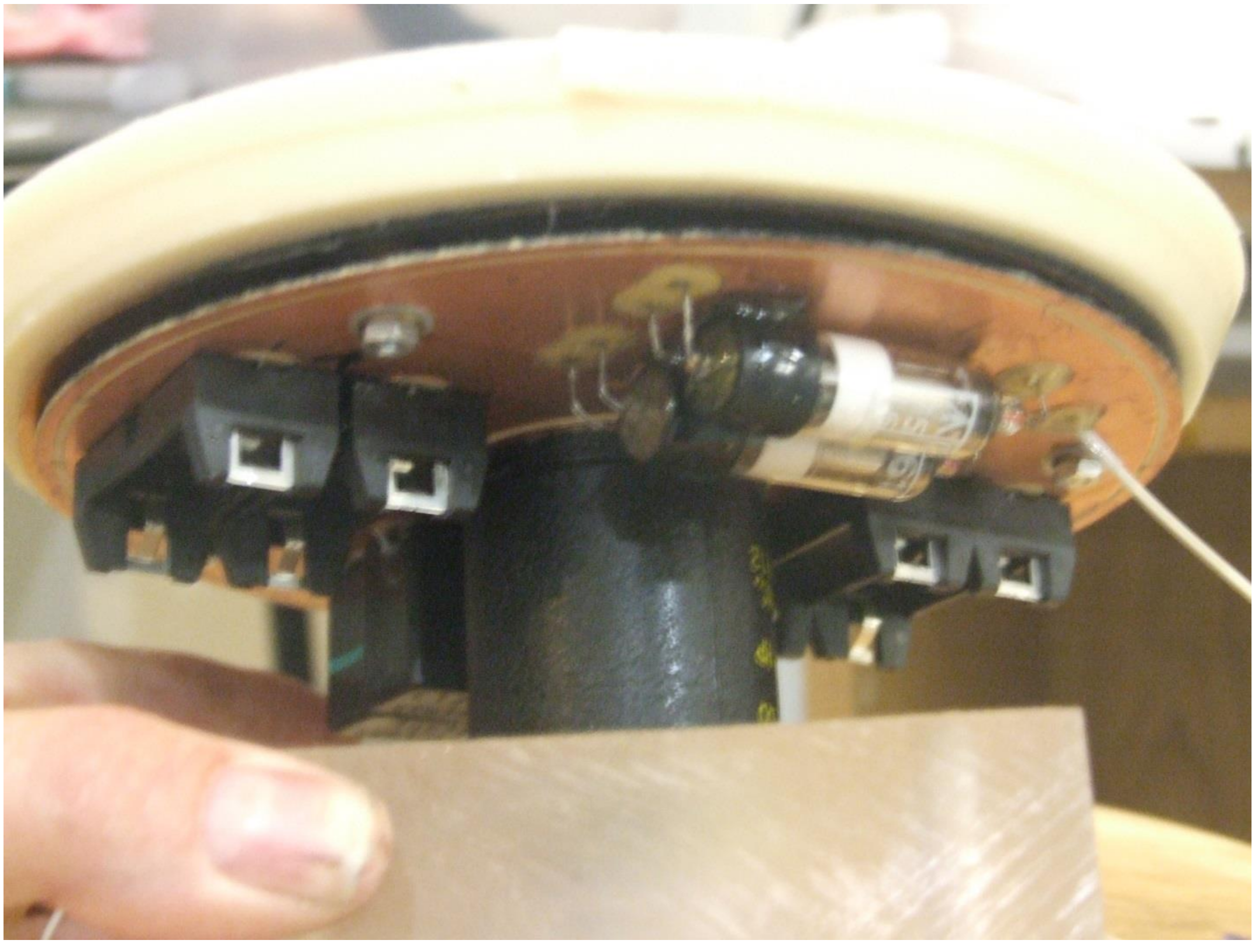
Static Displacement Field Drive Prototype to be used for future a 3rd party NASA thrust test.

<u>A number of important aspects of this device are not being displayed in this document.</u>



Top view of the Static Displacement Field Drive Prototype showing the cross-product disk with ultra-low leakage diodes.

<u>A number of important aspects of this device are not being displayed in this document.</u>



The bottom view of the Static Displacement Field Drive Prototype that is showing the HV board assembly with electronic tube diodes.

<u>A number of important aspects of this device are not being displayed in this document.</u>

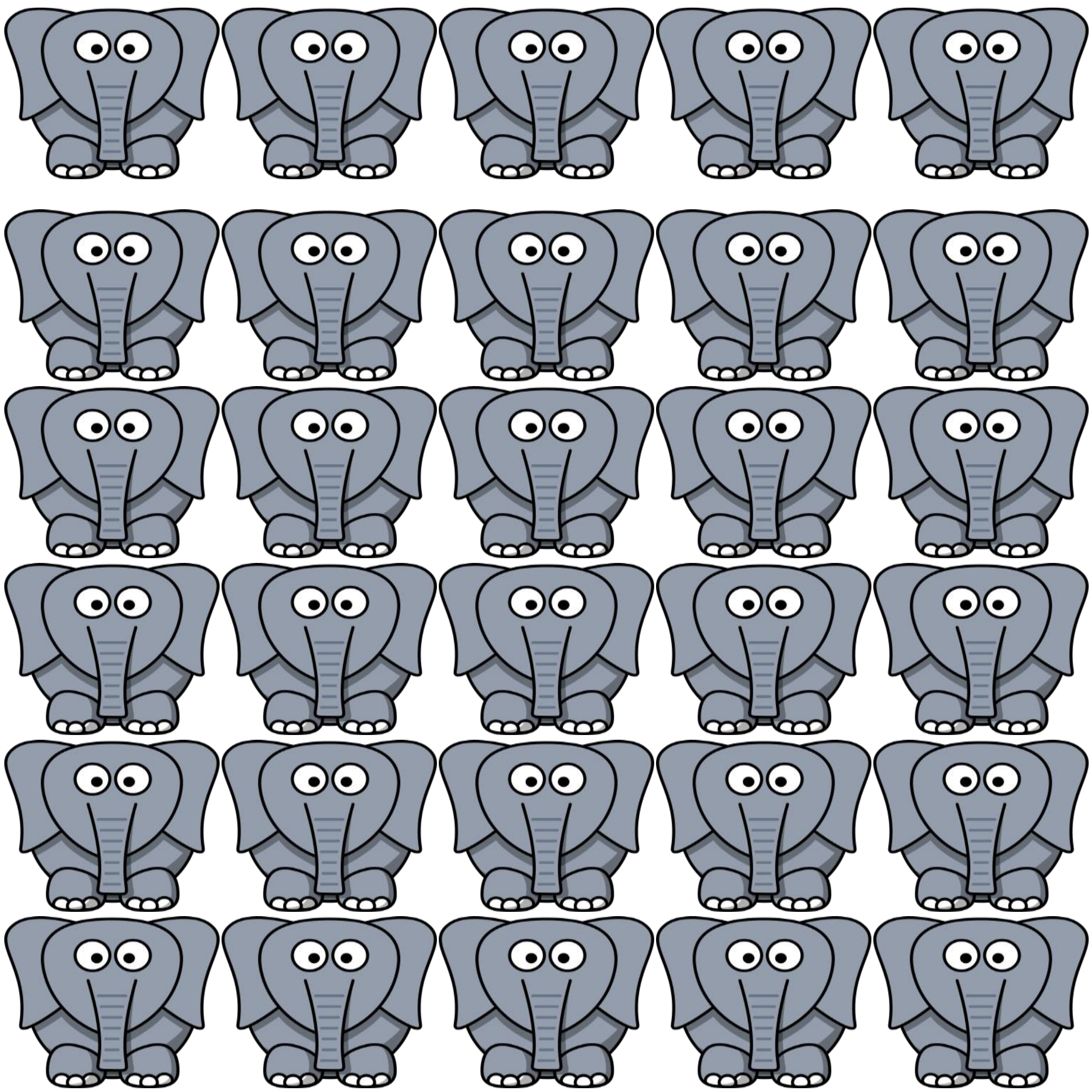
Symbol Definitions:

mN	milli-Newton
nC	Nano Coulomb
Kg	Kilogram
m/s	Meter/Seconds

Bibliography

Wikipedia was the source for most of the references in this document.

Epilog



Question to the Blind Man of Science:

How many elephants do you see?

His Answer:

What Elephants?