

# Ground Potential

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## **Abstract**

The baryon asymmetry problem, the nature of force, the invariance of a proton mass, the electron to proton mass ratio, the apparent numerical equivalence of charges, and last but not least, an accurate definition of ground potential are all questions we would like to answer. Herein a unified theory is proposed where the Lorentz  $\gamma$  factor can be accurately calculated for any body, either in motion or at rest in a gravitational field, from the electron to proton mass ratio. This model shows why the relative potentials of electrons and protons are exclusively a function of observer potential, which in turn leads to a unification of gravity and the electromagnetic force. Based on the current standard for electron and proton energies, Earth ground potential has been established at 930 million volts.

## I. INTRODUCTION

The standard model of particle physics has stood the test of time, yet problems are now surfacing which can't easily be explained. In this paper it will be shown how the investigation of the following problems led to an unexpected, yet elegant solution.

### A. Matter over antimatter

A known problem in physics is the baryon asymmetry, the absence of anti matter [1]. Both theory and experiment show how energy is converted into matter and antimatter particles of equal mass, with opposite charge. Thus far no significant amount of antimatter has been found. This has been a known problem since Paul Dirac proposed the existence of antimatter in 1928 [2,5]. What happened to antimatter?

### B. The nature of force

Since Isaac Newton published his theory of gravity [3], the term *force* has been in common use. Most people would say it is well understood, but when asked about the nature of force, few will have a good answer. Current theories have postulated force carriers and provided mathematical solutions, but these solutions require four separate forces to work and are not elegant. We ask, what is the nature of force?

### C. Protons and electrons

Not a commonly debated problem, but certainly a puzzle, is the invariance of the proton mass. We have a universe full of these particles, yet we have no theory to explain where these particles come from and in such quantities with amazingly uniform precision. We also question why there are apparently equal numbers of negative and positive charges in the universe. We understand that the ratio of the electron mass to proton mass is 1836:1, but why this number, and does it change over time?

### D. Ground potential

The term *ground potential* is used extensively in the fields of physics and electrical engineering, but what does it mean, does electrically neutral mean equal numbers of electrons and protons? It is common belief that potential is a scalar and needs to be referenced to some other potential, but do we measure it against the Moon, the Sun or what else? So it poses the question, what is ground potential?

## II. POTENTIAL ENERGY LIMITS

By definition an electron accelerated through a potential of 1 volt will gain a total energy of 1 electron volt (eV), likewise due to charge equivalence between protons and electrons, a proton accelerated through a potential of 1 volt will also gain 1 eV of energy. The mass energy of an electron is known to be approximately 0.511 MeV, therefore the energy to charge ratio (herein after referred to as potential) of one electron is 0.511 million volts (Eq.1),

$$\frac{0.511 \text{ MeV}}{1e} = 0.511 \text{ million volts} ,$$

*Eq. 1*

where  $e$  is the elementary charge.

Furthermore we can see how two, three or any arbitrary number of electrons, which may represent a multiple of charges, still only have a combined potential of 0.511 million volts (Eq.2),

$$5 \frac{(0.511 \text{ MeV})}{5e} = 0.511 \text{ million volts} ,$$

*Eq.2*

Likewise we can make the same argument for protons, which demonstrates that although, there is no limit to the amount of charge one can theoretically accumulate in one space there appears to be an upper limit to potential. We do not know of any stable particle with higher potential than a proton, it is therefore reasonable to assume that all stable particles ought to exist between zero and 938 million volts potential, therefore the following theory shall rest on a single postulate;

*a) that, no matter can exist at a higher potential than the energy to charge ratio of a single proton*

Just as it is already established how speed is the ratio distance over time, potential is the ratio of energy to charge, we already accept speed has an absolute physical limit  $c$ , so why not also an absolute limit to electrical potential?

Fortunately, the masses and therefore the energies of both electrons and protons are known to high precision.

Electron: 0.510998928(11) MeV\*

Proton: 938.272046(21) MeV\*

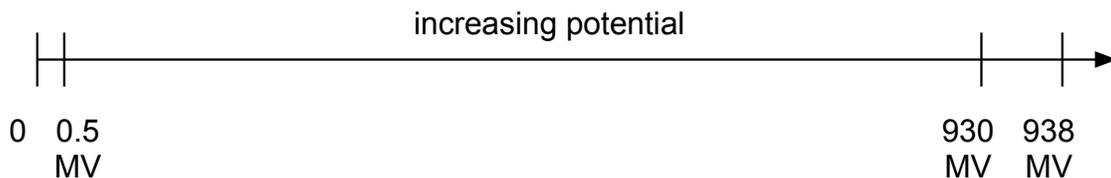
\* Source: *The NIST Reference on Constants, Units and Uncertainty*

Therefore we shall mainly focus on the potential in between these two particles.

### III. OBSERVERS POTENTIAL IS ASYMMETRIC

After establishing an upper and lower limit to electrical potential it would now be interesting to determine ground potential. Newton was no doubt faced with a similar problem, when he was calculating the gravitational constant  $G$ ; he would have wanted to know the mass of Earth. Newton could have made a crude estimate of the Earth's mass by filling up a bucket with rock and dirt, to obtain the density, then he could approximate the Earth mass by its volume accordingly.

Likewise we may also start with a rough guess. As demonstrated above with the electron and proton, the mass per nucleon of any atom divided by its number of nucleons will give the electrical potential of the nucleus. Therefore we may speculate, Earth's major component being iron its surface potential ought to be in the order of 930 million volts (Fe56 mass per nucleon). We shall soon see how close this assumption is. A clearer picture has begun to emerge and we realize how ground potential lies much closer to the proton potential than to the electron potential (Fig. 3).



*Fig. 3 Linear axis (not to scale) showing increasing potential to the right, with markers showing electron potential ground potential and proton potential.*

Such a severely asymmetric view of the world is quite contrary to the popularly held view, where ground potential was assumed to be somewhat neutral or in the middle. This understanding gives us an important clue as to why the electron mass is so much lower than the proton mass. The electron appears trapped in its own negative potential energy

well, thereby appearing to have suffered a mass defect. We are already familiar with this kind of mass defect, as we understand how radioisotopes decay and convert some of their mass to energy.

So with this new understanding of how an electron may have a mass deficit we ask the hypothetical question; Could the electron and the proton be a particle pair?

According to the standard model of particle physics, one expects objections:

- 1. the two particles have vastly different mass, and*
- 2. the electron has no internal structure like the proton, and*
- 3. the positron is the antiparticle to the electron*

Physicists know what happens when particle pairs are created; matter and antimatter particles of equal mass and opposite charge are created without exception. But let's consider how pair creation may look from an individual particle's point of view. Each particle is given almost instant velocity, momentum and relativistic mass, the initial velocity is taken to be  $c$ . According to Einstein's special relativity [6], relative velocity has the effect of shortening the axis along the direction of motion and slowing time. The result is zero relative velocity from the perspective of either particle, a particle experiences no velocity with respect to its antiparticle. To either particle its antiparticle would appear infinitely far away in a deep potential energy well.

It is exactly this relative potential which is responsible for the electrons apparent mass defect.

Now it can be understood that we are not observers in a great laboratory called the universe, instead we *are* "the experiment", made from matter we are acting like protons.

Now it appears plausible to calculate ground potential accurately, using a technique similar to the Lorentz transformation.

The worldview of the observer, is subject to relativistic effects caused by its own potential and we will try to show how it is congruent with special relativity [6].

Figure 4. is showing a graphic representation of the congruent relationship between local potential (V) and absolute potential (Ø) vs. velocity (v) and absolute velocity (c).

We consider the proton potential to be a constant in the same way as c (the speed of light) is a constant in velocity.

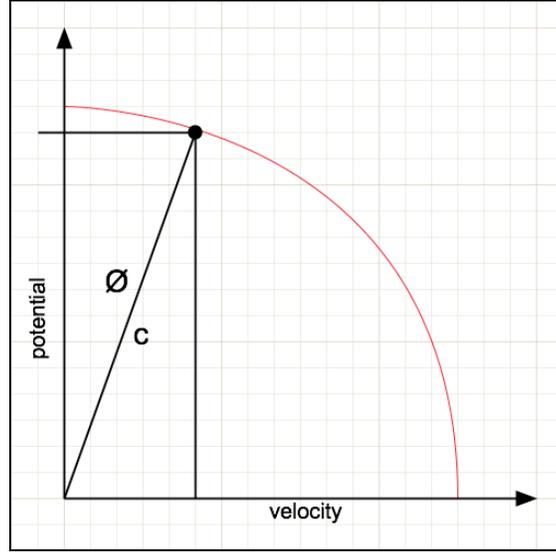


Fig. 4. Schematic of the relationship between, velocity and potential

In the schematic above the potential ratio: the ratio of ground potential  $V_g$  to the absolute proton potential  $\phi_p$  serves a similar function to the  $\beta$ -parameter (the ratio of velocity v to the speed c) in the usual Lorentz  $\gamma$ -factor.

It is by no coincidence that this new Lorentz type function involving the  $\beta$ -potential ratio, i.e., ground potential over absolute potential is congruent with the  $\beta$ -parameter: relative velocity over absolute speed.

Therefore, and in the context of the present work, we have replaced the expression

$\beta = \frac{v}{c} < 1$  with  $\beta = \frac{V_g}{\phi_p} < 1$  to arrive at the following entity;

$$\gamma = \sqrt{1 - \frac{v^2}{c^2}} = \sqrt{1 - \frac{V_g^2}{\phi_p^2}},$$

Eq.3

Where  $V_e$  is the known electron potential,  $\phi_p$  is absolute proton potential and  $V_g$  is the local observers (ground) potential.

This new  $\beta$ -potential expression opened up the exciting possibility of relating the electron potential to the proton potential, and after some trial and error the following relation was found to agree with the estimated value for ground potential.

$$(V_e)\gamma = \frac{(V_g - \phi_p)}{2},$$

Eq.4

Eq. 4 states that the electrons potential multiplied by gamma is equal to half the difference between the proton potential and ground potential. It can also be written in this form.

$$V_e = \frac{(V_g - \phi_p)}{2} \sqrt{1 - \frac{V_g^2}{\phi_p^2}}, \quad (I)$$

simplifies to,

$$V_e = -\frac{\phi_p}{2}(1-\beta)\sqrt{1-\beta^2}, \quad (II)$$

equivalently,

$$2\left(\frac{V_e}{\phi_p}\right) = -(1 - \beta^2) \sqrt{1 - \beta^2}, \quad (III)$$

redefining  $\frac{V_e}{\phi_p}$  as  $\alpha$  and squaring both sides,

$$4\alpha^2 = (1 - \beta)^2 (1 - \beta^2), \quad (IV)$$

we conclude that,

$$(1 - \beta)^3 (1 + \beta) - 4\alpha^2 = 0 \quad (V)$$

Eq.5

It is noteworthy to mention that Eq.4 and Eq.5 place the observers potential first, so that the electron comes out with negative potential.

We can now insert some real numbers in Eq.5 (V) and calculate a value for ground potential (x) as follows,

$$\left(1 - \left(\frac{x}{938.272 \text{ MV}}\right)\right)^3 * \left(1 + \left(\frac{x}{938.272 \text{ MV}}\right)\right) - \left(4 \left(\frac{0.511 \text{ MV}}{938.272 \text{ MV}}\right)^2\right) = 0, \quad \text{Eq. 6}$$

which gives the following solutions for x,  $x \neq 0$ ,

$$\mathbf{X = 930.377 \text{ MV}}$$

$$X = -938.272 \text{ MV},$$

$$X = 942.219 - 6.81798 i,$$

$$X = 942.219 + 6.81798 i,$$

$x = 930.377 \text{ MV}$  is a solution to Eq.6, because as we predicted it lies very close to the potential of Fe56 (930.412 MV), and Ni62 (930.417 MV) the elements known to have the highest binding energy. This value for ground potential agrees with the mass per nucleon of Ni-62 to a precision of 99.9957..% , a result which should be taken seriously.

Contrary to  $x = 930.377$  ;  $x = -938.272$  is not a solution to Eq.6

**Proof:** Upon substitution of x with -938.272 in Eq.6 and substitution of Ve with x we get a value of zero, which is meaningless.

For the complex solutions  $942.219 - 681798 i$  and  $942.219 + 681798 I$ , no physical interpretation has thus far been suggested.

A plausible reason as to why nuclear binding energies peak at Ni-62, is now proposed, for as we are observing the world from ground potential, matter simply decays towards the lowest potential and no further. See Fig.5

Atomic Mass Table Spreadsheet prepared by Dr. Gordon Gilmore of Nuclear Training Services Ltd. Data taken from the 1995 update to the atomic mass evaluation by G.Audi and A.H.Wapstra

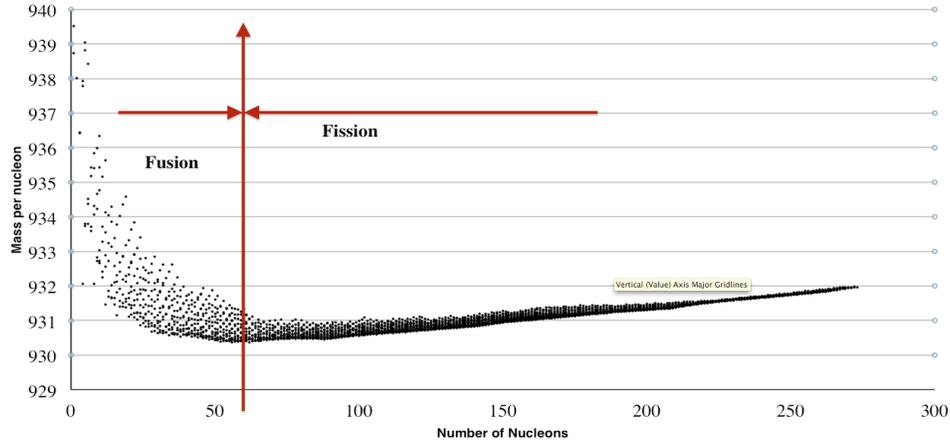


Fig. 5 Table of known elements plotted as nucleons vs. mass per nucleon, data reconstructed from a table [7] prepared by Dr. Gordon Gilmore of Nuclear Training Services Ltd.

Isotopes with higher potential than ground potential release energy by fusion, while isotopes with lower potential than ground give up some energy when undergoing fission. In this way we should consider both fission and fusion reactions as nuclear decay processes, the isotopes simply do as they do to reach ground potential, the observers rest frame.

### E. INTRINSIC PARTICLE VELOCITY

In the following discussion we shall consider how there is an absolute velocity associated with a body of any given potential, and how relative electric potential translates into relative velocity. In equation Eq. 7, we first show again how  $\gamma$  equals the classic Lorentz factor, which in turn equals to the new potential factor. Note both the classic Lorentz factor and the new potential factor are, in their standalone form, dimensionless numbers. When combined, these two factors allow us to solve for velocity as follows:

$$\gamma = \frac{1}{\sqrt{1-\beta^2}} = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{1}{\sqrt{1-\frac{V_g^2}{\phi_p^2}}}$$

(i)

which reduces to,

$$\beta = \frac{v}{c} = \frac{V_g}{\phi_p} \quad (\text{ii})$$

and then solving for velocity,

$$v = c \left( \frac{V_g}{\phi_p} \right). \quad (\text{iii})$$

*Eq. 7*

Equation 7, shows how there is an absolute velocity associated with a body of any electrical potential, ranging from zero to the speed of light, therefore arises a relative velocity between any two bodies of unequal potential. This relative velocity explains gravity, and possibly the other forces of nature, all with this simple equation,

$$\Delta v = c \left( \frac{\Delta V}{\phi_p} \right).$$

*Eq. 8*

Eq.8 states that the relative velocity between two bodies  $\Delta v$  is equal to the speed of light  $c$  factored by their difference in potential over absolute potential.

As there exists a clear difference in potential between an observer at ground potential and a free hydrogen ion, we can work out it's natural or intrinsic velocity as follows;

$$\Delta v = c \left( \frac{930 \text{ MV} - 938 \text{ MV}}{938 \text{ MV}} \right),$$

for which the solution is,

$$\Delta v = -2,557.10^6 \text{ meters per second}$$

*Eq. 9*

Eq.9, tells us that a proton observed from ground potential has an intrinsic velocity in the order of two and a half times the galactic escape velocity from Earth.

\*The negative sign indicates that the velocity is outwards directed, away from the observer.

#### A. The arrow of time

Due to the constant decay of naturally occurring radioisotopes in the Earth, and the fusion reactions taking place in stars, it is reasonable to assume that ground potential is in a state of decay. This constant change in potential albeit small, appears responsible for time itself. In other words, the passage of time is synonymous with a drop in potential. To demonstrate this we can literally borrow an apple from Newton, and state that an apple falling from a tree will always arrive at a destination in its future, therefore we conclude, the arrow of time points in the direction of lower potential.

#### B. Gravity

We can now attempt to unify gravity with electric potential, because it is almost trivial to convert velocity to potential and vice versa. Let us take one of the kinematic equations and show how to relate potential to gravity. Classical physics tells us that the velocity of a body in free fall under the influence of gravity is;

$$v = \sqrt{2gh},$$

*Eq.10*

where g is the acceleration due to gravity and h is the height above ground. We can now replace v with our new expression for velocity and solve for the difference in potential;

$$c \left( \frac{\Delta V}{\phi_p} \right) = \sqrt{2gh},$$

and solve for  $\Delta V$ ,

$$\Delta V = \phi_p \left( \frac{\sqrt{2gh}}{c} \right)$$

*Eq.11*

We can then use Eq.11 show how electrical potential varies with height above the ground, and our unification is complete.

## CONCLUSION

To summarize the above findings we shall go back and look at how this new understanding solves some of the current problems in physics.

### A. Matter over antimatter

Understanding how every proton was created along with an electron, explains what happened to antimatter, it is no longer a problem. Antimatter is right here, every atom is made from both protons and electrons, we as observers just happen to be potentially biased towards the proton. Symmetry dictates that there must be a complete identical and equally valid anti-world as seen from the electrons potential. This prospect opens up a new question about the topology of an atom, in this scenario a seamless transformation from a positive state to a negative state is required. Such a seamless transformation is easy to visualize for Hydrogen, but it would be mindboggling complex for the heavier nuclei.

### B. The nature of force

As shown above, the nature of electromagnetic force and gravity can be explained as the difference in absolute velocity between bodies of different mass to charge ratio. There is no need to postulate multiple separate forces or force carriers, because intrinsic relative velocity is all what is required.

### C. Protons and electrons

If protons and electrons were created in pairs they must appear in exactly the same numbers. The electron to proton mass ratio is explained and it is no longer a puzzle why the proton is 1836 times heavier than an electron. Last but not least, explaining why protons all appear in the same size remains a puzzle to solve. We can speculate that matter in our universe is created by some standard mechanism, which consistently makes pairs of exactly 938 MeV, and such a “machine” might turn out to be a black hole.

### D. Neutrons

Until now it has been understood that neutrons are particles without charge. Now we need to rethink the concept of no charge, because for the neutron to be unaffected by the electric field it must have the same potential as ground potential ie. +930 MeV so it can hardly be considered charge less. Inside the nucleus of Ni62, a neutron may be indistinguishable from a proton, and the constant presence of transient electrons passing through the nucleus maintaining the charge balance. Once free from the nucleus, the neutron finds itself at the wrong potential where it instantly takes on its intrinsic velocity,

eventually disintegrating into it's individual components.

#### E. Ground potential

We now understand what is meant by ground potential; it is the observers electrical potential, and by knowing the mass of the proton and electron we can calculate the exact potential. We also understand that ground potential is in a state of decay, and that this may be the mechanism by which time flows. The continuous processes of nuclear decay being responsible for the decay over time, meaning the electrical potential we call ground potential is constantly falling. Fortunately the process is slow in terms of human life span, and since the beginning of time the potential has only fallen by 8 million volts or 0.85%, resulting in today's electron mass of 0.511 MeV. Regardless, we can project forward and solve Eq.4 for a ground potential of zero, which would signify the end of time, as follows:

$$V_e = \frac{(0 - \phi_p)}{2} \left( 1 - \frac{0}{\phi_p^2} \right)^{\frac{1}{2}},$$

which simply reduces to,

$$V_e = \frac{\phi_p}{2}.$$

*Eq. 12*

What Eq. 12 tells us is that ground potential goes towards zero as the potential of the electron approaches half the potential of the proton. This we understand as the potential equivalent of the Schwarzschild radius, and the end of time in this frame of reference. One may further speculate that a body with rest mass transforms to a photon when reaching zero potential.

#### IV. CONFIRMATION OF THEORY

This theory can best be proven by showing an upwards drift in the mass of the electron, but due to the relatively slow decay of ground potential, it could take some time before we are able to confirm a measurable drift in the proton to electron mass ratio. Recent studies conducted at the VU University Amsterdam [8] has set a stringent limit on a drifting proton to electron mass ratio by comparing transitions in methanol observed in the early universe. Their published results are consistent with a null value. This is what one would expect when conducting the experiment at ground potential. The state of the

universe including its age, its size and the mass of its electrons, is a function of the observer's potential, which renders the VU University experiment invalid. This theory implies that the mass every electron in the universe is a function of the observers potential.

## V. ACKNOWLEDGEMENTS

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