

Novel Quantum Gravity Model of the Physics of Operability of Galvanic Cells and Electrical Power Generation

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Submitted: 16 Jan 2021; **Accepted:** 28 Jan 2021; **Published:** 31 Jan 2021

Citation: C Bhattacharya (2021) Novel Quantum Gravity Model of the Physics of Operability of Galvanic Cells and Electrical Power Generation. *Adv Theo Comp Phy* 4(1): 07-13.

Abstract

The dimensions of the physical variables like resistance, electrical current and potential difference associated with ohm's law have been evaluated applying the theory of quantum gravity (QG theory) and those dimensions have been utilized to evaluate the actual mechanism of functioning of the galvanic cells to originate electricity, power and power transmissions.

Itself, the terminology, 'Electromotive Force (emf)' of a galvanic cell does not stand at the proper stead, as has been established in this article by revealing the unidimensional characteristics of emf or the difference in electrode potential between the positive electrode (cathode) and the negative electrode (anode). In QG theory, Force is a 2-dimensional physical variable of the universe, being originated from unidimensional 'Distance' or 'Entropy'.

The traditional concept of the mapping the emf of galvanic cells by the free energy changes of the chemical reaction occurring in a cell is not justified and the energy output from a galvanic cell has been proved to be a phenomenon of continuous passage or flow of in-situ activation volumes or activation energies of the chemical reactions occurring, through the external conducting paths.

Keywords: EM-Wave, Electrical Current, Resistance, Power, Potential Difference, Time

Introduction

The ohm's law and the associated mathematical equation, $V=IR$, relating the resistance (R), electrical current (I) and the potential difference (V) across a conductor is a very famous equation on which, the subjects of electro-physics and electro-chemical physics rests upon. This equation being the most important equation in the above said fields, have been analysed in this article for the first time, in regard to its relationship to the most fundamental physical variables or gravitons, as for example the 'mass graviton', 'force graviton', 'entropy graviton', and 'acceleration or space expansion graviton'. This analysis gives rise to a dimension of the electromotive force which is unidimensional and it is being shown that ohm's law is very much derivable from the most fundamental equation of Newtonian Physics, Force = mass x acceleration. The dimension of the physical variable 'resistance' turns out to be inverse 3-dimensional, the same dimension as that of 'masses' of the QG theory [1, 3, 5].

The output of an electro-chemical cell in the form of electrical current, energy or power has been shown to originate from the continuous flow of the activation volume/energy (of the chemical reactions occurring within the cell) through the external circuits. The

conventional theories of electro-chemistry depict that an electrical current is the outcome of the change in free energy of the chemical reactions. The free energy is a thermodynamic state variable and is a property of the system exclusively. The mechanism by which this free energy is being transformed to electrical current and which does continually pass out to the external conducting path of the reaction vessel have never been elaborated in the literature.

The novel quantum gravity theory driven model of electrical current generation and electrical power generation of a galvanic cell in this article, has been derived stepwise from the activation energies of the anode and cathode chemical reactions and in none of the steps the free energy parameter, either does appear on its own, or is required to be brought in the picture of the said derivation of the novel model. The said novel model has been diagrammatically shown in this article.

The physical variables of an electro-chemical cell or electro-physics, as for example, resistance, resistivity, potential difference, electrical current are all being present in the geometrical figure drawn of an atom, in the theory of quantum gravity and that has been elaborated and shown diagrammatically.

1. Revealing the Physical Dimensions and the Geometrical Shapes of Electrical Potential difference, Electrical Resistance and Electrical Resistivity of Baryonic Matters of the Universe.

One of the most fundamental mathematical equation of Newtonian Physics of motion is,

$$\text{Force} = (\text{Mass}) \times (\text{Acceleration}) \quad (1.1)$$

$$(1/\text{Force}) = 1(\text{Mass}) \times 1/(\text{Acceleration}) \quad (1.1a)$$

The classical physics defines mass as a physical variable of the universe or the baryonic matters, which is a resistance to acceleration. Why and how the masses resist acceleration, the classical or Newtonian Physics, however, is silent.

The QG theory, after revealing the geometry of mass (a, 3-dimensional saddle), however, can explain it. Since mass is 3-dimensional saddle, it is very much an attractive field and while acceleration is space expansion or dispersive type, the mass tries to pull it back. When mass and acceleration interacts with each other, while mass tries to inhibit space expansion, the space expansion tries to overcome the pull back of mass and as a result of that, when the acceleration wins the race, it is 'Force' and when the mass wins the race, the domain itself changes, the domain does pass on to the inverse dimensionality domain and it is 'inverse force' or the 'time' is being evolved, the universe's attractive cage.

A physical variable does exist in between mass and acceleration, which is Force. The QG theory explains equation (1.1) in a different manner than Newtonian logic. Equation (1.1) can be written in either of the following two forms,

$$\text{Acceleration} = (\text{Force}/ \text{Mass}) \quad (1.2)$$

$$\text{Or, } (1/\text{Acceleration}) = (\text{Mass}/\text{Force}) \quad (1.2a)$$

The QG theory logic is, when the Force overcomes the mass, then it is an acceleration or space expansion having the dimensionality of 5. When mass overcomes the force, it is inverse acceleration or space inversion having the inverse 5 dimensionality.

In Newtonian physics, the physical variable acceleration was put in some abstract form without labelling it with a proper geometrical nomenclature. Applying QG theory, equation (1.1) can be rewritten as,

$$\text{Force} = (\text{Mass}) \times (\text{EM -Wave}) \times (\text{Distance or entropy}) \quad (1.4)$$

In Figure 1 below, QG theory derived geometrical shapes and dimensional notations of the physical variables like mass, entropy/distance, order, energy/volume, EM-wave, space expansion or acceleration, space inversion or inverse acceleration have been shown.




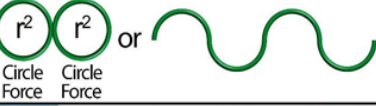
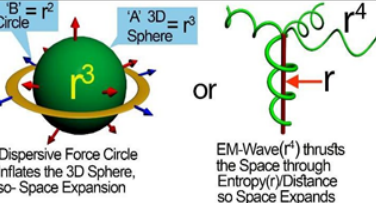
Physical Variables	Geometrical Shapes	Dimension Notations
1. Entropy/ Distance		r
2. Order		1/r
3. Volume/ Energy		r³
4. EM-Wave		r⁴
5. Space Expansion/ Acceleration		r⁵

Figure 1: Geometrical Shapes and Dimensions of the Physical variables.

From Figure 1, it is very clearly understood that acceleration/ space expansion is a di- hybrid of EM-wave and entropy/distance and Force is a tri-hybrid of 'EM-wave, Space Expansion/acceleration and entropy/distance. The inverse dimensionality of mass swallows some of the dimensionalities of acceleration/space expansion and resulting to bi-dimensionality of the physical variable, force.

Now the dimension of resistance/impedance in physics is, (L²MT⁻¹Q⁻²). Now in QG theory [1]:
 L=Distance=r, M= Mass= (1/r³), T =Time= (1/r²), Q= electric Charge= r² and so the dimension of resistance comes out be, (r²x r³x r²x r⁴) = (1/r³). So resistance is mass or mass is resistance since both of the said physical variables are of inverse dimensionality, (r⁻³).

The physics dimension of potential difference or Planck electromotive force (L²MT⁻²Q⁻¹) and the QG theory dimensions of the concerned physical variables are:
 L=Distance=r, M= Mass= (1/r³), T =Time= (1/r²), Q= electric Charge= r² and if these are being put in the physics dimension of electromotive force, one obtains,
 Emf or potential difference = (r²) x (1/r³) x (r⁴)x(r²) = r. So QG theory predicts the dimensionality of emf to be unidimensional.

Now dividing equation (1.1) by distance (r), both sides, one gets,
 (Force/ distance) = (mass) x (EM-wave) (1.5)
 Or, (r²/r) = (mass) x (EM-wave) (1.6)
 Or, r= distance = (mass) x (EM-wave) (1.7)

The ohm's law is,
 Potential difference (V) = Resistance (R) x electrical current (I) (1.8)

The resistance in QG theory [1] has already been proved to be the same as mass and electric current is an EM-wave, and hence, if one compares, equation 1.7 and 1.8, it is found that,
 Distance = Potential difference (V) = (mass) x (EM-wave) = (Resistance (R) x electrical current (I) (1.9)

So, potential difference or emf is truly a unidimensional physical variable. So the nomenclature conferred to the physical variable 'Potential difference' as 'Electromotive Force' is a misnomer since force is bi-dimensional while potential difference is unidimensional as is understood from the discussions made above.

The atomic level definition of resistivity is being given towards the end of this article. However, at first, the dimension of resistivity (ρ), is being derived from Ohm's definition:

Ohm's law states that, the Resistance(R) of a conductor is directly proportional to the length (l) and inversely proportional to the cross sectional area (A) and this is being mathematically represented by:
 $R = \rho \times (l/A)$ (1.10)

Where ρ is the proportionality constant and is being defined as the resistivity of the conductor. If the QG theory derived dimensions of the physical variables are being put in equation (1.10), one obtains,
 $(1/r^3) = \rho \times (r/r^2)$
 Or, $\rho = (1/r^2)$ (1.11)

Figure 2 below shows the geometrical shapes of the physical variables, resistance, and resistivity, mass and potential difference. The resistivity parameter bears the same dimension as that of time or in the other way represents time.

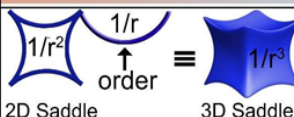

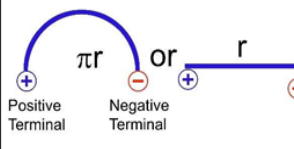
Physical Variables	Geometrical Shape	Dimensional Notations
1 'Resistance'		$(1/r^2 \times 1/r) = 1/r^3$
2 'Resistivity' or 'Time'		$1/r^2$
3 'Potential Difference' or 'Voltage'		r

Figure 2: Geometrical Shapes & Dimensions of Electro – Physics Variables.

So resistivity like 'time' is an inverse force [1] or a 2-dimensional saddle and that's the reason higher the resistivity or higher the pull back, the resistance of a conductor becomes higher.

The variable mass and resistivity are very much alike to each other since both are of inverse dimensionality and is attractive in nature. So mass is an inverse sphere (r^3) and the base inverse circle of of

mass is resistivity and which is r^{-2} . One can write,
 Volume of the inverse sphere = constant x r^3 = Mass = constant x (Area of the base of the inverse circle, r^2) x (radius of the inverse circle, r^{-1})

As per QG theory, radius of the inverse circle is the index of 'order graviton', so it can be written, that

Mass = Constant x Resistivity x order = Resistance of a conductor or Baryonic matter.
 Volume = Constant x Conductivity x entropy = Conductivity of a conductor or Baryonic matter

So resistivity is an inverse force graviton (or time) and when it gets hybridised with order graviton, the physical variable which emerges, is mass. So mass is 'ordered resistivity' and such nomenclature would be the most worth as far as the quantum gravity logic of electro-physics or electro-chemistry is being concerned.

2. The Quantum Gravity Model of 'Physics of the generation of Electrical output of Galvanic Cells'.

In a Galvanic cell, the metal at the anode readily dissolves to form metal ions due to the lower activation energy or activation volume of the chemical reaction occurring at the anode. On the other hand, at cathode, the activation energy or activation volume of the chemical reaction type, metal ion to metal, is higher than that of the anode.

So it can be written,
 Activation Energy or Volume at Cathode > Activation Energy or Volume at Anode (2.1)

In QG theory Volume/ Energy is hybrid of Force and Entropy or distance, and the so called emf or potential difference of a Galvanic cell is the outcome of the difference in energy between the Cathode and the Anode or is difference in the Activation Volume or Energy between the Anode and the Cathode. It can be written

(Electrostatic Force x Average distance of travel of cation to discharge at Cathode >
 (Electrostatic Force x Average distance of travel of cation to unite with anion at Anode.

Since the electrostatic forces between the cations and anions must be the same at the state of equilibrium of generation of steady electrical output of a galvanic cell, at the cathode and anode respectively, so,

Average distance of travel of cation to discharge at cathode (r_c) > Average distance of travel of cation to re-unite with anion at Anode (r_A).

So, $(r_c - r_A) > 0$ (2.2)

So the so called emf or potential difference of a galvanic cell is simply the difference in the average distances of travel of cations as stated above at cathode and anode respectively and is unidimensional by its geometry. The distance in QG theory is being termed as 'entropy' and in fact the potential difference is a 'directional entropy' or 'entropy dipoles' and those flow in definite directions only in the form of electrical current [1]. This has been discussed

in more detail while explaining an electric field, at the end of this article.

In Figure 3, Figure 4 and Figure 5 below, diagrammatically the EM-waves generations have been shown at the cathode and anode respectively along with the generation of potential difference or the so called 'emf' of a Galvanic cell.

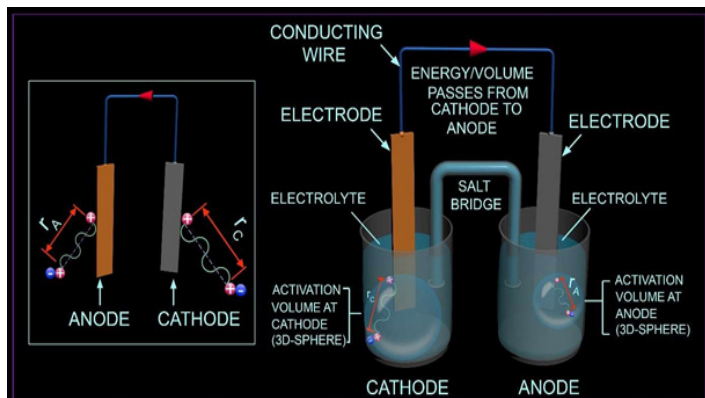


Figure 3 : Diagrammatic Presentation of the operability of a Galvanic cell Generating Electrical Current.

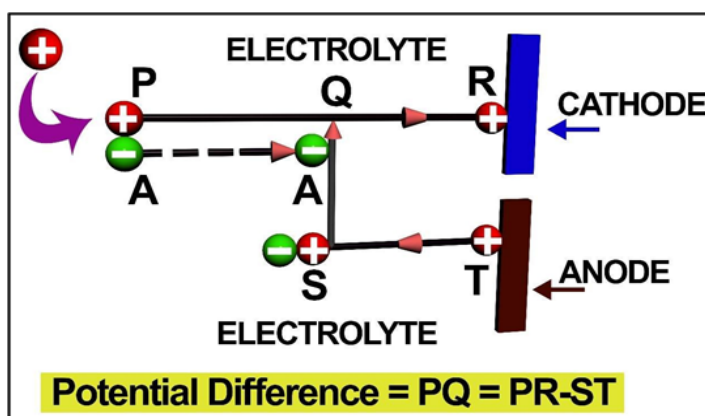


Figure 4 : Representation of Potential difference as "Distance or Entropy Graviton"

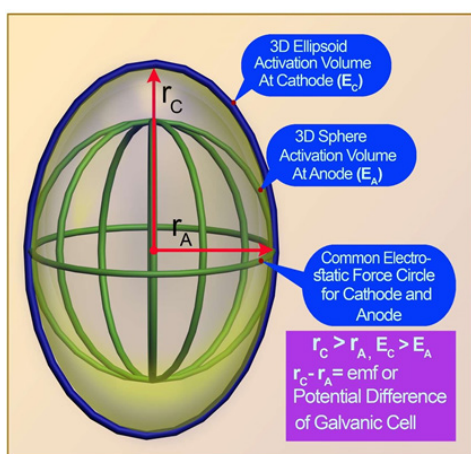


Figure 5 : Representation of the Geometrical Shapes of the Activation volumes at Cathode and Anode respectively with Equal Magnitude of Electrostatic Force.

As shown in Figure 4 above, the cation at Cathode travels an average distance PR to discharge at the Cathode. At anode, the cation travels an average distance ST to come into the electrolyte solution. The direction of movements of the cations are in opposite directions as shown in figure 4. At Cathode, the cation moves from electrolyte to the electrode (cathode) and at anode it moves from electrode (anode) to electrolyte. The distances QR and ST are equal in magnitude but are of opposite directions and hence they cancel each other and what is left is the distance PQ and that is the potential difference or the so called emf of a galvanic cell. While moving towards the electrode, the cation at cathode drags its counter anion (due to the attractive forces between opposite charges) and the counter anion reaches the point Q. Also the instant at which the cation at cathode is being driven towards the electrode, its space is being replaced by another cation from the electrolyte, as shown in figure 4. So within the distance PQ, there do exist a positive electrical pole at point P and a negative electrical pole at point Q. This is the reason it is being called an 'entropy dipole' and this indeed is the potential difference of a galvanic cell.

The shapes of the activation volumes at cathode and anode have been shown to be as 3D spheres as shown in figure 3 for understanding of the concept of it. However, in real situations, the shapes of the activation volumes deviate from perfect 3D spheres. This is being shown in figure 5. While the electrostatic force circle remaining the same for both cathode and anode, it is the breadth of the 3-dimensional geometry which differs. The current model is based on the fact that at equilibrium condition of generation of electrical current, the electrostatic force at cathode and anode remains to be the same but which differs is r_c and r_a . Exactly this is being shown in Figure 5. The breadth r_c is higher than the breadth r_a and as a result the activation volume at Cathode acquires a 3D-ellipsoid shape and the activation volume at Cathode (E_c) remains to be higher than the activation volume (E_a) at anode, the shape of which remains to be a 3D -sphere.

The electrical power is defined as the energy spent or work done by an electricity generating device per unit time (t). It will be shown here that the work done is very much connected to the difference in activation volumes at the Cathode and anode respectively.

$$\text{Electrical Power} = (\text{Energy or Work}) / \text{time} \quad (2.3)$$

In QG theory Energy or work is same as volume and is 3-dimensional physical variable. The work done should be taken as the difference in work done between cathode and anode or the work done is the difference in the Activation volumes between the cathode and the anode or the net activation volume. Now Volume, as shown above, can be written as conductance (like mass is resistance),

$$\text{Net Activation volume} = E = \text{conductance} = (1 / \text{Resistance})$$

Applying equation (1.8) or the ohm's Law, one gets, $(1/R) = (\text{electric current}) / (\text{Potential difference})$ Electrical Power (P) = (Net Activation Volume/time) = (electrical current / potential difference) / (time)

$$= (\text{electrical current} / \text{time}) \times (1/\text{potential difference}) = (r^4/r) / (1/r^2) = r^5 \quad (2.4)$$

So electrical power is 5 dimensional and the dimensionality break-ups in the following manners, give rise to the actual concept of, what an electrical power or power transmission (P) is:

$$P=r^5 = r^4 \times r = (\text{electrical current or EM -wave}) \times \text{distance (entropy)} = (I \times V) \quad (2.5)$$

So electrical power is propagation of EM – wave or electrical current over distances.

$$\text{Again, } r^5 = r^3 \times r^2 = r^3 \times 1 / (1/r^2) = \text{Net Activation Volume} / \text{time} = (E/t) \quad (2.6)$$

So electrical power is the continuous flow of the ‘net activation volume of cathode to anode’ per unit of time through the conducting path of a Galvanic cell.

In figure 6, the electrical power generation of a Galvanic cell has been shown in the form of continuous EM-wave propagation throughout the conducting path as represented by equation (2.5) above [1, 3].

In figure 7, the electrical power generation of a Galvanic cell has been shown in regard to the flow of net activation volume through the conducting path, as represented by equation (2.6)

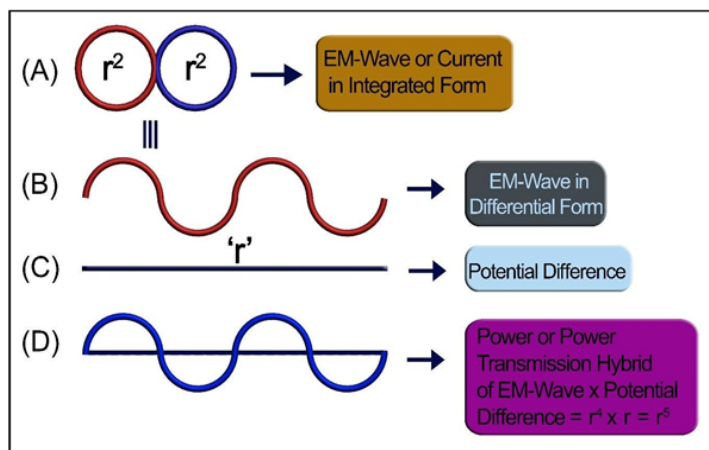


Figure 6: Representation of Power Generation as a hybrid of EM-wave (I) and Potential Difference ($P=I \times V$)

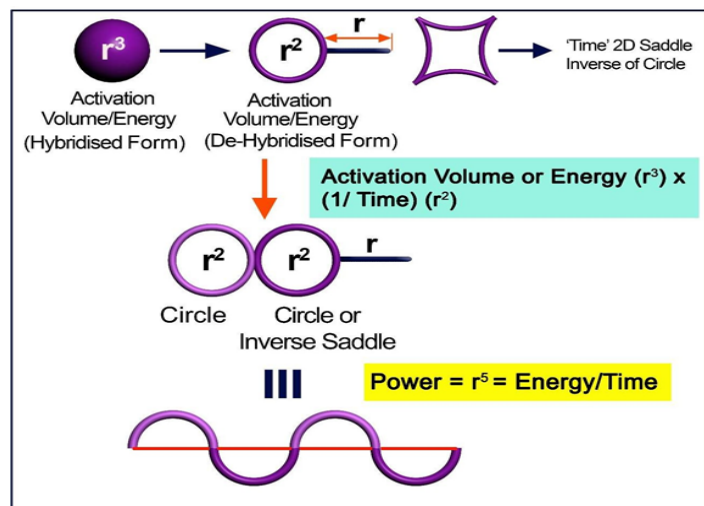


Figure 7: Representation of power generation in the form of (Activation volume/time) or (E/t)

It is required to be noted very much that the representation of electrical power, which is being, 5 –dimensional entity by either Figure 6 or Figure 7 conveys the same meaning basically although they look different diagrammatically step to step but finally being the same.

The model of electrical power generation as presented in this article (Figure 3) needs to be very strongly established. The electrical power generation (P), as a matter of fact, is related to the following 3 parameters:

- Activation Volume
- EM-Wave
- Time

The equation (2.4) can be re-written in the following form, keeping in mind that as per QG theory, volume is 3 dimensional, EM-wave is 4 dimensional and time is inverse 2 dimensional.

$$r^5 = (r^3) \times (r^4)/(r^2) = (\text{Activation Volume}) \times (\text{EM-wave}) \times (\text{Time}) \quad (2.7)$$

If Figure 3 is being followed, it is being revealed that visibly in the chemical reaction vessel (cathode or anode), the electrical output is a di hybrid of 3-D sphere activation volume and the 4 –D, EM Wave (or electrical current). However, the physical variable, which is invisible in the figure and cannot be shown that way, but is omnipotent, is the variable ‘time’. To the end, the electrical output cannot be the activation volume alone, cannot be the EM-Wave alone, or it cannot be even the dihybrid of activation volume and EM-wave. It has to be, the tri-hybrid of Activation volume, EM-Wave and time. Since power is a transmission and transmission is linked to time. The power transmission is being shown as per equation (2.7) in the following figure 8.

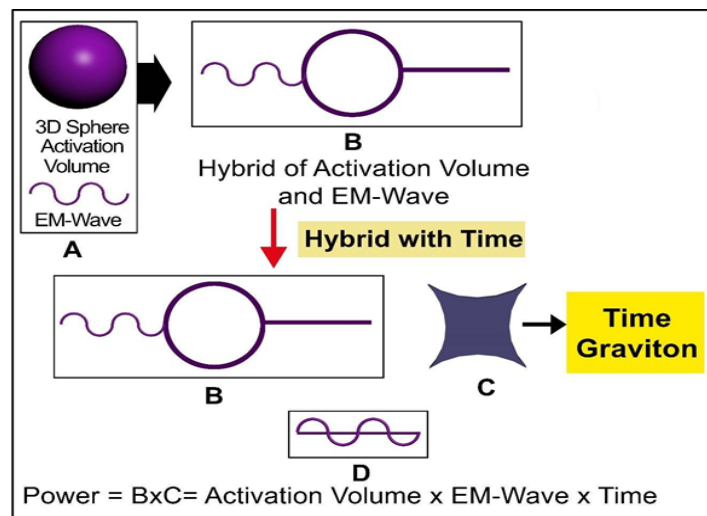


Figure 8: Representation of Power Generation of a Galvanic Cell as a tri hybrid of Activation Volume, EM-wave and Time.

A very good conceptual description can be given about the electrical power output of a galvanic cell and that concept needs to be accepted as a universal concept of electro –physics. The very affluent essence of the theory of quantum gravity is, any physical variable of the universe can be considered as a hybrid of ‘order’ and ‘disorder’. The ‘disorder’ part of electrical power output is the

hybrid or the product of activation volume (r^3) and EM-wave (r^4) in equation (2.7) and these two dispersive physical variables take the dimension to r^7 . However the 'order' part of P is 'time', which when gets hybridised with the order part, brings down the dimensionality of P to r^5 . so one can write,

Disorder part of electrical output, $P = (\text{activation volume} \times \text{electrical current})$

Order part of electrical output, $P = (\text{time})$

So $P = (\text{order} \times \text{disorder}) = (\text{time} \times \text{activation volume} \times \text{electrical current or EM-wave}) = r^5$

The above said concept stands to be the best conceptual definition of electrical power output against the mathematical expression of power output in the form of (activation volume x electrical current x time) as given in equation (2.7) and is an universal concept of power.

A question may arise that in equation (2.6) the power has been shown to be (Activation volume)/time but in equation (2.7) it is shown in different form, where 'time' goes to the numerator. As a matter of fact, when one considers the hybrid of activation volume and EM -wave, EM-wave (r^4) is the outcome of the baryonic matter overcoming the 'time' attractive cage [3], hence it is in the form (Baryonic matter (r^2))/ (time) or (Baryonic matter (r^2))/ ($1/r^2$) and the time factor does invisibly come in the denominator '(Activation Volume)' x (EM-wave)' part of equation. So equation (2.7) can be written as:

$$r^5 = (r^3) \times (r^4)/r^2 = (\text{Activation Volume}) \times (\text{EM-wave}) \times (\text{Time}) \\ = (\text{Activation Volume}) \times (\text{Baryonic matter } (r^2))/ \\ (\text{time}) \times (\text{time})$$

The parameter 'time' in the above expression cancels each other in the numerator and the denominator respectively and consequently, the equation (2.7) merges with equation (2.6).

Most interestingly, one can retrieve the physics, or the truth about the EM-Wave or electrical current and 'time' variables of the universe and which is shown below, If the equation (2.6) and equation (2.7) are compared with each other, one may write, (Activation Volume)/ (time) = (Activation volume) x (electrical current) x (time)

Or, electrical current (I) = $1/(\text{time})^2$ or, $I = 1/t^2$ or $t = (1/I)^{1/2}$

So electrical current is the result of inversion of squeezed time dimension of the universe or as a corollary, it can be stated the time dimension of the universe is the inversion outcome of squeezed electric current or EM-wave. (While, squaring of an inverse physical variable/dimension is squeezing, the square rooting of a normal dimensional variable is squeezing too [1]).

Now the concept of 'Electric Field' or 'Electric Field Strength/Intensity' will be elaborated. It has already been proved in the QG theory1, that an electric field is dimensionless. The path through which an electrical current flows in an electrical circuit, holds an electric field or an electric field does exist al through the path length of an electrical circuit. The strength/ intensity of an electric field is being defined in physics as, (potential difference/Distance). If the potential difference of a galvanic cell is 10 cm, for example,

and the path length is 100 cm then the strength of the electric field would be, (10cm/100 cm) = 0.1 (dimensionless). If this being expressed as percentage, then the value would be $0.1 \times 100 = 10\%$. What does this 10% indicate? This 10% indicates that the potential difference graviton (or entropy dipole graviton) is only 10% of the total path length and to fill up the said entire path length, 10 nos. of such gravitons would be required. If, for example, the strength of the electric field is found to be 20% for an another such consideration, then 5 nos. of such gravitons would be required to fill the entire path length. In the latter case, the electric field intensity or strength is considered to be higher than the former since the entire path length could be covered with 5 nos. of gravitons in the latter while it requires 10 nos. of gravitons in the case of former.

If one considers the flow of, for example, water through a pipe, then at any instant of continuous flow of water at a steady rate, in the length, in between the entry and exit ends of the said pipe, the number of molecules of water present remain to be constant. Similarly, for the case of the electrical field of 10% strength, at any instant, the number of potential gravitons that would be present throughout the entire path length, would be 10. So electrical current in a galvanic cell is the directional flow of 'entropy dipoles' (positive charge at one end and negative charge at the other end) from cathode to anode throughout the entire path length of an electrical circuit. There is no point to consider that the electrons do flow through the circuit while a galvanic cell is producing current. It is the electrical dipoles or the entropy dipoles which do flow. The entropy dipoles are carrying positive charge at one end and negative charge at the other end and as a whole is electroneutral.

A Carnot engine as has been shown in the QG theory [1], generates 'directional entropies' and which do come out from the system and drives the vehicle. So a Galvanic Cell and a Carnot engine are basically being the same and continually go on generating 'directional entropy' and in the thrust of the said entropy the electrical current or EM-wave is generated in the former and a motion is induced in the latter.

Baryonic matters are composed of entropy gravitons [1] and since the entropy gravitons do continually emerge out from a galvanic cell or a Carnot Engine, with the progress of usage of a galvanic cell or a Carnot engine, the electrolytes are being lost over time in case of a galvanic cell and the engine oil is being exhausted in case of a Carnot engine. The 'Life Cycles' of the Galvanic Cells or the Carnot Engine comes towards end and to make them re-workable, they are required to be replenished with fresh electrolytes or Engine oils.

Electric field is a vector in the sense, it has got a definite direction, as discussed above and as well it has a magnitude but the magnitude is dimensionless. The shear stress in physics is being defined as a ratio between 'Force' and 'area' and since Force and Area both are bi-dimensional as per QG theory1, the shear stress is dimensionless by its magnitude but of course it has a direction. For example, a liquid can be made to flow in a definite direction by applying shear stress. So electric field strength and shear stress are the same phenomena. The physical variable, which is being called electric field in electro-physics merges to the shear stress in Newtonian Physics and both are the ratio of two distances. This is shown below, by dimensional break-ups:

Shear Stress = (Mass x acceleration)/(Area) = (MLT²)/(L²)=(MT²/L)=(1/L³) x (L²)/L² = L/L= (Distance)/(Distance).

In QG theory, T= time = 1/r², M = Mass = 1/r³, L=r= Distance.

3. 'ATOM GRAVITON'[1] of QG Theory vis-à-vis Ohm's laws connecting the Potential difference (V), the current density (I), the Resistance (R) and the Resistivity (ρ) of Baryonic Matters.

The QG theory has pictured an 'Atom Graviton' and one can figure out the existences of the electro physical variables in the said pictures [6]. Two pictures have been presented in QG theory of an atom graviton and those are:

Picture 1: In the form of 'ENERGY x ENTROPY x TIME'
(see figure 9 below)

Picture 2: In the form of 'ENERGY x MASS X FORCE'
(see figure 9 below)

At first, the picture 1 will be discussed. The resistivity equation (1.10) of a conductor can be written in the following form,

$$\begin{aligned} \text{Resistance} &= \text{Mass} = (\text{Resistivity}) \times (\text{Distance} / \text{Area}) \\ &= (\text{Resistivity}) \times (1/ \text{Distance}), \text{Area} = (\text{Distance})^2 \\ \text{Or, Mass} &= (\text{Resistivity or time}) \times (1/ \text{Distance}) \\ \text{Or, Volume} &= (\text{Distance})/ (\text{Resistivity or time}), \text{Volume is inverse to mass} \\ \text{Or, (Volume or Activation Volume)} &\times (\text{Resistivity or time}) = \text{Distance or entropy.} \end{aligned} \quad (3.1)$$

Figure 9 as shown below Picture (1) does just reflect the mathematical relationship as shown in equation (3.1).

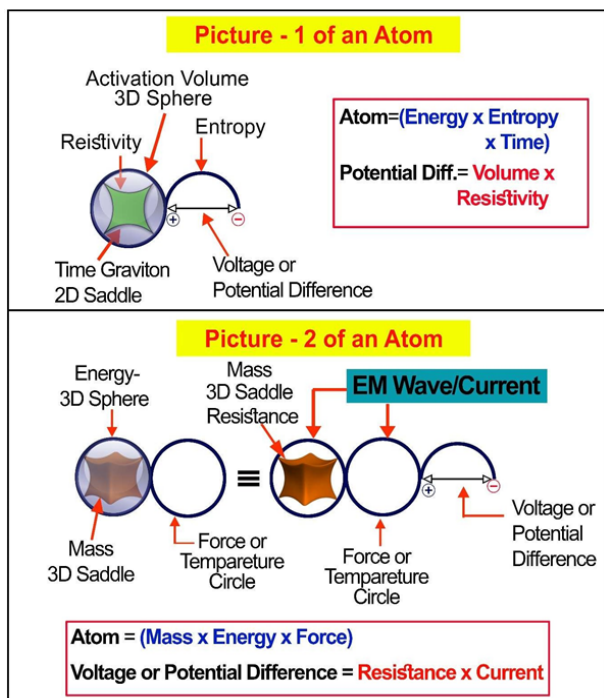


Figure 9: An Atom of a Baryoinc matter vis-a-vis Ohm's Law of Electrical Current.

Figure 9 as shown above (Picture 2) does just reflect the ohm's law parent mathematical equation of, $V= IR$, equation (1.9).

Conclusion

The Novel model of 'Electrical Output of a Galvanic Cell' as presented in this article helps the indepth understanding of the physics of the operability of a Galvanic cells and a new horizon is opened up to carry out further theoretical and experimental research work about monitoring the average workable life of the Galvanic cells and to design higher efficiency versions of the same. The philosophies would be i) to choose right electrolytes and the right concentrations of the electrolytes such that the length of the 'entropy dipole' be maximum, for higher efficiency version and ii) the 'net activation volume of cathode to anode' to be kept minimum for higher workable life of a Galvanic cell. Over and above, the proper understanding of the geometrical shapes and the dimensions of the electro-physics variables might also lead to the design and development of 2nd degree and 3rd degree or plasma galvanic cells.

Acknowledgement

The author is grateful to Mr Gopal Manna, IACS, Jadavpur, Kolkata, India for drawing the figures of the article and expresses his gratitude to Mr Bijoy Sarkar , CEO, Austin Paints & Chemicals for his high level encouragement and support.

References

1. C Bhattacharya (2020) "Cosmology and the Unified Quantum Gravity Theory of the Universe". Advances in Theoretical and Computational Physics.
2. Nakano Tadao, Nishijima, Kazuhiko (1953) "Charge Independence for V-particles", Progress of Theoretical Physics 10: 581-582.
3. C Bhattacharya (2020) "Novel Quantum Gravity Approach to Evaluate the Dimensionalites and The Geometrical Profiles of the Chemical Reactions, International Journal of Scientific & Engineering Research.
4. C Amsler et al. (2008) Pentaquarks.
5. C Bhattacharya, "Novel Quantum Gravity Interpretation of Chemical Equilibrium, Free Energy, Dark Energy and Dark Matters of the Universe".
6. C Bhattacharya, "The Universe being folded in the Geometry of an Atom".

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