Measurement of Neutrino's Magnetic Monopole Charge, Aether, Dark Energy and Cause of Quantum Mechanical Uncertainty

Abstract

Charge conservation in the theory of elementary particle physics is one of the best-established principles in physics. As such, if there are magnetic monopoles in the universe, the magnetic charge will most likely be a conserved quantity like electric charges. If neutrinos are magnetic monopoles, as physicists have speculated the possibility, then neutrons must also have a magnetic monopole charge, and the Earth should show signs of having a magnetic monopole charge on a macroscopic scale. To test this hypothesis, experiments were performed to detect the magnetic monopole's effect near the equator by measuring the Earth's radial magnetic force using two balanced high strength neodymium rods magnets that successfully identified the magnetic monopole charge. From this observation, we conclude that at least the electron neutrino which is a byproduct of weak decay of the neutron must be magnetic monopole. We present mathematical expressions for the vacuum electric field based on the findings and discuss various physical consequences related to the symmetry in Maxwell's equations, the origin of quantum mechanical uncertainty, the medium for electromagnetic wave propagation in space, and the logistic distribution of the massive number of magnetic monopoles in the universe. We elaborate on how these seemingly unrelated mysteries in physics are intimately intertwined together around magnetic monopoles.

Introduction

In 1988, J.J. Steyaert published a conference paper titled "The Neutrino as a Tachyonic Non-charged Light Magnetic Monopole?" [1]. Alan Chodos et al discussed in their paper "The neutrino as a tachyon" in 1985 [2] and E. Recami on the same issues in 1978 [3]. Much earlier, O.M.P. Bilaniuk, V.K. Deshpande and E.C.G. Sudarshan already discussed the possibility of the existence of tachyon in 1962 [5].

Dirac theorized early on that for electric charge to be quantized, a magnetic monopole must exist [6]. Many years later, in 1974, Polyakov [7] and 't Hooft [8] discovered that the existence of monopoles follows from quite general ideas about the unification of fundamental interactions. Some GUTs [9], such as the Pati-Salam model [10] and superstring theory [11], predict the existence of magnetic monopoles as well. Despite the ongoing measurements of the neutrino's mass, it becomes increasingly evasive, suggesting the possibility that neutrinos could be tachyons. Recently, in 2019, the joint experimental team of UK, South Africa, Spain, France, and Brazil published
reporting that the lightest neutrinos have an upper bound mass of $0.086 \ eV$ with a 95% confidence level [12].

Undoubtedly, the questions of whether neutrinos are tachyons, whether there are magnetic monopoles in the universe, or whether neutrinos are both tachyons and magnetic monopoles has been an enduring mystery in physics for quite some time.

In this paper, we present new experimental evidence that neutrinos are light magnetic monopoles by measuring the Earth's magnetic monopole charge based on the general charge conservation principle in particle physics, the results of which prove automatically that neutrinos are also tachyons.

In conventional nuclear beta decay processes, a neutron decays into a proton, electron, and an anti-neutrino as follows.

$$^1_0 n \rightarrow ^1_1 p + ^0_{-1} e + ^0_0 \bar{\nu}_e \quad (1)$$

The electric charge and baryon number are conserved in the process, while the neutrino carries the left-over energy and momentum.

The unanswered question is "Is it reasonable that the individual neutrons must have measurable magnetic monopole charge if neutrino is magnetic monopole?"

**Experimental Principle**

Neutrons exist in substantial numbers in the atomic elements on Earth in their composite nuclear structures. In essence, the task of measuring the magnetic monopole charge of neutrino becomes the task of measuring the Earth's magnetic monopole charge based on the assumption that magnetic charge is conserved. If a perfectly balanced high strength long cylindrical test magnet is placed in the horizontal position on the surface of the earth having pivot at its center, the Earth's magnetic monopole will make the assembly tilt toward one side or the other with the magnitude of tilting force being dependent on the strength of the Earth's magnetic monopole charge.

On the other hand, the Earth's geomagnetic field, as shown in images [14] [15], runs horizontal to the surface of the Earth with a vertical component in both the northern and southern hemispheres that can obscure the data when measuring only the Earth's magnetic monopole effect. Therefore, the first task is to find the location in the world where the vertical component of the dipole geomagnetic field is negligible. We accomplished this through a novel sensor design that uses two different cylindrical neodymium magnet sets having different diameters and lengths by stacking neodymium disk magnets. After carefully weighing each of the halves of the long dipole magnet assembly and balancing the weight of each separately on a precision micro scale, the center of the dipole magnet was placed on the pivot of tight string made of nonmagnetic
material with negligible thickness to ensure minimum torque resistance on the magnet rod assembly to minimize obscure experimental data. If the Earth does not have any magnetic monopole charge, the well-balanced neodymium magnet rod should remain balanced in the horizontal position. Any tilting force on the sensor magnets will be measured in the horizontal position using the precision micro scale to reflect the collective magnetic monopole charge of the neutrons on Earth.

**Measurement and Analysis of Experimental Data**

We decided to choose Cuenca Ecuador a city close to the equator with high altitude. In October 2018, we traveled to Cuenca equipped with two sets of long neodymium cylindrical magnets, a precision magnetometer (WT10A), a precision digital micro scale (AMOTGR 2001) and a well-thought-out balancer. The coordinate location where the measurement was made is (-2.899350, -78.989264) at Avenue Gonzalez Suarez and Calle Jacinto in Cuenca Ecuador.

One of the assembled neodymium magnets has a length of 19 cm and a diameter of 10 mm, where both sides have magnetic fields of the same magnitude measured by the sensitive Gauss meter (WT10A), and the other neodymium dipole magnet has a length of 16.6 cm and a diameter of 12 mm. The earth as a monopole magnet will exert magnetic force on these test magnets by pulling down on one side and pushing up the other when the balanced dipole magnet is placed horizontally and resting at the center on a tight string of negligible thickness.

If consistent tilting occurs on the balance test of two different monopole sensors, it indicates that the earth has indeed magnetic monopole charge stemming from the accumulative monopole effect of its neutrons.
The above pictures of the geomagnetic field lines show that in the northern and southern hemispheres, the vertical component of the magnetic field is present because the geomagnetic field line is not strictly horizontal to the surface of the Earth in those regions. Image [15] depicts computer simulated Earth's magnetic dipole in the hypothetical case of pole reversal, which is significant because the prominent vertical component of the Earth's magnetic field can be populated in large areas of the Earth. 

The basic equation of the force between two different permanent magnet poles $q_m1$ and $q_m2$ is

$$F = \frac{\mu_0 q_{m1} q_{m2}}{4\pi r^2} \quad (2)$$

which is identical in form to the equation for the force between two different electrostatic charges [15].

To determine the magnetic strength of the test magnets, $F_1$ is measured at the moment when each half of the full length of the test magnets is pulled to be separated at the preset separation gap $r_1$. The separation distances $r_1$ 5.2 mm and 5.1 mm are chosen for no specific reason other than to make sure the gap distance is not too close or too far so that the measured results do not obscure the actual strength of the test magnets. 1.2 kg and 0.65 Kg of weight equivalent horizontal magnetic pulling forces are measured (5)

$$F_1 = \frac{\mu_0 q_m q_m}{4\pi r_1^2} \quad (3)$$

for the magnetic charge strength of the two test magnets. It turns out that using this method to measure the strength of each magnetic pole is more direct and reliable than using the result of magnetic flux density measured by a Gauss meter and converts it into the magnetic charge strength.

The next step is to measure how much strength the magnetic monopole of the earth has and then calculate the estimated number of neutrons in the entire earth, and we will be able to obtain the single magnetic monopole charge of the individual neutron and subsequently that of the individual neutrino.

For the total magnetic monopole charge $Q_n$ of the Earth, the tilting force due to the interaction between the Earth magnetic monopole and the dipole magnet placed on the horizontal pivot at the center is given by

$$F_2 = \frac{2\mu_0 q_m Q_m}{4\pi R^2} \quad (4)$$

The factor of 2 comes from the two sides, one from the attractive force between N-S and the other from the repulsive force between N-N on the opposite side of the test magnet.
The elevation at the test site of Cuenca Ecuador is 2.56 km above sea level. Hence, $R = (6368 + 2.56) Km$ and the downward tilting weights measured at the horizontal position of the magnets are 0.78 g and 0.52 g, respectively, on the digital micro scale for the two test magnets (5).

**Measurement Data**

| Rod Magnet  | length | diameter | $F_i$ | $r_i$ | $F_2$ | $B_0$ | Weight R/L       |
|-------------|--------|----------|-------|-------|-------|-------|-----------------|
| Rod Magnet 1| 16.6 cm| 12 mm    | 1.2 kg| 5.2 mm| 0.78 g| 454 mT| 71.81 g/71.84 g |
| Rod Magnet 2| 19 cm  | 10 mm    | 0.65 kg| 5.1 mm| 0.52 g| 413 mT| 56.83 g/56.86 g |

(5)

The south pole side of the magnet tilts downward consistently for both test Rod Magnet1 and Rod Magnet2, indicating that the Earth is a north magnetic monopole. "Weight R/L" is the weight of half of each test magnet separately measured before assembling the two halves into the full length. The weight of each half of the test magnets is measured in the vertical position with the S pole side down on the micro scale placed on top of the three-inch-tall nonmagnetic foam to minimize the magnetic interference on the electronic micro scale.

In both cases, the difference in weight of the right and left sides of the rod magnet remained within 0.03 g after balancing, and this weight difference is considered spread evenly along the length of the magnets. We found negligible differences in the magnitude of the measured $F_2$ after flipping both halves of the test rod magnets from N to S and vice versa.

**Analysis**

Using the data obtained after repeated measurements, we found $Q_m = 2.75 \times 10^{16} \text{Weber}$ for the Earth's monopole magnetic charge of the north kind measured by Rod Magnet1 and $Q_m = 2.54 \times 10^{16} \text{Weber}$ for the same north kind measured by Rod Magnet2. We chose the average of the two and determined $Q_m = 2.645 \times 10^{16} \text{Weber}$ for the north magnetic monopole charge of the Earth.

To estimate the total number of neutrons on Earth to calculate the individual magnetic monopole charge of the neutron, we used the element table published by the CRC handbook of Chemistry and Physics 97th edition [16].

For 99.9 percent of the mass on Earth according to the element table,
| %   | Element     | # Neutron/Proton | Weighted Average N/P |
|-----|-------------|-----------------|----------------------|
| 5.63| Iron        | 30/26           | 168.9/146.38         |
| 46.1| Oxygen      | 8/8             | 368.8/368.8          |
| 28.2| Silicon     | 14/14           | 394.8/394.8          |
| 2.33| Magnesium   | 12/12           | 27.96/27.96          |
| 8.23| Aluminum    | 14/13           | 115.22/106.99        |
| 4.15| Calcium     | 20/20           | 83/83                |
| 2.36| Sodium      | 12/11           | 28.32/25.96          |
| 2.09| Potassium   | 20/19           | 41.8/39.71           |
| 0.565| Titanium   | 26/22           | 14.69/12.43          |
| 0.095| Manganese  | 30/25           | 2.85/2.375           |
| 0.14| Hydrogen    | 0/1             | 0/0.14               |

The mass difference due to the isotopes is considered in each element's average atomic mass.

We find the percentage distribution of the mass of the Earth to be 50.7% neutron and 49.3% proton, and the contribution from electrons is negligible. Using the known total mass of the Earth $5.972 \times 10^{24}$ Kg and the mass of a single neutron $1.675 \times 10^{-27}$ Kg, we find the best estimated number of neutrons on the Earth $\#n_{\text{earth}} = 1.8076 \times 10^{51}$.

Hence, the single magnetic monopole charge $m_v$ of a neutron is calculated to be

$$m_v = \frac{Q_m}{\#n_{\text{earth}}} = 1.463 \times 10^{-35} \text{Weber}.$$  \hfill (7)

Further investigation illustrated that the repulsive monopole magnetic force between two matter objects is $1.14 \times 10^{-13}$ times smaller than the attractive gravity force between them, assuming that the same number of neutrons comprised each of the two matter objects. This indicates that the repulsive magnetic monopole force among the stars and planets is negligible compared to that of gravity on a galactic scale.

The noted discrepancy of this finding from the results of past studies is that the measured magnetic monopole charge of the neutron does not match Dirac's prediction of $g = \frac{N \ h c}{2 \ e}$ [19], where $h$ is Planck's constant and $N$ is an integer resulting in the calculated Dirac's magnetic monopole charge $N \times 0.99 \times 10^{-7}$.

However, if Dirac's magnetic monopole is taken for the magnetic monopole charge of a neutron, the repulsive magnetic force between matter objects becomes too large to be ignored in celestial mechanics. Newtonian mechanical description of planetary motion does not work in such cases.
There is a difference in the order of $10^{28}$ between Dirac's and the present report of the magnetic monopole charge $1.463 \times 10^{-35} \text{Weber}$. Dirac's magnetic monopole is rather close to the value $g = N \frac{\mu_0}{4\pi}$, where $\mu_0 = 4\pi \times 10^{-7} \text{H} / \text{m}$ is vacuum permeability.

This brings us to the relation $h = \frac{\mu_0 e}{c}$ and by assuming $\mu_0 = n_0 m_e$ where $m_e$ the magnetic monopole charge of the neutrino and $n_0$ is the vacuum magnetic monopole flux number density of the neutrinos in a given volume, we have recovered the form $m_e = \frac{1}{n_0} \frac{hc}{e}$ for magnetic monopole where $n_0 = 8.589 \times 10^{28}$.

(8)

**Neutron Beta Decay Process Including Magnetic Monopoles**

Based on the principle of the conservation of magnetic charge in the universe, the neutron beta decay now becomes

\[
\begin{align*}
\begin{array}{ccc}
1 & n_1 & \rightarrow \\
0 & P_0 & + \\
1 & 0 & e_0 + \\
0 & 0 & V_{e1}
\end{array}
\end{align*}
\]

(9)

where the low right-hand side sub-indices indicate the number of conserved magnetic monopole charges. In this picture, W boson is identified as a temporary composite transient particle that has both the magnetic and electric charges before splitting into an electron and antineutrino. As J.J. Steyaert pointed out in his paper [1], the weak interaction in the standard model must be a manifestation of the magnetic monopole effect in the nuclear interaction processes.

**Estimated Speed of Non-Stationary Magnetic Monopoles in the Universe**

To estimate the speed of the background magnetic monopole neutrinos, we demand that the electric field created by the traveling background neutrinos must be strong enough to counteract the attractive electrostatic force in atomic structures, for example between the electron and the proton inside the hydrogen. The reason for this request is because the quantum mechanical uncertainty is not a real mechanical force but merely an anecdote in modern physics in the sense that it doesn't address the physical mechanism required for the mechanical stability of the atomic structures.

The fact that stationary neutrinos have never been experimentally detected strengthens this position. Most of the detected neutrinos in the laboratories have been high energy neutrinos that have the speed of travel close to the speed of light. Furthermore, physicists never address the burning question where the neutrinos have gone after losing their
energy and what happens to their speed and location. There is no evidence that those neutrinos become stationary like the ordinary matter particles after losing energy and neutrinos can not simply go out of existence in the universe.

Richard Feynman used to lecture to his students "Don't ask, just calculate!" in his class of quantum mechanics. Of course this is not only a special case of Feynman but a dilemma all physics teachers must face in their classes of quantum mechanics.

Needless to say, it is not the most recommendable form of scientific methodology to transfer to the students. It is a desperate attempt to mitigate and bypass the serious inadequacy in scientific understanding and then proceed to move on to superficiality. Every physicist knows how to calculate Schrodinger's equation but no one knows where the mechanical basis of Schrodinger's equation came from. As such, we have to use all the necessary tools and amenities at hand to understand the fundamental mysteries of quantum mechanics and that of the nature.

Since the fundamental interaction between the electrons and the positively charged nucleus in various atoms is electromagnetic, any external force that is capable of neutralizing the 'strong' attractive force between the electrons and nucleus in various atoms and prevent them from collapsing must also be electromagnetic.

Following this perspective, we designate the electric field created by the traveling magnetic monopole neutrino as

\[ \vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{m_v \vec{v} \times \hat{r}}{r^2} \]  

(10)

where \( m_v \) is the magnetic monopole charge and \( \vec{v} \) is its velocity.

The electric field (10) created by moving magnetic monopole is not unexpected but not utilized because isolated magnetic monopole has not been identified until now.

Furthermore, the fact that time varying (moving) magnetic field in typical household electrical transformers generates alternating electrical current in the secondary winding is already well known and commercially utilized physical principle, which indicates there is nothing out of ordinary about moving magnetic charges creating electric field around them.

Therefore, when a magnetic monopole neutrino is produced in the process of neutron beta decay (9), the electric field it creates must have the same mathematical form as the well known magnetic field

\[ \vec{B} = \frac{\mu_0}{4\pi} \frac{q\vec{v} \times \hat{r}}{r^2} \]  

(11)
created by moving electric charge $q$ with speed $\vec{v}$ just like the case of two identical mathematical forms of Coulomb and static magnetic field (2).

The underline assumption in the equation (10) is that Maxwell's equation permits the speed of travel for magnetic monopoles without restriction. The speed of matter particles has encountered limit $c$ by the introduction of special relativity later by Einstein.

However, Maxwell's equations are not subject to this restriction because there is no known first principle that limits the speed of charged particles in Maxwell's theory of electricity and magnetism. In fact, there is no explicit mass parameter in Maxwell's equation and the equation does not ask if the particular electric charge has mass or not nor restrict how fast it can or can not travel, which means Maxwell's equation is valid regardless of the mass of the individual charges whether it's electric or magnetic or at what speed they travel and there are no known exceptions to this principle.

We demand the vacuum electric field (10) created by traveling magnetic monopole neutrino must have equivalent strength as the well known Coulomb electrostatic field from the proton

$$E = \frac{1}{4\pi \varepsilon_0} \frac{e}{r^2} \quad (12)$$

to prevent the electron from collapsing into the proton.

While the two electric fields (10) and (12) are geometrically different since one (10) is cylindrical and the other (12) is spherical, depending on the frequency of many directionally varying magnetic monopoles passing by the proton, the two fields counteract each other in random mode and keep the electron in a constant agitating and rotating state.

By equating (10) at $\theta = 90^\circ (\vec{v} \perp \hat{r})$ and (12), the optimum speed of the magnetic monopole to prevent the collapse of the electron-proton substructure turns out to be

$$v = \frac{e}{m_c} \quad (13)$$

to provide enough strength of background vacuum electric field to keep the electron afloat from the proton.

For the charge of the electron $1.6021766 \times 10^{-19}$ Coulomb and the measured magnetic monopole charge $1.463 \times 10^{-35}$ Weber, we obtained the speed of the magnetic monopole neutrino $1.095 \times 10^{16} \text{m/sec}$, which is $3.652 \times 10^7$ times the speed of light to be able to stabilize the hydrogen atom and/or all the atoms since there is no dependency on $r$ in the relation (13).
We find this result significant because the calculated speed of the background neutrinos needed to stabilize the atomic structure is universally identical regardless of the specific atomic numbers and/or sizes or where the atom is located. It is noted that this particular speed of neutrino's travel is the key to the stability of the entire architecture of the material universe without having to invoke "quantum mechanical uncertainty".

Reconstruction of the Symmetric Form of Maxwell's Equation

Based on these results, we present the following symmetric form of Maxwell's equation,

\[ \nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0} \]
\[ \nabla \cdot \mathbf{B} = \mu_0 \rho_m \]
\[ \nabla \times \mathbf{E} = -\frac{1}{\varepsilon_0} \frac{\partial \mathbf{B}}{\partial t} - \frac{1}{\varepsilon_0} \mathbf{J}_m \]
\[ \nabla \times \mathbf{B} = \mu_0 \mathbf{J}_e + \mu_0 \frac{\partial \mathbf{E}}{\partial t} \]

where \( \rho_m \) is the static magnetic monopole charge density formed by neutrons and \( \mathbf{J}_m \) is the magnetic monopole current density from traveling neutrinos. The conventional equation \( \nabla \cdot \mathbf{B} = 0 \) works without measurable inconsistency because \( \rho_m \) is extremely weak and individually undetectable unless the collective effect from a massive number of neutrons is subjected to the test. The magnetic current density \( \mathbf{J}_m \) in the third equation can also be omitted in the expression for \( \nabla \times \mathbf{E} \) without conflict because there is no "net" observable magnetic current density due to the isotropy of neutrinos flux in free space.

Magnetic current is observable in the form of magnetic flux when the coherent collimated stream of magnetic monopoles passes along the magnet, forming an air gap loop. The actual effect of the electrical current in a typical copper magnet wire according to equation (14) is to rearrange the flow of the random magnetic current that already exists in space into a coherent collimated stream instead of creating the entire magnetic flux from the empty space. We have just outlined the identity of the magnetic flux on what it is actually made of by the symmetric form of Maxwell's equation [14].

Similar extensions of Maxwell's equation have already been proposed earlier by other researchers [17] who were searching for symmetry between electricity and magnetism. However, they fell short of identifying what the physical quantities \( \rho_m \) and \( \mathbf{J}_m \) represent among the known elementary particles by providing experimental evidence to account for the mysterious physical phenomena based on their extended form of Maxwell's equations.

Vacuum Electric Field and Equation of Motion for Electron in Hydrogen Atom
We designate the vacuum electric field $\vec{E}(\vec{r},t)$ created by the fast traveling magnetic monopole tachyonic neutrinos as

$$\vec{E}(\vec{r},t) = \sum_{i=1}^{N} \frac{1}{4\pi\epsilon_0} \frac{m_\nu \vec{v}_i \times (\vec{r} - \vec{r}_i(t))}{[(\vec{r} - \vec{r}_i(t))]^3}$$  \hspace{1cm} (15)$$

which is an extension of equation (10), where $m_\nu$ is the magnetic monopole charge of the neutrino, $\vec{v}_i$ is the velocity, $\vec{r}_i(t)$ is the position of the particle at time $t$ and $N$ is the total number of electron neutrinos in the universe which is estimated to be in the order of $10^{78}-10^{79}$.

This form of background vacuum electric field provides a rigid medium for electromagnetic wave propagation since the electric field cancels out directionally on the macroscopic scale but not the strength of the field itself in the presence of randomly traveling high-density magnetic monopole neutrinos in the universe. We identify the vacuum electric field (15) as the "Aether" which is required as a medium for light propagation in space while it has been considered non-existent in modern theory of physics.

The strongly compressed electromagnetic field in the vacuum from the uniformly distributed superluminal magnetic monopole neutrinos due to their high density accumulates electromagnetic energy in space. We found the total magnetic potential energy of the uniformly distributed magnetic monopole neutrinos in the universe at an instant moment of time given by

$$U_{\text{vacuum}} = \frac{3\mu_0 N^2 m_\nu^2}{20\pi R} \text{ Joule}$$  \hspace{1cm} (16)$$

where $R$ is the radius of the observable universe $4.4\times10^{26}$ meter, $N$ is the total number of magnetic monopole neutrinos which is in the order of $10^{79}$ and $m_\nu$ is the single magnetic monopole charge $1.463\times10^{-35}$ Weber and $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$, and the vacuum energy in this particular case is $U_{\text{vacuum}} = 2.919\times10^{84}$ Joule.

The uniformly distributed magnetic monopoles push against each other and as a result the universe expands which indicates $R$ in equation (16) increases and it subsequently decreases the vacuum energy of the universe. We identify this vacuum energy (16) as a part of the missing dark energy which is the cause of the expansion of the universe since both have the identical characteristics.

On the other hand, in addition to the repulsive magnetic potential energy among neutrinos, there is also energy created by the interaction of the electric fields carried along by the traveling magnetic monopoles represented by the equation (10). For example, when two
neutrinos travel in parallel, there is repulsive electric force perpendicular to both the direction of their movement and the line connecting the two neutrinos because the two cylindrical electric fields points against each other. However, this force doesn't contribute to either attraction or repulsion between the two traveling neutrinos. Also, when two neutrinos travel in opposite direction approaching each other, the interaction between the two cylindrical electric fields carried by the neutrinos is attractive toward perpendicular to both the direction of their travel and the line connecting them. These two cases are essentially the same and the resulting force has no direct contribution to the expansion of the universe. However, they still create energy which is given by

\[ dU = \frac{4}{3} \frac{m_n \nu \pi r^3}{4 \pi \varepsilon_0 r} \left( m_n \nu \pi r^3 \right) \]  

(17)

where \( n \) is the density of neutrinos in space, \( m_n \) is neutrino's magnetic monopole charge, \( \nu \) is the speed of the traveling neutrinos. When integrated over the radius \( R \) (4.4 \times 10^26 \text{ meter}) of the universe, the total energy is calculated to be

\[ U = 3.14 \times 10^{103} \text{ Joules} \]  

(18)

We identify this as the main part of dark energy that does not directly contribute to the expansion of the universe but there to support the integrity of the material universe.

Using the relation \( \frac{U}{\frac{4}{3} \pi R^3} = \frac{1}{2} \varepsilon_0 E^2 \), we obtain the strength of the electric field of the vacuum (15) given by

\[ |E| = 1.41 \times 10^{17} \text{ Newton / Coulomb} \]  

(19)

We believe this is enough strength of vacuum electric field as a medium to handle massive amount of ultra high frequency electromagnetic waves propagating in space.

The mystery of the existence of vacuum permittivity \( \varepsilon_0 \) and permeability \( \mu_0 \) in the presumably absolute empty space has been a puzzle for a long time. Equation (15) shows that the space is not empty but filled with tachyonic magnetic monopole neutrinos of charge \( m_v \), which is directly related to vacuum permeability by \( \mu_0 = n_0 m_v \) (8).

We write the equation of motion of a free electron in vacuum using the vacuum electric field (15) as

\[ m_e \frac{d^2 \vec{r}}{dt^2} + e \sum_{i=1}^{N} m_v \vec{v}_i \times (\vec{r} - \vec{r}_i(t)) \frac{e}{\left| (\vec{r} - \vec{r}_i(t)) \right|^3} = 0 \]  

(20)
, which defines the inertial mass of the electron in the vacuum. The motion of the electron in free space is restricted by the presence of the rigid fluctuating electric field, yet the electron's position and momentum are not precisely determined on the microscopic scale.

It is noted that the quantum particle electron's position and momentum in free space are at the whim of magnetic monopole current of neutrinos that have random characteristics in motion. This indicates that apart from the energy consideration, the stochastic interaction between the neutrinos and the electrons is the key to the cause of quantum mechanical uncertainty since there are no other known elementary particles that are deemed responsible for such chaotic interaction in the vacuum.

We subsequently designate the full equation of motion of an electron in an isolated hydrogen atom in space as

\[ m_e \frac{d^2 \vec{r}}{dt^2} + \frac{e}{4\pi \varepsilon_0} \sum_{i=1}^{N} m_e \vec{v}_i \times (\vec{r} - \vec{r}_i(t)) + \frac{e^2}{4\pi \varepsilon_0 r^2} = 0 \]  

(21)

where \( m_e \) is the mass of the electron and \( e \) the single electronic charge.

Equations (17) and (18) must be reduced into probabilistic statistical forms to obtain meaningful physical information on the electron because there are no means to predict the precise motions of each and every individual tachyonic magnetic monopole neutrinos in the universe other than the physical constraints that they are expected to observe collectively. We acknowledge that a mathematical reduction of the equations (20) (21) into probabilistic forms will result into a formal structure reminiscent to Schrödinger equation when the following constraints are applied.

In general, fermions do not have a fixed speed of travel and we projected a case where tachyonic magnetic monopole neutrinos have a Maxwell-Boltzmann type velocity distribution like gas molecules peaking around \( 1.095 \times 10^{16} \text{ m/sec} \) and tapering off to zero at both the speed of infinity and speed of light at the low end. However, since tachyonic neutrinos do not have inertial mass, such as matter particles, nor their motion is influenced by ambient temperature, we concluded that their velocity distribution must be radically different and close to a delta-function peaking at \( 1.095 \times 10^{16} \text{ m/sec} \) in addition to the isotropy condition \( \sum_{i=1}^{N} m_e \vec{v}_i = 0 \).

On the other hand, the arguments against the legitimacy of quantum mechanics, for example, action at far great distance, non-locality, quantum entanglement, hidden variables and incompleteness of quantum mechanics [20], are expected consequences of the theoretical efforts to incorporate the inherent interference from the superluminal tachyonic magnetic monopoles in space that is missing in the local probabilistic description of the classical quantum mechanics.
Discussion

The experimental measurement of the magnetic monopole charge of a neutron made a starting point to challenge the decades puzzling old dogma of classical quantum mechanics. In fact, in addition to the prediction of the existence of magnetic monopole by Dirac [6] and many others [7][8], the possibility of the existence of tachyonic particles was already imbedded in Einstein's relativistic mass-energy equation, where the mathematical imaginary "numbered" mass represents particles that travel always faster than the speed of light. When tachyons lose energy, they travel faster as if losing "weight" makes them more superluminal according to the special relativistic mass-energy relation,

\[ u^2 = c^2 (1 - \frac{m_0 c^4}{E^2}) \]  \hspace{1cm} (22)

The paradox here is that the low-energy magnetic monopole neutrinos travel faster and create uniform electric field density in space which is the medium for light propagation in space according to the equation (15).

The incredibly fast speed of travel of these particles assures their uniform density in the vast space and it creates vacuum energy due to their repulsive magnetic interactions. The stable atomic structures and material universe we observe cannot exist without such a paradoxical arrangement since quantum effect is the basis of the existence of the material universe.

What we have observed so far is that contrary to the material particles, non-material particle neutrinos are inherently superluminal and it is their preferred and natural state of existence. And when they happened to gain energy, they can not wait to lose it as quickly as possible by interacting with other matter particles and go back to the superluminal state. This phenomenon reminds us that the universe has kept the skewed partner of the material particles in secret in the form of tachyons that breaks the symmetry in the material world in subtle details. The surprise in physics is always in the details on how the non-conforming groups break the symmetry. And it is ironic to realize that the material universe owes its existence to this skewed partner's contribution to atomic structures and support of the life forms by providing the medium for light and electromagnetic wave propagation.

Dirac predicted the presence of positron based on his mathematical equation that later has proven to be true. This is an example showing that physical reality that is hidden behind the benign looking equations is more penetrating than the rigid interpretation based on traditional conviction.

In fact, the mass of a matter particle only plays the role as a mathematical parameter that determines its mechanical property depending on the external force that affects its motion. If tachyonic magnetic monopole neutrinos are the ones that provide the property of the
inertial mass to other elementary particles (17) in the first place, there is no reason for neutrinos to share the same mathematical attributes for their "mass" as other matter particles.

At the time of this writing, the neutrino is widely considered a spurious elementary particle that exists for no apparent reason other than to satisfy the energy momentum conservation in the nuclear beta decay process and in other nuclear interactions. It is believed to have no effect on quantum mechanical uncertainty. It is not expected to provide a medium for light propagation in empty space nor has any magnetic property according to the current understanding of the universe.

Neutrinos have been observed to change flavors while traveling in space, especially when they present out of the South Pole of the Earth according to a recent experimental report [21]. Since neutrino's magnetic monopole is north kind according to the present report, neutrinos gain energy by traveling from the Earth's North Pole to the South and change its flavor.

**Conclusion**

We presented the measurement details of the Earth's magnetic monopole charge to confirm the hypothesis of magnetic monopole tachyonic neutrinos according to the well established charge conservation principle. Based on this result, we formulated the new symmetric form of Maxwell's equations [14] where \( \rho_m \) is identified as the magnetic monopole charge density of static neutrons and \( J_m \) is identified as the magnetic current density of traveling magnetic monopole neutrinos.

In conclusion, we demonstrated the proof that tachyonic magnetic monopole neutrinos are the mechanical origin of quantum mechanical uncertainty while at the same time addressing the mysteries of the fundamental origin of Aether and the missing dark energy problem within the framework of the new Maxwell's equation without adding contradictions, and this provides us with an example showing that nature does not waste any material or immaterial substances within its boundary to demonstrate its mysterious workings of the universe.

**References**

[1] Steyaert, J.J. 1988 The Neutrino as a Tachyonic Non-charged Light Magnetic Monopole? In: Klapdor H.V., Povh B. (eds) Neutrino Physics. Springer, Berlin, Heidelberg

[2] Chodos, Alan; Hauser, Avi I.; Kostelecký, V.A. The neutrino as a tachyon. Physics Letter B 150, 431-435 1985

[3] Recami, E. ed., Tachyons, monopoles and related topics (North-Holland, Amsterdam, 1978) and references therein.
[5] Bilaniuk, O.M.P., V.K. Deshpande and E.C.G. Sudarshan, Am.J. Phys. 30 (1962) 718; O.M.P. Bilaniuk and E.C.G. Sudarshan, Phys. Today 5 (1969) 43.
[6] Dirac, P. A. M. 1931. Proc. R. Soc. London A 133 : 60
[7] Polyakov, A. M. 1974. JETP Lett. 20: 194
[8] 't Hooft, G. 1974. Nucl. Phys. B 79 : 276 4. Georgi, H., Glashow, S. L. 1974. Phys. Rev. Lett. 32 : 438
[9] Simpson, J.J. in: Third workshop on grand unification, eds. P.H. Frampton, S.L. Glashow and H. van Dam (Birkh–iuser, Basel, 1982)p. 258.
[10] Pati, Jogesh C.; Salam, Abdus (1 June 1974). "Lepton number as the fourth "color". Physical Review D. American Physical Society (APS).10(1): 275–289.doi:10.1103/physrevd.10.275.ISSN0556-2821.
[11] Polchinski, Joseph. String Theory: Volume I. Cambridge University Press, p. 4.
[12] Arthur Loureiro, Andrei Cuceu, Filipe B. Abdalla, Bruno Moraes, Lorne Whiteway, Michael McLeod, Sreekumar T. Balan, Ofer Lahav, Aurélien Benoit-Lévy, Marc Manera, Richard P. Rollins, and Henrique S. Xavier Phys. Rev. Lett.123, 081301 2019
[13] Talha Ahmed Khan, Kushairy Kadir, Muhammad Alcm, Zeeshan Fchihid, M. S. Mazliham Geomagnetic field measurement at earth surface: International Conference on Engineering Technology and Technopreneurship (ICE2T) 2017
[14] Glatzmaier, Gary A.; Roberts, Paul H. (1995). "A three-dimensional self-consistent computer simulation of a geomagnetic field reversal".Nature.377(6546): 203–209.Bibcode:1995Natur.377..203G. doi:10.1038/377203a0.
[15] "Basic Relationships", Geophysics.ou.edu. Archived from the original on 2010-07-09. Retrieved 2009-10-19.
[16] ABUNDANCE OF ELEMENTS IN THE EARTH’S CRUST AND IN THE SEA,CRC Handbook of Chemistry and Physics,97th edition (2016–2017), p. 14-17
[17] A. I. Arbab, Complex Maxwell's Equations, Chinese Physics B, Volume 22, Number 3 (2013),
I. Bialynicki-Birula and Z. Bialynicka-Birula, Magnetic Monopoles in the Hydrodynamic Formulation of Quantum Mechanics, Physical Review D, Volume 3, Number 10, 15 May 1971,
Henning F. Harmuth, Beate Meffert. The modified Maxwell equations (1985)
[18] Uggl, Claes (2006). "Spacetime Singularities". Einstein Online. 2 (1002). Archived from the original on 2017-01-24. Retrieved 2015-10-20.

[19] Jackiw, R. Dirac’s Magnetic Monopoles (Again) https://arxiv.org/pdf/hep-th/0212058 2000

[20] Einstein A, Podolsky B, Rosen N; Podolsky; Rosen (1935). "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?". Phys. Rev. 47(10): 777–780. Bibcode:1935PhRv...47.777E. doi:10.1103/PhysRev.47.777.

[21] IceCube Collaboration (2013). "Evidence for High-Energy Extraterrestrial Neutrinos at the IceCube Detector". Science. 342(6161): 1242856. arXiv:1311.5238