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Physics and Space Science

Highlights

Black Hole Radiation

Generation of Secondary Electrons

Earth Space Environment

Analysis for Electromagnetic-Wave

Discovering Thoughts, Inventing Future

GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH: A
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Generation of Secondary Electrons and Positrons in the Near-Earth Space Environment from the Data of Experiments PAMELA, FERMI and AMS (2006-2016)

By Stanislav Konstantinov

Russian State Pedagogical University

Abstract- In the article it is proposed to expand the framework of the standard model of generation and distribution of cosmic rays and, in addition to the model of inelastic interactions of the protons of the radiation belt and cosmic radiation with the nuclei of atoms of the residual atmosphere, to consider the resonant mechanism of generation of secondary electrons and positrons in the near-Earth space environment. Based on the analysis of the data obtained in the PAMELA experiments, FERMI and AMS, a plot of the resonance curves for the generation of secondary particles was constructed and the probable cause is named of the relative growth of the positron flux in the total flux of secondary electrons and positrons, starting with the proton energy above W = 5 GeV.

Keywords: dark matter; electron; positron; proton; mass; energy; resonance.

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GENERATIONOFSECONDARYELECTRONSANDPOSITRONSINTHENEAREARTHSPACEENVIRONMENTFROMTHEDATAOFEXPERIMENTSPAMELAFERMIANDAMS20062016

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Generation of Secondary Electrons and Positrons in the Near-Earth Space Environment from the Data of Experiments PAMELA, FERMI and AMS (2006-2016)

Stanislav Konstantinov

Abstract- In the article it is proposed to expand the framework of the standard model of generation and distribution of cosmic rays and, in addition to the model of inelastic interactions of the protons of the radiation belt and cosmic radiation with the nuclei of atoms of the residual atmosphere,, to consider the resonant mechanism of generation of secondary electrons and positrons in the near-Earth space environment. Based on the analysis of the data obtained in the PAMELA experiments, FERMI and AMS, a plot of the resonance curves for the generation of secondary particles was constructed and the probable cause is named of the relative growth of the positron flux in the total flux of secondary electrons and positrons, starting with the proton energy above W = 5 GeV.

Keywords: dark matter; electron; positron; proton; mass; energy; resonance.

I. Introduction

Primary high-energy electrons in cosmic rays are formed during acceleration in supernova remnants. Secondary electrons and positrons are generated in the cosmic medium by relativistic protons of the Earth's radiation belt and cosmic radiation and are within the boundaries of the Earth's magnetosphere, which is assumed to be 25000 km. It was established that the generation of secondary particles from protons is almost 100 times higher than that from cosmic radiation [1]. The obtained results are difficult to explain in the framework of the model of inelastic interactions of protons of a radiation belt with a residual atmosphere. Electron-positron ratios of secondary particles increase with the proton energy, starting from 5 GeV, which contradicts the standard model of generation and distribution of cosmic rays and can mean the existence of another source of positrons and electrons [2]. And such a source is - this is the etheric shell of the planet, formed by dark matter. There is a mechanism for the generation of secondary particles in the etheric shell of the Earth - this is a resonance, there are also theories that allow describing the irreversible process of particle formation [3, 4, 5]. Only there is no willingness of the

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scientific community to part with A. Einstein's relativistic dogmas GRT and recognize the new reality [6].

II. Experiments

The PAMELA magnetic spectrometer was launched aboard the Resurs-DK satellite to an elliptical near-polar orbit with a height of 350-600 km to study the fluxes of particles and antiparticles of cosmic radiation in a wide energy range from tens of MeV to hundreds of GeV.

Continuous measurements of cosmic ray fluxes were carried out. The PAMELA device consists of a magnetic spectrometer based on a permanent magnet of $\sim$ 0.4 T, surrounded by anti-coincidence detectors, an electromagnetic calorimeter, a time-of-flight system, scintillation counters and a neutron detector. The magnetic spectrometer has six silicon strip planes that measure the coordinates of the track with an accuracy of 3 mkm, which allows us to determine the sign of the charge of the particle and their stiffness by the deviation in the magnetic field. The electromagnetic calorimeter makes it possible to separate the electromagnetic and hadronic cascades and measure the energy of electrons and positrons with an accuracy of not worse than 10% from several GeV to hundreds of GeV. The time-of-flight system has a resolution of about 300 ps and makes it possible to separate low-energy protons from positrons up to 0.8-1 GeV. The authors of the PAMELA device assert that "the use of a full set of criteria provides a proton-screening coefficient at the level of 10^{-5}, which makes it possible to reliably isolate electrons and positrons against a background of protons." [1,2].

In my article, I will allow to disagree with the statement made by the creators of the PAMELA device about the reliable separation of relativistic protons of the Earth's radiation belt from secondary positrons. In doing so, I rely on two factors:

1. Conclusions to which the researchers come when analyzing the results of the PAMELA experiment: "PAMELA, FERMI and others detect an increase in the relative share of positrons in the total flux of positrons and electrons in the cosmic medium, starting with photon energy above 30 GeV.

According to new data, the AMS detector installed onboard the ISS, the positron spectrum becomes more rigid with increasing energy, while the electron spectrum varies little. The maximum increase in the number of positrons takes place at an energy Wp ≈200GeV." [7]. This contradicts the standard model of generation and distribution of cosmic rays and can mean the existence of other sources of primary positrons [2, pp. 173-174];

2. The problem of the interaction of the cosmic medium with the electromagnetic energy of a moving charge and the replacement of the controversial idea of an increase in the mass of a moving charge to infinity as the speed of light approaches, to a more acceptable idea of the deformation of the electric field of a moving charge and the reduction to zero of the interaction force with it. The interaction of a moving electric charge q with an electric field E0, taking into account retarded potentials and deformation of the electric field E of a moving charge, can be described by the dependence [8]:

$$F = \mathbf{E}_0 \, q \, \sqrt{1\text{-} v^2 / c^2} \tag{1}$$

Taking into account the mass of the charge and acceleration α, the dependence (1) can be written in the form:

$$F = \mathbf{E}_0 \, q \, \sqrt{1\text{-} v^2 / c^2} \, = m_v \alpha = \frac{m \alpha}{\sqrt{1\text{-}\frac{v^2}{c^2}}} \tag{2}$$

Within the framework of the relativistic concepts of modern electrodynamics dependence (2) is interpreted as the effect of "increasing the mass" m_o moving charge to infinity when approaching the speed of motion of the charge to the speed of light. However, equation (2) is a relativistic effect of reducing the force interaction of the moving charge with the electric field E0, formed by a stationary charge. The effects of delayed potentials and deformation of the electric field of moving charges leads to a restriction of the growth of the mass of the charge, at v→c. The increase in particle mass at a rate occurs for other reasons (non-relativistic effect) [6].

The method of measuring the energy of relativistic particles by the deviation of charged particles in a magnetic field does not take into account the deformation of the electric field of moving charges and the decrease to zero of the interaction force with it and is therefore unacceptable. The most common instruments for the accurate measurement of the energy spectrum of constant and pulsed beams of charged particles are magnetic spectrometers. This method is based on the dependence of the radius of the cyclotron orbit on the kinetic energy of the particle. The equality of the Lorentz force and the centrifugal force when the particle moves around the circumference in a homogeneous magnetic field leads to the equation:

$$qvB = \frac{mv^2}{r} \tag{3}$$

where q is the particle charge, v is its velocity, B is the magnetic field induction,
r is the radius of the cyclotron orbit, $m = m_o / \sqrt{1\text{-} v^2 / c^2}$, m_o = rest mass,
c is the speed of light.

From the known q, r, B, we can calculate the kinetic energy of a particle:

$$W = m_o c^2 \left\{ \sqrt{\frac{q^2 \mathbf{B^2 r^2}}{(m_o c^2)^2} + 1} \text{ - } 1 \right\} \tag{4}$$

In modern spectrometers, an approximate relation is used to estimate the kinetic energy of ultrarelativistic charged particles in a magnetic field when $qBr \gg m_o c^2$ [9].

$$W \approx q\mathbf{B}r \tag{5}$$

where q is the particle charge,
B is the induction of a homogeneous magnetic field,
r is the radius of a circle described by a particle.

It is seen from expression (5) that the kinetic energy of a charged particle in a magnetic spectrometer is directly proportional to the charge value, which in classical electrodynamics does not depend on the velocity of the particle, and the radius of the cyclotron orbit, which is determined experimentally in the spectrometer with the help of Faraday cylinders.

Thus, the reliability of the conclusions about the complete elimination of relativistic protons from the total flux of secondary electrons and positrons is doubtful. The tracks of relativistic protons in the magnetic field of the PAMELA spectrometer will be close to the positron tracks and, therefore, starting from 30 GeV, the PAMELA experimenters observe the growth of secondary positron fluxes (more precisely, protons and positrons). This can also be confirmed by the fact that the positron spectrum becomes more rigid with increasing energy, while the secondary electron spectrum varies little.

III. DATA ANALYSIS

Secondary electrons and positrons are generated in the cosmic medium by relativistic protons and cosmic radiation. It was established that "the generation of secondary particles from protons is almost 100 times higher than that from cosmic radiation" [2]. The obtained results are difficult to explain in the framework of the model of inelastic interactions of protons of a radiation belt with a residual atmosphere. It is necessary to expand the framework of the model and, in addition to the residual atmosphere, include dark matter entering into it, interacting with cosmic radiation and relativistic protons of the radiation belt. Moreover, there is also a mechanism for generating secondary electrons and positrons-this is resonance [10].

Generation of secondary particles has two characteristic features [1]:

1) The energy spectrum of these particles is very "soft" with a sharp drop above 100 MeV, which can be explained by the resonance mechanism of particle generation;

2) Positrons predominate in the secondary particle flux. The ratio of positron fluxes to electron fluxes (Np / Ne) reaches 7-9.

"Recent measurements of electron-positron ratios in PAMELA, FERMI and AMS experiments have shown that it increases with energy growth starting from 5 GeV, which contradicts the standard model of generation and distribution of cosmic rays" [2].

On the one hand, the predominance of positrons may indicate a more effective capture of electrons by the cosmic medium and the presence of a source of primary positrons, but on the other hand, the red branch in Fig. 1 may indicate that, at energies above W = 5 GeV, relativistic protons in a PAMELA magnetic spectrometer are summed up with secondary positrons.
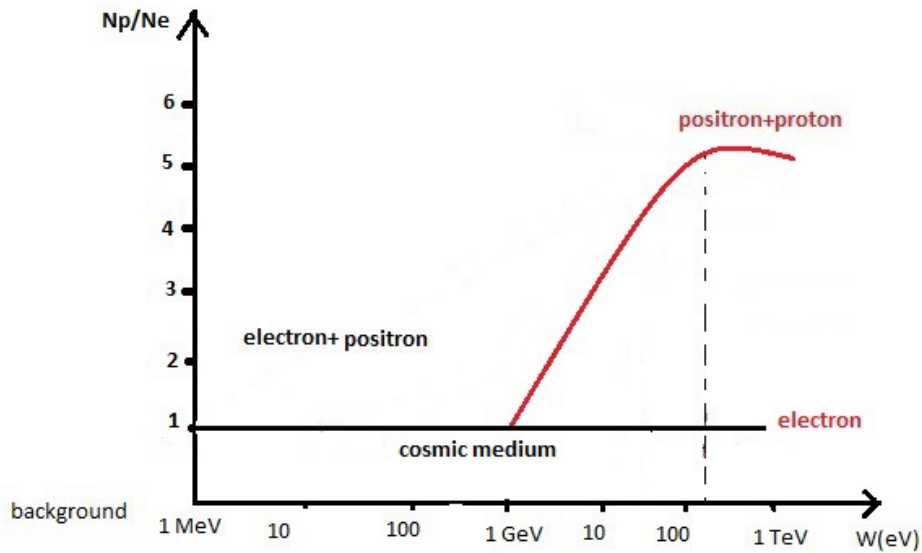
Figure 1: The Graph of secondary electrons and positrons from the data of PAMELA, FERMI and AMS

The experimentally obtained curves of the relative growth of the secondary electron and positron fluxes in the cosmic medium, starting with the cosmic-ray energy W = 1 MeV and ending with the cosmic-ray energy W = 200 GeV, allow us to conclude that the secondary electrons and positrons are generated in a resonant process (see Fig. 2) [5, 11pp. 25-29].

An experimental confirmation of this is the appearance of a flow of backward electrons with a "soft" energy spectrum in multi-wave Cerenkov generators, with the primary-electron energy W = 2 MeV [12].
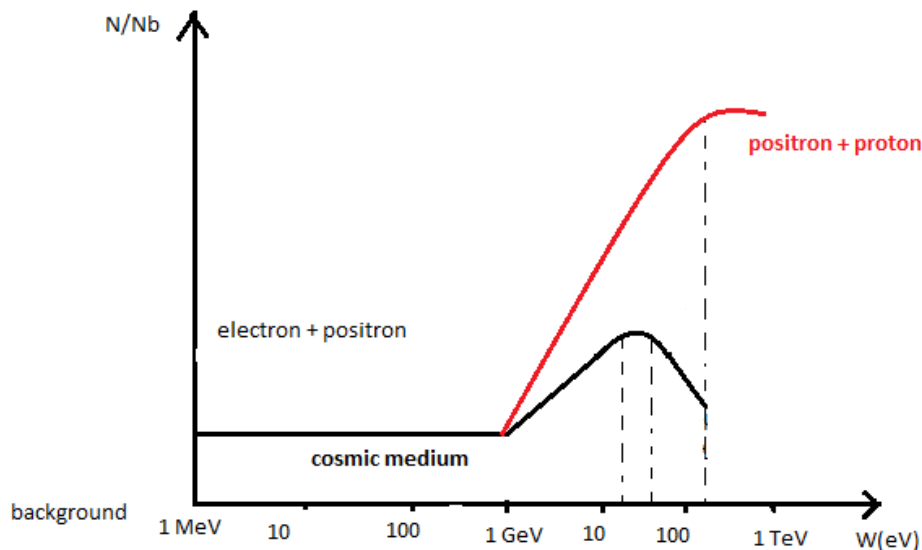
Figure 2: Graph of resonance curves of generation of secondary electrons and positrons

The summation of relativistic protons, starting at W = 5 GeV, with secondary positrons in the PAMELA magnetic spectrometer (the red branch of Figure 2) distorts the results of the experiments and masks the resonant maximum of the generation of secondary electron and positron fluxes relative to their background values (N / Nb).

$$W_k \geq 1 \text{ MeV} = 1.6493 \cdot 10^{-13} \text{ J}. \quad \nu_k = 2.4891 \bullet 10^{20} \text{ Hz}$$

$$W_r \approx 20 \text{ GeV} = 33 \bullet 10^{-10} \text{J}, \quad \nu_r = 4.7 \bullet 10^{24} \text{Hz},$$

If the PAMELA and AMS data is correct and there really is a second resonance maximum for positrons at $W_r = 200 \text{GeV}$ [7], this may mean that the space medium exists in two phase states, respectively,

Analysis of the resonance curves shown in Fig. 2 allows one to determine the frequency of the photon corresponding to the red boundary of the photoelectric effect for the near-Earth space environment and the resonance frequency [11 pp. 11-13]:

$$\omega_k = 1.4945 \bullet 10^{21} \text{ Hz} \qquad \lambda_k = 1.23 \bullet 10^{-12} \text{ m}.$$

$$\omega_r = 2.82 \bullet 10^{25} \text{ Hz}, \quad \lambda_{r(de)} = 6.39 \bullet 10^{-17} \text{ m}$$

as dark matter and dark energy. Then the natural frequency of the structural element of the dark energy will be:

$$W_r \approx 200 \text{GeV} = 330 \cdot 10^{-10} \text{ J} \quad \nu_r = 4.78 \cdot 10^{25} \text{ Hz} \qquad \omega_r = 28.2 \cdot 10^{25} \text{ Hz} \quad \lambda_r = 0.6 \cdot 10^{-17} \text{ m}$$

IV. Conclusion

Experiments PAMELA, FERMI and AMS give the researcher a unique opportunity to simultaneously measure secondary electron and positron fluxes, which is extremely important for the development of a standard model for the generation and distribution of cosmic rays. Direct experimental determination of the resonance dependence of birth N elementary particle pairs of frequency ν is almost completely silenced by modern physics. The same processes should be observed in accelerators and colliders. Following the deceptive logic of the modern theory, this dependence is drawn as a monotonically increasing curve. The resonant nature of the secondary electrons and positrons under the influence of external radiation is a fundamental process of the universe is birth in the space environment divergent flows or drains and sources.

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Anisotropic Magnetic Metamaterial in Numerical Analysis for Electromagnetic-Wave Propagation around Cloaking Device

By Alexandre Bambina, Shuhei Yamaguchi, Shigeyuki Miyagi & Osamu Sakai

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Abstract- Anisotropic property of media is one function which metamaterials make possible for electromagnetic propagation. Hypothetical magnetic currents in the finite difference time domain (FDTD) method create such anisotropy in permeability in numerical models, in similar way to the modeling of Drude-type permitivity for plasma. Numerical results show clear effects of cloaking in which anisotropic permeability is conceivable by experiments.

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ANISOTROPICMAGNETICMETAMATERIALINNUMERICALANALYSISFORELECTROMAGNETICWAVEPROPAGATIONAROUNDCLOAKINGDEVICE

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Anisotropic Magnetic Metamaterial in Numerical Analysis for Electromagnetic-Wave Propagation around Cloaking Device

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Abstract- Anisotropic property of media is one function which metamaterials make possible for electromagnetic propagation. Hypothetical magnetic currents in the finite difference time domain (FDTD) method create such anisotropy in permeability in numerical models, in similar way to the modeling of Drude-type permitivity for plasma. Numerical results show clear effects of cloaking in which anisotropic permeability is conceivable by experiments.

I. Introduction

During the last decade, metamaterials were readily apparent as new artificial complex media, which have been offered subjects of great attention from the scientific communities [1–3]. Different kinds of metamaterials as passive media were picked out in agreement with macroscopic characteristics against electromagnetic waves [4]. Interest in metamaterials arosed from their intrinsic property whose both permittivity and permeability covers negative/ positive real values and/or anisotropic features. Manufacturing of a metamaterial as an array of electric or magnetic resonators requires conditions in which the size of the unit resonator is smaller than the wavelength of the wave. This array satisfies new values of permittivity and permeability in directions of the electric and magnetic fields, respectively [5]. By this reason, possibilities of metamaterials are greater than conventional isotropic materials which cannot realize the entire control of electromagnetic wave propagation. Therefore, one of the most required point for the anisotropic characteristic is the spacial arrangement of the resonators in a metamaterial.The possibility to realize anisotropy with a gradient characteristic was experimentally verified [6]. This spacial arrangement supports both possible anisotropic and gradient parameters which should be elaborately designed using theoretical approaches.

Previous efforts on metamaterials have encountered transformation optics to build up new devices, leading to the fact that its mathematical method reveals the real impact of anisotropic characteristics against electromagnetic wave propagation [7–9]. Our particular interest is the method on cloaking layers which are theoretically and experimentally based on the anisotropic media; to address this issue, we represent numerical results on differences between anisotropic and isotropic effects in wave media in this report.

Main focus so far was on the specific metamaterial which achieves the high control on permeability on the one hand and accessibility in terms of the fabrication on the other hand. This metamaterial is double split ring resonator (DSRRs) [5], which provides us possibilities for choosing the permeability in cloaking devices.

Smooth gradient of parameters is basically required in the ideal cloaking solution. When we form a cylindrical plasma, the profile of the electron density in the plasma follows the Bessel function in the radial direction [10], which is close to the theoretical prediction for cloaking phenomena. Based on this potential possible in experiments, the point we pursue in this report is a theoretical model predicting optimized solutions adequately [11].

This study of the design on anisotropic structure is based on solutions of electromagnetic-wave propagation solutions from a numerical code on finite-difference timedomain (FDTD) method [12]. We demarcate a two dimensional plane; an electromangetic-wave source is polarized on transverse magnetic (TM) mode in which the electric field is perpendicular to and the magnetic field is parallel to the plane. This numerical code is used here as a platform of measure in order to discuss the mechanism of anisotropic impacts from the best case to the worst case with comparable parameters [13]. The gradient permittivity formed, by plasma is in radial coordinate direction, and to compute such properties in the numerical code, the method introduced here is to implement a continuous electronic current. This current is derived from the equation for motions of charged particles [14], and its direction of gradient is easy to manage. In the same way, we introduced here the idea of hypothetical magnetic current and manage the anisotropic permeability in the radial and azimuth directions. In experimental circumstances, the magnetic currents will be achieved by DSRRs, whereas the electric current exist in plasma as spacial gradient. We note the difference between gradient of the perfect cloaking solution and the one made by the plasma, and this difference causes small amount of scattering waves

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from the target region. A simple coordinate transformation will finish our concrete construction for Cartesian coordinate used in (FDTD) method.

In Section 2, we describe our numerical model. In Section 3, we demonstrate numerical results with discussion. In Section 4, we conclude our results on our numerical method which achieves inclusion of anisotropic effects in the flexible way.

II. NUMERICAL MODEL

a) Integration of permittivity/permeability by current densities

Let us consider the relation for motion conservation of charged particles, that is, electron momentum balance equation [10]:

$$mn_e(r)\frac{d\mathbf{v}_e(r)}{dt} = -n_e(r)e\mathbf{E} - \nabla p_e(r) - mn_e(r)\mathbf{v}_e(r)\nu_E. \quad (1)$$

m is mass of electron, e charge of electron, $\mathbf{v}_e$ electron fluid velocity, $\mathbf{E}$ electric field (V/m), n_e electron density and r radial position, t time, and ν_E electron elastic collision frequency with neutral particles. Admitting homogeneous electron pressure p_e and neglecting positive-ion contribution due to their huge mass in comparison with electrons, we found electric current density $\mathbf{J}_E$ as a function of $\mathbf{E}$[15]:

$$\frac{\partial \mathbf{J}_E}{\partial t} + \nu_E \mathbf{J}_E = \epsilon_0 \omega_{pe}^2 \mathbf{E}. \quad (2)$$

Here ω_{pe} is electron plasma frequency, and ϵ_0 the permittivity in vacuum. To determine the solution of electromagnetic propagation, waves can be composed of the harmonic sinusoidal signals using Fourier transformation, which gives us, with ω the angular frequency and components at ω shown by the top arrow over variables;

$$(j\omega + \nu_E)\vec{J}_E = \epsilon_0 \omega_{pe}^2 \vec{E}. \quad (3)$$

In the FDTD code we compute the Maxwell-Ampere equation, keeping the current density as:

$$\nabla \times \vec{H} = j\omega\epsilon_0 \vec{E} + \vec{J}_E. \quad (4)$$

Substitution of current $\vec{J}_E$ from Eq. (3) into Eq. (4) leads to:

$$\nabla \times \vec{H} = j\omega\epsilon\vec{E}\left(1 - \frac{\omega_{pe}^2}{\omega(\omega - j\nu_E)}\right)$$

$$\equiv j\omega\epsilon_0\epsilon\vec{E}. \quad (5)$$

In Eq. (5) the Drude model can be extracted for the permittivity ϵ, making large possible values of permittivity set through $\vec{J}_E$. Formulation of Eqs. (1-5) shown in [15] is an alternative way to implement medium characteristics, and $\vec{E}$ is normal to the two-dimensional plane in our numerical code, as $\vec{J}_E$. For

further details, we take into account the distribution of n_e which is in the shape of the Bessel function in the radial direction, corresponding to the fact that it is the solution in correlation with real distribution of charged particle [10]. The permittivity with charge distribution is completed by the relation between n_e and ω_{pe}.

Throughout this report, we introduce several currents in our numerical code for control of electromagnetic-wave propagation. Since cloaking solutions require anisotropic permeability (or more precisely, refractive index), for this purpose, we introduce the magnetic current $\vec{J}_M$ in the Maxwell-Faraday equation in the same manner to the permittivity of Maxwell-Ampere equation;

$$\nabla \times \vec{E} = -j\omega\mu_0\vec{H} + \vec{J}_M$$

$$= -j\omega\mu_0\vec{H}\left(1 + j\frac{|\vec{J}_M|}{|\vec{H}|}\right) \equiv -j\omega\mu_0\mu\vec{H}. \quad (6)$$

This hypothetical current is the origin of any transformation of permeability μ in our numerical code. Directions of all preceding currents are designed for our media with adequate characteristics; the cloaking solution on cylindrical cloak has anisotropic permeability which is in radial (r) and azimuthal (θ) directions from the cylindrical coordinate. Our model for the FDTD method is discrete in the Cartesian coordinate, and vector transformation on currents back to the Cartesian characteristics is obtained by following transformation:

$$\vec{J}_{Mx} = \cos(\theta)\vec{J}_{Mr} - \sin(\theta)\vec{J}_{M\theta}, \quad (7)$$

$$\vec{J}_{My} = \sin(\theta)\vec{J}_{Mr} + \cos(\theta)\vec{J}_{M\theta}. \quad (8)$$

$\vec{J}_{Mr}$ is the magnetic radial current, $\vec{J}_{M\theta}$ is the magnetic azimuthal current used in the cylindrical coordinate for radial and azimuthal anisotropic permeability; $\vec{J}_{Mx}$ and $\vec{J}_{My}$ are magnetic currents on the Cartesian coordinate.

(a)

(b)
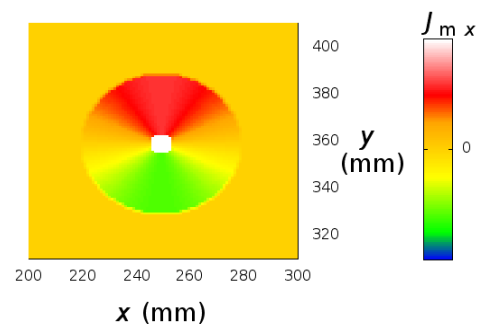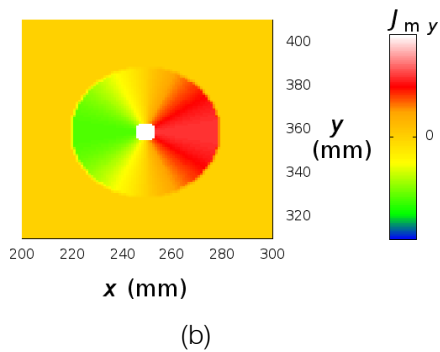
Fig. 1: Current densities distribution in space (a) $\vec{J}_{Mx}$ and (b) $\vec{J}_{My}$. White area in center is for object which becomes invisible

We have degrees of freedom on permeability parameters from Eqs. (6-8). Figure 1 shows an anisotropic current of J_{Mx} and J_{My} derived from anisotropic cylindrical parameter used for the cloaking device shown in Fig. 2.
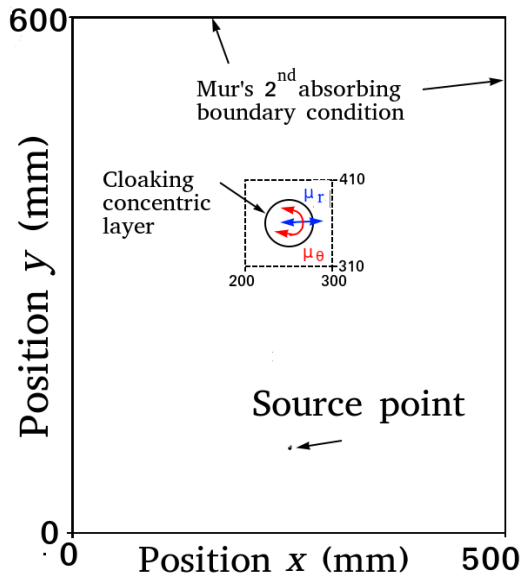
Fig. 2: Scheme of two dimensional plane implemented in the FDTD code

b) Model for finite-difference time-domain (FDTD) space

Electromagnetic-wave propagation which we solve by the numerical code is based on FDTD method. Our cloaking device has the outer boundary with 30-mm radius. Outside this region, a dielectric layer with permittivity 2.0 is located with 5-mm thickness, and this dielectric will confine in our experiment the plasma as a vacuum chamber. In the center, we place perfect conductor of 4-mm radius, and our aim is to manage to cloak this conductor. From the conductor region to the inner boundary of the dielectric layer, the metamaterial is assumed to be on the dielectric plates, and spatially-averaged permittivity of these plates is 2.0. Plasma is assumed to exist between the plates, and ϵ decreases spatially towards the center from 2.0. We develop a

code on the two-dimensional space with the size of 500×600 mm^2 on x and y axis, respectively. Electromagnetic fields in the FDTD code are calculated in every 0.5-mm square grid. The FDTD code simulates current flows from Eqs. (4-6) as well as the fields in the Maxwell equations. Calculation of the propagation is made at every 0.5 ps on the purpose of propagation stability (the so-called Courant condition [12]). On the border of the two-dimensional space [10], we apply the second Mur's boundary [12], as shown in Fig. 2, which realizes almost perfect absorption. The source of the electromagnetic wave is a point one, at microwave frequency of 6 GHz, placed at $x = 250$ mm and $y = 100$ mm. We selected the TM mode, where **E** is normal to the two dimensional plane and **H** is parallel to the plane.

The device under test is composed of plasma and metamaterial to achieve invisibility of the perfect conductor located at $x = 250$ mm and $y = 360$ mm. Effects of $\vec{J}_E$ and $\vec{J}_M$ work with wave propagation expressed in the Maxwell's equation; $\vec{J}_E$ is supported by n_e in the form of Bessel function in radial direction, which enables plasma to provide smooth gradient permittivity due to n_e profile in the ampibolar diffusion regime, shown as Fig. 3. We regulated μ in the radial (μ_r) and azimuthal (μ_θ) directions as shown in Fig. 1. Using Eqs. (7, 8), in fact, future experiments will be successfully performed by DSRRs as the metamaterial on a cylindrical shape where μ can reach any positive and negative values.
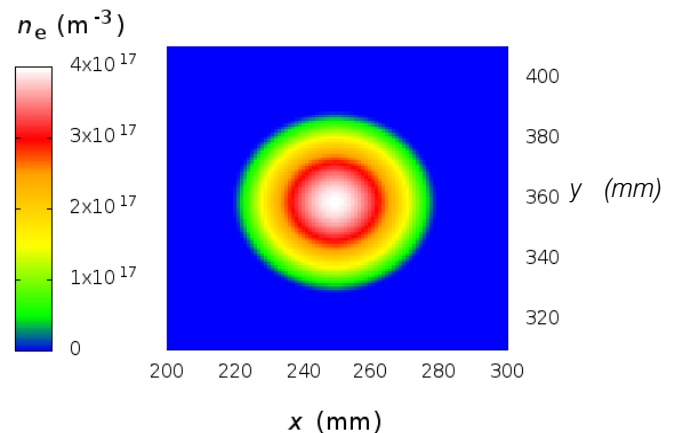
Fig. 3: Electron density distribution of plasma assumed in FDTD code

III. Numerical Results

Validation of the numerical code is shown in Fig. 5(a), which is a benchmark as waves in free-space propagation. Here, we see power propagation as $|\mathbf{E}|^2$ at fixed time. No scattering wave exists, and decremental power is a consequence of spacial profile of power spread as a function of r radius from the point source. In the case of anisotropic solution close to good cloaking in Fig. 5(b), we use parameter profiles shown in

Fig. 4. The two-dimensional plane including the magnetic field has anisotropic permeability $\mu_r = 0.27$ and $\mu_\theta = 1$. In addition to ϵ gradient of plasma, we add an effect of the dielectric from the metamaterial dielectric plates supporting metamaterial structure and boundary of the device. Thanks to anisotropy and gradient in Fig. 4, we observed cloaking in wave propagation in Fig. 5(b). In comparison with the result of free space propagation in Fig. 5(a), spacial profiles of wave power and phase behind the device is quite similar. This result indicates that suitable setting of parameters of μ and ϵ achieves cloaking phenomena.
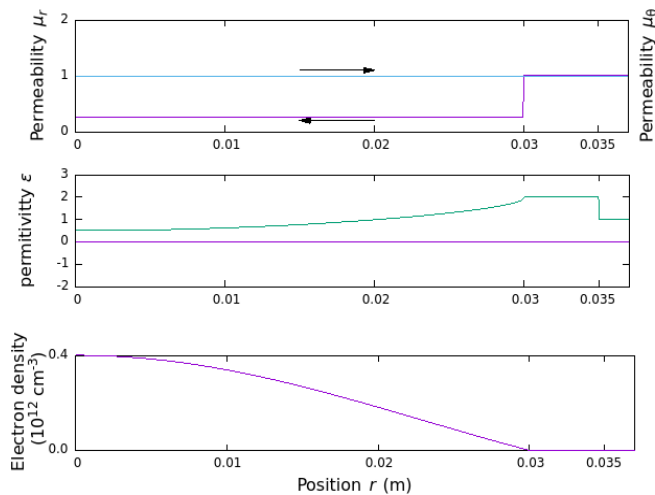
Fig. 4: Parameter distributions along r used in FDTD calculation

(a)

(b)

Fig. 5: Wave power, square of electric field in case (a) with free pace propagation and (b) case with solution for cloaking

Imperfect point, observed in residue of scattering waves in Fig. 5(b), is due to the slight mismatch between theoretical prediction from transformation optics and possible parameters which is assumed in our numerical model. We apply the n_e profile similar to experimental observation but slightly different from the ideal case predicted by transformation optics. For reference of Fig. 5, we performed numerical calculation with comparable parameters equal to the values found in optimal parameters for cloaking except one of them, and the results are displayed in Fig. 6.

When we input isotropic permeability, the wave with fairly low power can pass through the device, and its large part is reflected or swerves into abnormal direction as shown in Figs. 6(a-d), which indicates that it induces consequent scattering wave. In case of the anisotropic characteristic in Fig. 6(e), the wave can propagate behind the antenna. However this anisotropic characteristic leads to a different one which is far from cloaking, and the anisotropic matrices are not reversible. These numerical results confirm the impact of anisotropic properties for media of electromagnetic waves. They show the validity of the FDTD method with addition of electric- and (hypothetical) magnetic-current densities to solve Maxwell's equations for any medium.

IV. Conclusion

The numerical results shown in this report confirm that anisotropy opens possibilities for electromagnetic wave control, and they can be predicted using the FDTD method. Our numerical results are representations of the effects of anisotropic permeability as well as cloaking layers which can be realized in experiments using layers of magnetic metamaterials and plasma. Installation of hypothetical magnetic currents is a good imitation of anisotropic permeability which is realized in metamaterial experiments. Putting on light a new solution for electromagnetic wave, this report enlarges the possibility of media who could be designed by numerical methods.

V. Acknowledgments
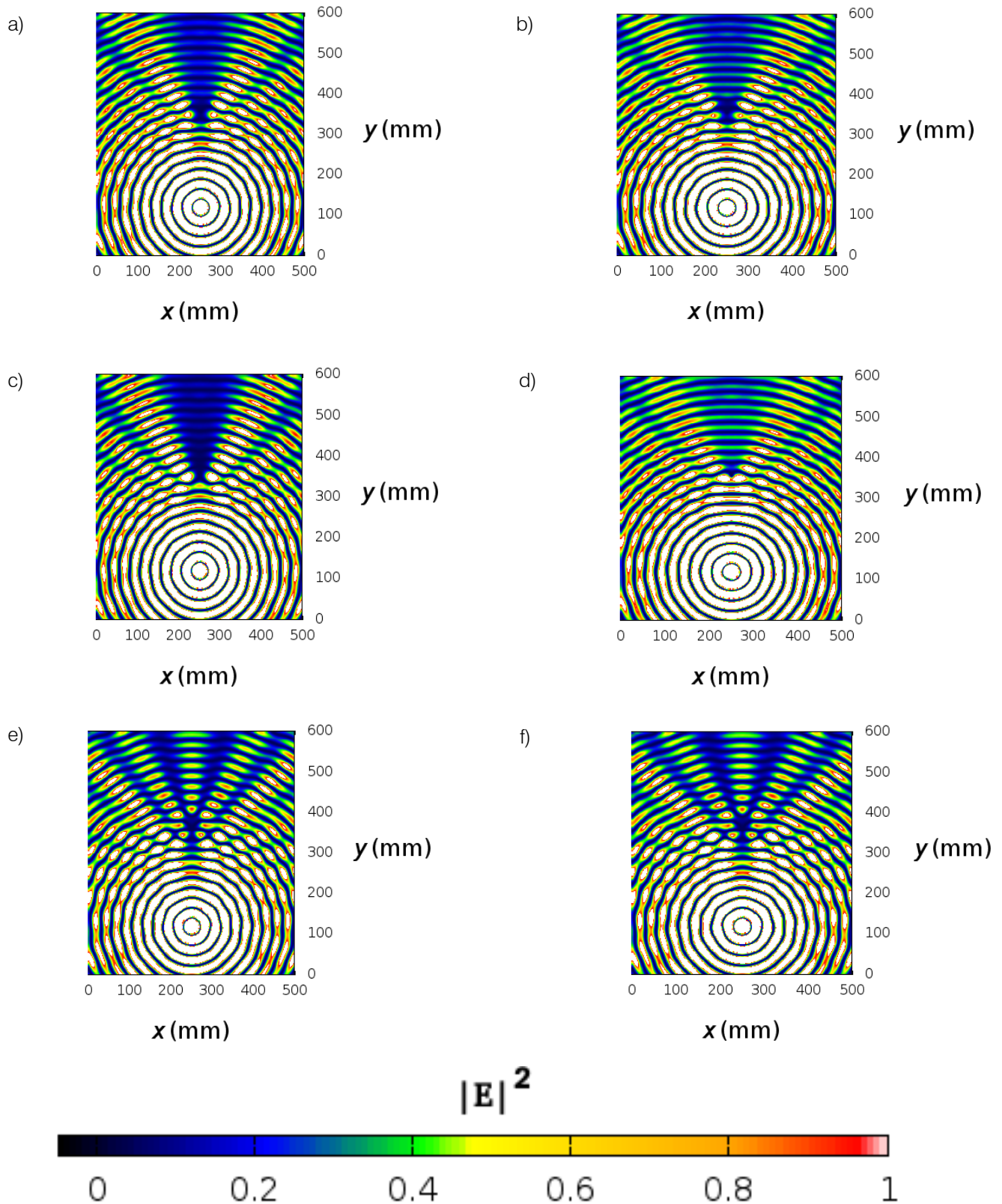
Fig. 6: Power propagation in FDTD at fixed time. In (a, c, e) plasma gradient is include and (b, d, f) only the metamaterial is keep for the result, (a & b) $\mu_r = \mu_\theta = 0.268$; (c & d) $\mu_r = \mu_\theta = 1$; (e & f) $\mu_r = 1$ and $\mu_\theta = 0.268$

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The American Physical Society and Errors in Gravitation

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Abstract- In spite of accurate predictions and an impressive explanation on perihelion of Mercury, Einstein's general relativity accepted by the APS is currently infested with unsolved problems due to his own earlier errors together with additional errors from his followers. Although subsequently his linearized equation has provided more impressive results, Einstein was puzzled because his equation has no wave solutions, but his linearized equation has. The root is due to his accumulated inadequate proposals in physics, and inadequacy in pure mathematics of many physicists such as Pauli. Moreover, the contributions from mathematicians such as Penrose and Yau made the situation worse because they use invalid assumptions due to not understanding physics. These errors are responsible for the lack of progress in gravitation of the APS.

Keywords: anti-gravity coupling; gravitational radiation; repulsive gravitation; principle of causality; unification.

GJSFR-A Classification: FOR Code: 020105

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The American Physical Society and Errors in Gravitation

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Abstract- In spite of accurate predictions and an impressive explanation on perihelion of Mercury, Einstein's general relativity accepted by the APS is currently infested with unsolved problems due to his own earlier errors together with additional errors from his followers. Although subsequently his linearized equation has provided more impressive results, Einstein was puzzled because his equation has no wave solutions, but his linearized equation has. The root is due to his accumulated inadequate proposals in physics, and inadequacy in pure mathematics of many physicists such as Pauli. Moreover, the contributions from mathematicians such as Penrose and Yau made the situation worse because they use invalid assumptions due to not understanding physics. These errors are responsible for the lack of progress in gravitation of the APS. Currently, there are ten major errors: 1) misinterpretation of the equivalence principle and the invalid covariance principle; 2) the conflict between the Einstein equation and $E = mc^2$; 3) inadequacy of Einstein's notion of photons and invalidity of $E = mc^2$; 4) the invalid Space time Singularity Theorems of Hawking & Penrose; 5) the non-existence of a dynamic solution and the Principle of Causality; 6) the rejection of the anti-gravitational coupling; 7) the absence of the reaction force for gravitational radiation; 8) the existence of repulsive gravitation; 9) the weight reduction of a charged capacitor and the current-mass interaction; 10) the necessary extension of general relativity to a five-dimensional space. A main problem is that physicists are incompetent in pure mathematics. This results in awarding the 2016 APS Medal for Exceptional Achievement in Research to Witten even without the support of experiments. There are three types of experiments that show formula $E = mc^2$ is invalid, but the APS still did not recognize them because of the incompetence of Dr. Eric J. Weinberg, Editor of the Physical Review D, in mathematics and physics. Moreover, many had made the same errors as Eric J. Weinberg because of the inadequacy in mathematics and physics. Thus, for the progress of physics, the APS must improve the level of pure mathematics and rectify the past errors in gravitation.

Keywords: *anti-gravity coupling; gravitational radiation; repulsive gravitation; principle of causality; unification.*

I. Introduction

Since Einstein's prediction on the bending of light rays was verified, general relativity is dominating astrophysics [1]. Subsequently, predictions based on the linearization of the Einstein equation were verified [1, 2]. Then, Einstein is established as a genius.

However, Einstein has the puzzle that the non-linear Einstein equation does not support the existence of a gravitational wave solution [3, 4] although the linearized equation assured the existence of a gravitational wave solution. In fact, Einstein concluded his talk on gravitational waves at Princeton University by saying [5] "If you ask me whether there are gravitational waves or not, I must answer that I do not know. But it is a highly interesting problem." Thus, Einstein's last words on this subject was that "I do not know." However, the Physical Review insisted that the gravitational wave solution exists because they believed that an unbounded solution is valid in physics so long as there is no singularity [6]. This started the conflict between Einstein and the American Physical Society (APS).

First, according to the principle of causality [7], a valid solution in physics must be bounded. Second, the existence of an unbounded gravitational solution is useless in physics because the calculation of a gravitational radiation requires a bounded solution [8, 9]. Thus, in 1937 this marked the beginning of a process that the APS added errors to general relativity, in addition to those errors already in Einstein's theory. Another example of such a conflict is the unbounded solution of Penrose [10] for an electromagnetic wave published in the Review of Modern Physics in 1964. His unbounded solution is in disagreement with the implicit assumption used in the calculation for the bending of light in which the gravity of the electromagnetic wave is assumed to be negligible.

Moreover, Einstein's equivalence principle was misinterpreted by the Wheeler School [2) to become mathematically impossible [1, 11] (see Appendix A). Nevertheless, due to the general inadequacy of the APS in pure mathematics, their invalid interpretation was prevailingly accepted. Moreover, the APS was not aware that Einstein's covariance principle is inconsistent with Einstein's equivalence principle.

In this paper, we shall explain the errors in general relativity that have been accepted by the APS as valid because of inadequacy in mathematics and/or physics. In particular, the over-looked inconsistence in Einstein's theory must be identified and rectified.

II. The Invalid Covariance Principle and Measurements in General Relativity

Einstein's general relativity consists of three parts: 1) the equivalence principle; 2) the covariance principle; and 3) the Einstein field equation. Here, we

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shall discuss the equivalence principle and the covariance principle, but later the problems in the Einstein equation,

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = - \kappa T_{\mu\nu} \,, \qquad (1)$$

where $g_{\mu\nu}$ is the space-time metric, $R_{\mu\nu}$ is the Ricci curvature tensor, $R = R_{\alpha\beta} g^{\alpha\beta}$ is the Ricci curvature, $T_{\mu\nu}$ is the sum of energy-stress tensors and κ is the coupling constant. Einstein's equivalence principle is a starting point of general relativity, and thus everybody paid lip service to it, but currently no text book interprets Einstein's equivalence principle correctly [11] except in Einstein's own book [12, 13].

As I have mentioned, the Wheeler School, Pauli [14] and the British Encyclopedia have misinterpreted this principle to become mathematically impossible [11]. In fact, Wald [2] has abandoned this principle and the 1993 Nobel Prize Committee for Physics incorrectly follows Wald [15]. Nevertheless, the consequences of this principle, i.e., the space contractions and the time dilation are supported by experiments [1, 12, 13]. Currently the covariance principle is most popular because of the mathematical freedom it provides.

However, as pointed out by Zhou [16], Einstein's covariance principle implicitly assigns different physical meaning to coordinates for different gauges. Thus, it is actually inconsistent with his equivalence principle that gives definite measurements to the time dilation and space contractions [17]. Note that the gauge independence of light bending [1] is only a coincidental, but not a proof for the gauge invariance since the same result can be obtained from unphysical gauges [18].

Einstein's "principle of covariance" has no theoretical basis beyond the principle of general relativity [17]. Philip Morrison of MIT [3] pointed out that the "covariance principle" is invalid since it disrupts the necessary continuity from special relativity to general relativity [17]. The covariance principle [12] was proposed to justify Einstein's adaptation of the distance in a Riemannian space. This has been pointed out by Whitehead [19] as invalid in physics. Nevertheless, Misner et al. [1, p. 430] claimed that the covariance principle can be verified, but they provided the opposite evidence. For instance, Will [1; p. 1067] claimed Whitehead's theory is invalid; but the solution of Whitehead is actually diffeomorphic to Einstein's [20].

Nevertheless, gauge invariance has a long history starting from electrodynamics. Then, gauge invariance has been developed according to non-Abelian gauge theories such as the Yang-Mills-Shaw theory [21, 22]. [4] They naively extended the invariance of the Abelian gauge to the cases of the Non-Abelian gauges in terms of mathematics. However, as shown by Aharonov & Bohm [23] the electromagnetic potentials actually are physically effective; and, as shown by Weinberg [24], all the physical non-Abelian gauge theories are not gauge invariant such that different masses can be generated. These facts support the view that gauge invariance of the whole theory would be a manifestation that there are some deficiencies [25, 26].

A counter example was provided by Bodenner & Will [27] and Gérard & Piereaux [28]. Although they showed that the deflection angle is gauge invariant to the second order, but the impact parameter b of the light ray and the shortest distance r_0 from the light ray to the center of the sun showed that these physical quantities cannot be both gauge invariant. From the harmonic gauge and the Schwarzschild gauge, one has respectively

$$b \approx 2\kappa M + r_0 \,, \qquad (2a)$$

but

$$b \approx \kappa M + r_0 \,. \qquad (2b)$$

Thus, Einstein's covariance principle is invalid since two physical quantities should not have gauge dependent relations.

Another counter example is the formulas for the de Sitter precession [29]. From the Maxwell-Newton Approximation [8], one would obtain a formula that is different from the formula obtained from the Kerr metric [2]. Unfortunately, the difference cannot be distinguished by the Stanford experiment, gravity Probe-B because this experiment detects only the time average, of which the difference is essentially zero [17]. Thus, this experiment of Stanford has a design failure. Moreover, the experiment on local light speeds [30] would show the break down of gauge invariance.

Now, we should find out what went wrong in Einstein's consideration on gauge invariance. To argue for the covariance principle, Einstein [12] claimed that for a circle in a uniformly rotating disk K' relative to an inertial system K, the quotient of the circumference and the diameter would be greater than π. This is due to that a measuring rod at rest relatively to K', when measured from K, the measuring-rod applied to the periphery undergoes a Lorentzian contraction, while the one applied along the radius does not. Nevertheless, many (included this author) had failed to see that his arguments are actually invalid. To see Einstein's errors, one must go into the details instead of glossing over his claims.

Consider a particle P resting at K'(r', ϕ', z', ct'). The local space of P is L*(dR, dX, dz', cdT) with a Minkowski metric. In K, P has a position (r, ϕ, z,) and its local space (dr, rdϕ, dz, cdt) has the Minkowski metric. These two local spaces have a relative velocity rΩ in the ϕ–direction. Moreover, let X be in the same direction of rdϕ.

Then, according to special relativity, one has $dz = dz'$ and $dr = dR$, and the Lorentz transformation as follows:

$$r d\phi = [1 - (r\Omega/c)^2]^{-1/2} [dX + r\Omega dT], \qquad (3a)$$

and

$$c dt = [1 - (r\Omega/c)^2]^{-1/2} [cdT + (r\Omega/c)dX]; . \qquad (3b)$$

or

$$dX = [1 - (r\Omega/c)^2]^{-1/2} [rd\phi - r\Omega dt], \qquad (4a)$$

and

$$dT = [1 - (r\Omega/c)^2]^{-1/2}[dt - (r\Omega/c^2)\, rd\phi]. \qquad (4b)$$

It follows that if dX is measured simultaneously (i.e. $dt = 0$) from K, from (4a) one has

$$U = (1/2)[1 - (D\Omega/2c)^2]^{-1/2}\oint D d\phi = \pi D[1 - (D\Omega/2c)^2]^{-1/2} \qquad (6)$$

to be valid. However, the error is that the distance dX in (5a) is not in K', but in a local space L*, which depends on t and ϕ. Although all L*s at different ϕ are at rest relative to K', they are *under different accelerations*. Thus, integration (6) would not make sense as distance in K'. Moreover, the space K is in a relative motion with respect to K'. *This is in a different situation for space contractions and the time dilation since the space S and such a local space L are at rest with each other.*

Therefore, (5a) and (5b) actually have nothing to do with Einstein's equivalence principle. Einstein's claims for space contractions and the time dilation are

$$dX = [1 - (r\Omega/c)^2]^{-1/2} [rd\phi]. \qquad (5a)$$

This is a space contraction for L* ($dX > r\, d\phi$). For a clock fixed at L* (i.e., $dX = 0$), from (3b) we would have

$$c dT = [1 - (r\Omega/c)]^{1/2}\, c dt \qquad (5b)$$

if measured from K. This is a time dilation for L* ($dt > dT$).

From (5a), Einstein concluded that $U/D > \pi$, where D is the diameter of a circle and U is its circumference. Since all the measurements in (5a) are done in K, Einstein mistakenly considered the integration as

supported with invalid arguments due to an over-sight on special relativity. Thus, Einstein had not provided a theoretical basis for his theory of measurement. Thus, it should be examined carefully.

Therefore, to clarify the issue of measurements, one should derive a space-time metric and show that such a metric satisfies Einstein's equivalence principle. We shall derive a metric for the case of a rotating disk. According to Landau and Lifshitz [31], the transformation to a uniformly rotating reference frame K'(x', y', z') [2)] with angular velocity Ω has the form,

$$x = x' \cos \Omega t - y' \sin \Omega t, \qquad y = x' \sin \Omega t + y' \cos \Omega t, \qquad \text{and} \qquad z = z', \qquad (7a)$$

or

$$r = r', \qquad z = z', \qquad \text{and} \qquad \phi = \phi' + \Omega t \qquad (7b)$$

Then a metric in terms of the coordinates in K'(x', y', z') can be obtained from (7b); and

$$dr = dr', \ dz = dz', \ \text{and}\ d\phi = d\phi' + \Omega dt. \qquad (7c)$$

The transformed metric in system K'*(x' y', z', ct) would have the following form,

$$ds^2 = (c^2 - \Omega^2 r^2)\, dt^2 - 2\Omega r^2\, d\phi' dt - dr^2 - r^2\, d\phi'^2 - dz'^2 \qquad (8)$$

and

$$g^{ct\, ct} = 1, \quad g^{r'r'} = g^{z'z'} = -1, g^{\phi'\phi'} = -(1 - \Omega^2 r'^2/c^2)/\,r'^2, g^{\phi'ct} = g^{ct\,\phi'} = -\Omega/c \qquad (9)$$

are the non-zero elements of the inverse metric, Then, one obtains that the force on a resting particle P with mass m is mv^2/r', which is also the force due to rotation. Note that (7a) implies also

$$r' = r, \quad x' = r \cos \phi', \quad \text{and} \quad y' = r \sin \phi', \qquad (10)$$

Thus, (10) means K'(x', y' z') also has a Euclidean-like structure. Thus Einstein's claim of measurement would be incorrect.

The system K'* (x', y', z', ct) with metric (8) could have led to the "light speed" $rd\phi'/dt$ larger than c because t is related to the local clocks resting at (x, y, z).

Moreover, one could have misinterpreted metric (8) as having no space contraction. To rectify these problems, one must have a metric in terms of the local time t' of K'(x', y' z').

Now, consider the local space L*, from (4a), (4b) and (7c) we have,

$$dX = [1 - (r\Omega/c)^2]^{-1/2}\, rd\phi', \qquad (11a)$$

and

$$dT = [1 - (r\Omega/c)^2]^{1/2}\, \{dt - [1 - (r\Omega/c)^2]^{-1}(r\Omega/c^2)\, rd\phi'\} \qquad (11b)$$

Then we have

$$ds^2 = (c^2 - \Omega^2 r^2) \{dt - [1 - (r\Omega/c)^2]^{-1}(r\Omega/c^2) \, rd\phi'\}^2 - dr^2 - [1 - (r\Omega/c)^2]^{-1}r^2 \, d\phi'^2 - dz'^2. \qquad (11c)$$

We note that local space L* is the local space of the Einstein-Minkowski condition. Consequently, we should have

$$ds^2 = g_{t't'} \, c^2 dt'^2 - dr'^2 - (1 - \Omega^2 r'^2/c^2)^{-1}r'^2 \, d\phi'^2 - dz'^2. \qquad (12)$$

Now, (11a) shows that the metric has space contractions. According to Landau & Lifshitz [31], we should have

$$ds^2 = (c^2 - \Omega^2 r'^2)dt'^2 - dr'^2 - (1 - \Omega^2 r'^2/c^2)^{-1}r'^2 \, d\phi'^2 - dz'^2. \qquad (13)$$

where

$$dT = [1 - (r\Omega/c)^2]^{1/2} \, dt' \quad \text{and} \quad cdt' = cdt - (r\Omega/c)rd\phi'[1 - (r\Omega/c)^2]^{-1}. \qquad (14)$$

Eq. (14), which is different from (5b), implies that for a local clock fixed at K' an observer at K would have

$$dt' = dt. \qquad (15a)$$

Thus, as Kündig [32] has shown, time dilation (14) can be verified. Moreover, since r = r', (11a) and (5a) imply

$$rd\phi \, [1 - (r\Omega/c)^2]^{-1/2} = dX = r'd\phi' \, [1 - (r\Omega/c)^2]^{-1/2}, \quad \text{and} \quad rd\phi' = r'd\phi \qquad (15b)$$

Thus, *Einstein's claim of U/D > π is not valid.* [5] Note that $[1 - (r\Omega/c)^2]^{-1/2} rd\phi'$ is a distance measured in different L*. Therefore, the integration of (11a) is not a distance in K'. However, relations (5a) all are measured in K.

Moreover, Einstein's theory of measurement is invalid because Einstein incorrectly regarded space contractions, which are obtained from a local space at free fall, as measured in the frame of reference.

Note that metrics (8) and canonical metric (13) relate to each other with the relations (7c) and

$$cdt' = cdt - (r\Omega/c) \, rd\phi'[1 - (r\Omega/c)^2]^{-1}. \qquad (16)$$

If one believed that dt' was a global variable, then one integrated them, and one would get (7b), and

$$ct' = ct - (r\Omega/c) \, r\phi'[1 - (r\Omega/c)^2]^{-1} \qquad (17)$$

if (16) were integrable. A problem is that $\phi' \pm 2\pi$ is the same position, but t and t' would not be the same. As shown in (14), dt' is related to dT of the local inertial systems L*(dR, dX, dz', cdT) at different t, r, and ϕ', and thus (16) is not integrable.

Now, the Einstein-Minkowski condition [12] is satisfied, and Einstein's notion of local time and local clocks are supported. Thus, the Euclidean-like structure (10) is physically realizable in terms of measurements. In turn, this implies directly that Einstein's claim on larger circumference/diameter ratio of a circle is invalid.

Einstein stated that the light speed is measured "in the sense of Euclidean geometry [12]". In fact, *all Einstein's predictions are in terms of the Euclidean-like structure.* A ray of light, traveling at a shortest distance Δ from the center of sun with mass M, will be deflected by an amount [12, 13] Mκ/2πΔ. The secular rotation of the elliptic orbit of the planet in the same sense as the revolution of the planet, amounting in radius per revolution to $24\pi^3 a^2/(1 - e^2)c^2T^2$. In addition to Δ, *e* the numerical eccentricity and *a* the semi-major axis of the planetary orbit in centimeters are defined in terms of the Euclidean-like structure, and T the period of revolution in seconds is defined in terms of the time of a "quasi-Minkowskian space" [33]. Thus, it is clear that Einstein's theory of measurement has not been used in his calculations.

In other words, his invalid theory of measurement is actually independent of the theory of general relativity. Moreover, calculation for the bending of light has actually proved that his theory of measurement is experimentally invalid since it would imply only half of the observed value of light bending [34]. The correct theory is, however, just what Einstein practiced in his calculation of the bending of light [30].[6] However, the covariance principle remains a useful mathematical tool [33]. Nevertheless, the approach of Wald [2], though accepted by the Nobel Prize Committee, is incorrect [35].

Now, it is clear that the covariance principle is invalid in physics. This principle is due to a confusion between physics and mathematics. Nevertheless, the linearized harmonic gauge is valid for the Maxwell-Newton Approximation [7-9] although the gauge for the Einstein equation is still not clear. Invalidity of the covariance principle leads to the important question of what the physical gauge is? Currently, we still do not yet have an answer. Zhou [16] chose the harmonic gauge. This seems appropriate since it is consistent with the linearized gauge for the case of Maxwell-Newton Approximation [7-9].

III. The Conflict between the Einstein Equation and E = MC²

We usually cite the achievements of Einstein on his field equation and the formula E = mc². However, few recognized that they are actually not always consistent [35]. Since the Einstein equation is the basis of the numerous predictions the only choice seems to

be just what can be done on the unverified $E = mc^2$ [36] if we do not want to abandon general relativity.

According to the Einstein equation (1), we have

$$R = R_{\alpha\beta}g^{\alpha\beta} = \kappa T_{\alpha\beta}g^{\alpha\beta}, \qquad (18)$$

for the space-time metric $g_{\alpha\beta}$. Since the electromagnetic energy-stress tensor is traceless, the electromagnetic energy cannot affect the Ricci curvature R, but the mass can. Thus, it is clear that the electromagnetic energy cannot be equivalent to mass.

One might argue that experiments show that a π_0 meson can decay into two photons. This would support that the electromagnetic energy is equivalent to mass, according to the proposal of Einstein [37] that photons consist of only electromagnetic energy. However, experimentally, Einstein's proposal is only partially verified since nobody has verified that the photons consist of only pure electromagnetic energy. In view of that all the charged particles are massive, it is entirely possible that the photons would include gravitational energy. Thus, we must investigate the gravity of an electromagnetic wave.

IV. Inadequacy of Einstein's Notion of Photons and Invalidity of E = MC²

It is the bending of light ray that makes Einstein famous. It will be shown that problems related to the bending of light also exposed the shortcomings of Einstein. Moreover, the electromagnetic energy must generate different gravitation [35].

In Einstein's calculation, it is implicitly assumed that the gravity created by an electromagnetic wave is negligible. Since Einstein also claimed that any energy-momentum tensor can be a source of his equation. Since such gravity is very weak in physics, Journals such as the Chinese Physics B and Physical Review D believed that such gravity can be calculated with the perturbation approach, but did not do it. Mathematically, for a perturbation approach to be valid, a necessary condition is, however, that this problem has a bounded solution. This compatibility between mathematics and physics is crucial for the validity of a theory in physics. Thus, it is natural for Einstein [38] to believe that his equation could be used for such a case.

For a plane electromagnetic wave, the metric obtained by Penrose [10] is the following:

$$ds^2 = du\,dv + Hdu^2 - dx_i dx_i, \quad \text{where } u = ct - z, \, v = ct + z. \ (19)$$

$$H = h_{ij}(u)x_i x_j, \quad h_{ij}(u) \text{ is the energy-momentun tensor.}$$

An obvious problem is that the solution (19) is not bounded. This violates the principle of causality and also common sense.

Moreover, since there are non-physical parameters (the choice of origin) that are unrelated to any physical causes, [7] this obviously further violate the principle of causality. However, according to the standard of the Physical Review, the solution of Penrose was perfectly valid [6]. Penrose is essentially a mathematician, and thus causality was probably absent from his training, but this lack of awareness in causality from the editors for the Review of Modern Physics, should be a surprise.

Moreover, explicit calculation based in causality shows that it is impossible to have a bounded solution for the gravity of an electromagnetic wave [39, 40]. In order for Einstein's theory to make sense, the related Einstein equation with an electromagnetic wave as the source, must include a photonic energy-stress tensor with the anti-gravity coupling [39, 40].

For this case the related modified Einstein equation is the following:

$$G_{ab} \equiv R_{ab} - \frac{1}{2}g_{ab}R = -K[T(E)_{ab} - T(p)_{ab}], \qquad (20)$$

and

$$T_{ab} = -T(g)_{ab} = T(E)_{ab} - T(P)_{ab},$$

where $T(E)_{ab}$ and $T(P)_{ab}$ are respectively the energy-stress tensors for the electromagnetic wave and the related photons. *Thus the photonic energy must include also the energy of its gravitational wave component.*

Therefore, Einstein also failed to see the need of an anti-gravity coupling in this case as in the case of a massive dynamic Einstein equation [41]. Note that it is this failure to see the need of the anti-gravity coupling that provides the erroneous theoretical basis for the space-time singularity theorems of Hawking and Penrose which actually are irrelevant to physics [42].

If the photons consist of only electromagnetic energy, there is a conflict since the photonic energy can be equivalent to mass and the electromagnetic energy is not. Now, this conflict is resolved since the photonic energy is the sum of electro-magnetic energy and gravitational energy, and thus it is established that $E = mc^2$ can be invalid.

Note that both quantum theory and relativity are based on the phenomena of light. It is gravity that makes the notion of photons compatible with the electromagnetic wave. Since Einstein proposed the photons before he conceived general relativity; understandably he failed to include gravitational wave energy. Now, since a charged particle is always massive, it would be natural to include the gravitational wave energy in a photon. Ohanian [43] incorrectly credited von Laue for complete proof of the equivalence of mass and photonic energy. However, the fact is that both von Laue and Einstein failed [12].

V. The Invalidity of the Spacetime Singularity Theorems in Physics

In physics, the existence of singularities suggests problematic assumptions. Nevertheless, in

current general relativity, the existence of space-time singularities plays a central role on the notion of black holes and the expanding universe. [8]

The existence of space-time singularities is due to the spacetime singularity theorems of Hawking and Penrose [2]. The mathematical validity of these theorems is highly reliable because Penrose has won his arguments in mathematics against the theoretical physicist, E. M. Lifshitz [44] in a long dispute. Moreover, the static Einstein equation has passed various tests.

A common implicit assumption on these singularity theorems is that all the coupling constants have the same sign. [9] Such an assumption would be necessarily valid if the formula $E = mc^2$ is unconditional. However, theoretically it has been found that the equivalence between mass and the electromagnetic energy is in conflict with the static Einstein equation. Moreover, it has been found that the anti-gravitational

$$R_{ab} \xi^a \xi^b = 8\pi \ [T_{ab} - (1/2)g_{ab} \ T] \ \xi^a \xi^b \ = 8\pi \ [T_{ab}\xi^a\xi^b + (1/2)T], \qquad \text{for a unit timelike } \xi^a \qquad (23)$$

It is believed that for all physically reasonable classical matter the energy condition is non-negative, i.e.,

$$T_{ab} \ \xi^a\xi^b \geq 0 \qquad\qquad (24)$$

for all timelike ξ^a. This assumption is the weak energy condition. However, it also seems physically reasonable that the stress of matter will not become so large and negative as to make the right-hand side of eq. (23) negative. This assumption,

$$T_{ab} \ \xi^a\xi^b \geq -(1/2)T \qquad\qquad (25)$$

for all unit timelike unit vector ξ^a, is known as the strong energy condition. These energy-conditions (23)-(25) imply that

$$R_{ab} \xi^a\xi^b \geq 0. \qquad\qquad (26)$$

if all the coupling constants have the same sign. Thus, the discovery of the anti-gravity coupling implies the assumption of the space-time singularity is invalid in physics (see Appendix B), and thus the singularity theorems are irrelevant to physics.

VI. THE NON-EXISTENCE OF A DYNAMIC SOLUTION FOR THE EINSTEIN EQUATION AND THE PRINCIPLE OF CAUSALITY

Because of inadequacy in non-linear mathematics, Einstein and his followers fail to see the non-existence of a dynamic solution for the Einstein equation [35]. [10] This error led to accepting the misleading positive mass theorem of Yau and Schoen [45, 46] as generally valid, [11] and thus delayed the development of general relativity for at least 13 years [47].

coupling is necessary for the case of an electromagnetic wave.

Here, it will be shown that the assumption of unique coupling sign is, indeed, necessary for the singularity theorems (see Appendix: B). Therefore, the space-time singularity theorems of Hawking and Penrose are actually irrelevant to physics.

According to Misner et al. [1], the Einstein equation takes the following form.

$$G_{ab} \equiv R_{ab} - (1/2) \ g_{ab} \ R = 8\pi T_{ab,} \qquad (21)$$

This is different from eq. (1) since the R_{ab} and g_{ab} in (21) is - R_{ab} and - g_{ab} in equation (1). Thus, we would have

$$R_{ab} = 8\pi \ [T_{ab} - (1/2)g_{ab} \ T] \qquad \text{where } T = g^{ab}T_{ab} \qquad (22)$$

Then,

The issue on the existence of a dynamic solution started with the perihelion of Mercury. In 1915 Einstein obtained the expected value of the remaining perihelion with his equation, and thus was confident on his theory. His confidence was subsequently boosted by the confirmation of the bending of light [12]. However, unexpectedly his equation was questioned by Gullstrand [48], the Chairman (1922-1929) of the Nobel Prize for Physics. The perihelion of Mercury is actually a many-body problem [35], but Einstein had not shown that his calculation could be derived from such a step. Thus, Mathematician D. Hilbert, who approved Einstein's calculation, did not come to its defense [41].

Nevertheless, Einstein was awarded a Nobel Prize by virtue of his photoelectric effects [12] instead of general relativity as expected [41]. The fact is, however, Gullstrand is right. In 1995, it was proven that Einstein's equation is incompatible with gravitational radiation and does not have a dynamic solution [7-9].

For space-time metric $g_{\mu\nu}$, for massive sources, the Einstein equation of 1915 [1, 2] is

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = -\kappa T(m)_{\mu\nu} \qquad (27)$$

where $G_{\mu\nu}$ is the Einstein tensor, $T(m)_{\mu\nu}$ is the energy-stress tensor for massive matter.·Eq. (27) implies no gravitational waves to carry away energy-momentum in vacuum and thus the principle of causality [13] is violated. This is the physical reason that there is no dynamic solution for the Einstein equation. Thus, Einstein's theory is at least incomplete.

There are serious consequences from the mistaken existence of dynamic solutions for the Einstein equation. A well-known result is the existence of the so-called space-time singularities due to implicitly

assuming the unique sign for all the coupling constants [2]. Another result is that the misleading [47] positive mass theorem of Yau and Schoen [45, 46]. Moreover, the unification of gravitation and electromagnetism was not recognized as necessary by others [35]. Thus, the criticism of Gullstrand turns out to be very crucially constructive and beneficial.

Nevertheless, there were erroneous claims for the existence of a dynamic solution because of inadequacy in non-linear mathematics among physicists. Mathematicians such as Yau [45] and Witten [46] supported the existence of a bounded dynamic solution with their misleadingly positive mass theorem [47]. [14] Moreover, Christodoulou and Klainerman [49] invalidly claimed they have constructed dynamic solutions [50]. Not only were their errors accepted by the 1993 Nobel Prize Committee for Physics [15] but also Christodoulou was awarded the 2011 Shaw Prize [15] in mathematics [51] in honor of his errors against the honorable Gullstrand. Subsequently, Christodoulou was accepted as a member of U.S. National Academy of Sciences. Thus, generations of physicists are misled into serious errors because of the over confidence. This is highlighted by a big error, the award of the APS Medal for Exceptional Achievement in Research without experimental support [52]. [16]

Moreover, Gullstrand was not the only theorist who questioned the existence of the bounded dynamic solution for the Einstein equation. As shown by Fock [53], any attempt to extend the Maxwell-Newton approximation to higher approximations leads to divergent terms. An independent supplementary evidence for the absence of a bounded dynamic solution is, as shown by Hu, Zhang & Ting [54], that a calculated gravitational radiation would depend on the approach used.

Nevertheless, many believed that the non-linear Einstein equation must have a bounded dynamic solution since the linearized Einstein equation has bounded dynamic solutions. Unfortunately, Einstein and his peers failed to see that for a dynamic case, these equations are actually independent equations [55]. The recent awards and honors to Christodoulou manifested an unpleasant fact that most of the theorists do not understand non-linear mathematics adequately.

To prepare those who would read the proof for the non-existence of dynamic solutions [7-9], we shall give examples in the literature to illustrate what has been wrong in their claims of the existence of dynamic solutions.

a) The Unbounded Wave Solutions

Now, consider a well-known metric obtained by Bondi, Pirani, & Robinson [56] as follows:

$$ds^2 = e^{2\varphi}\left(d\tau^2 - d\xi^2\right) - u^2 \begin{bmatrix} \cosh 2\beta\left(d\eta^2 + d\varsigma^2\right) \\ + \sinh 2\beta \cos 2\theta\left(d\eta^2 - d\varsigma^2\right) \\ -2\sinh 2\beta \sin 2\theta\, d\eta\, d\varsigma \end{bmatrix} \quad (28a)$$

where ϕ, β and θ are functions of u ($= \tau - \xi$). It satisfies the differential equation (i.e., their Eq. [2.8]),

$$2\phi' = u\left(\beta'^2 + \theta'^2 \sinh^2 2\beta\right) \quad (28b)$$

which is a special case of $G_{\mu\nu} = 0$. They claimed this is a wave from a distant source. However, the metric is irreducibly unbounded because of the factor u^2, and linearization of (28b) does not make sense since u is not bounded.

Moreover, when gravity is absent, it is necessary to have $\phi = \sinh 2\beta = \sin 2\theta = 0$. These would reduce (28a) to

$$ds^2 = \left(d\tau^2 - d\xi^2\right) - u^2\left(d\eta^2 - d\zeta^2\right). \quad (28c)$$

However, this metric is not equivalent to the flat metric. Thus, metric (28c) violates the principle of causality.

Consider again the gravitational solution obtained by Penrose [10] for an electromagnetic plane wave as follows:

$$ds^2 = du\, dv + Hdu^2 - dx_i dx_i, \quad \text{where} \quad H = h_{ij}(u)x_i x_j \quad (29)$$

where $u = ct - z$, $v = ct + z$. However, there are non-physical parameters (the choice of origin) that are unrelated to any physical causes. Penrose [10] over-looked the principle of causality. Linearization of (29) also does not make sense.

Another example is the plane-wave solution of Liu & Zhou [57], which satisfies the harmonic gauge, is as follows:

$$ds^2 = dt^2 - dx^2 + 2 F(dt - dx)^2 - \cosh 2\psi(e^{2\phi} dy^2 + e^{-2\phi}dz^2) - 2\sinh 2\psi\, dy\, dz. \quad (30)$$

where $\phi = \phi(u)$ and $\psi = \psi(u)$. Moreover, $F = F_P + H$, where

$$F_P = \frac{1}{2}(\dot{\psi}^2 + \dot{\phi}^2 \cosh^2 2\psi)\, [\cosh 2\psi\, (e^{2\phi}y^2 + e^{-2\phi}z^2) + 2\sinh 2\phi\, yz], \quad (31)$$

and H satisfies the equation,

$$\cosh 2\psi \, (e^{-2\phi}H,_{22} + e^{2\phi}H,_{33}) - 2\sinh 2\psi \, H,_{23} = 0. \tag{32}$$

For the weak fields one has $1 >> |\phi|$, $1 >> |\psi|$, but there is no weak approximation as claimed to be

$$ds^2 = dt^2 - dx^2 - (1 + 2\phi) \, dy^2 - (1 - 2\phi)dz^2 - 4\psi dydz \tag{33}$$

because F_p is not bounded unless $\dot\phi$ and $\dot\psi$ are zero (i.e., no wave).

The linearized equation for a dynamic case has been illustrated as incompatible with the Einstein equation. Thus, eq. (28b), eq, (29), and eq. (33) serve as examples. It will be shown that claimed bounded dynamic solutions actually do not exist.

b)   Errors of Misner, Thorne and Wheeler

A "wave" form considered by Misner, Thorne, & Wheeler [1] is as follows:

$$ds^2 = c^2 dt^2 - dx^2 - L^2\left(e^{2\beta}dy^2 + e^{-2\beta}dz^2\right) \tag{34}$$

where $L = L(u)$, $\beta = \beta(u)$, $u = ct - x$, and c is the light speed. Then, the Einstein equation $G_{\mu\nu} = 0$ becomes

$$\frac{d^2 L}{du^2} + L\left(\frac{d\beta}{du}\right)^2 = 0 \tag{35}$$

Misner et al. [1] claimed that Eq. (35) has a bounded solution, compatible with a linearization of metric (34).

However, it has been shown with calculus [58] that Misner et al. are incorrect and eq. (35) does not have a physical solution that satisfies Einstein's requirement on weak gravity. In fact, $L(u)$ is unbounded even for a very small $\beta(u)$.

On the other hand, from the Maxwell-Newton approximation in vacuum, Einstein [59] obtained a solution as follows:

$$ds^2 = c^2 dt^2 - dx^2 - (1 + 2\phi)dy^2 - (1 - 2\phi)dz^2 \tag{36}$$

where ϕ is a bounded function of $u \, (= ct - x)$. Note that metric (36) is the linearization of metric (34) if $\phi = \beta(u)$. Thus, the waves illustrate that the linearization is not valid for the dynamic case since eq. (35) does not have a weak wave solution. Since this crucial calculation can be proven with mathematics at the undergraduate level, it should not be surprising that Misner et al. [1] make other serious errors in mathematics and physics [11].

Note that Wheeler's student, Christodoulou [49] also falsely claimed the existence of bounded dynamic solutions [50].

c)   Errors of Wald

Wald [2] also fails to see the non-existence of dynamic solutions. The linearized vacuum Einstein equation means

$$G^{(1)}_{\mu\nu}[\gamma^{(1)}_{\alpha\beta}] = 0 \text{ where } G^{(1)}_{\mu\nu} = \frac{1}{2}\partial^\alpha\partial_\alpha\bar\gamma_{\mu\nu} - \partial^\alpha\partial_\mu\bar\gamma_{\nu\alpha} - \partial^\alpha\partial_\nu\bar\gamma_{\mu\alpha} + \frac{1}{2}\eta_{\mu\nu}\partial^\alpha\partial^\beta\bar\gamma_{\alpha\beta} \tag{37}$$

and

$$G_{\mu\nu} = G_{\mu\nu}^{(1)} + G_{\mu\nu}^{(2)}, \qquad \bar\gamma_{\mu\nu} = \gamma_{\mu\nu} - \frac{1}{2}\eta_{\mu\nu}\gamma, \qquad \text{and} \quad \gamma = \eta^{\alpha\beta}\gamma_{\alpha\beta}. \tag{38}$$

Thus, as Wald pointed out that we must correct $\gamma^{(1)}_{\mu\nu}$ by adding to it the term $\gamma^{(2)}_{\mu\nu}$ that satisfies

$$G^{(1)}_{\mu\nu}[\gamma^{(2)}_{\alpha\beta}] + G^{(2)}_{\mu\nu}[\gamma_{\alpha\beta}] = 0, \qquad\qquad \text{where} \quad \gamma_{\mu\nu} = \gamma^{(1)}_{\mu\nu} + \gamma^{(2)}_{\mu\nu} \tag{39}$$

which is the correct form of eq. (4.4.52) in [2] (Wald did not distinguish $\gamma_{\mu\nu}$ from $\gamma^{(1)}_{\mu\nu}$). However, detailed calculation shows that this equation does not have a solution for the dynamic case [7-9] although it does have a solution for the static case. Wald believed that eq. (39) had a solution for the dynamic case, due to his false confidence on Yau's theorem [45].

VII.   The Rejection of the Anti-Gravitational Coupling

Einstein was unaware of the need for an anti-gravitational coupling although Pauli [14] mentioned this possibility. It has been shown that anti-gravity coupling is needed in the calculation of the gravitational waves generated by an electromagnetic wave [39, 40]. This also leads to the conclusion that the anti-gravity coupling must be also present for the massive cases.

For the case with a massive source, there is a conflict between the Einstein equation, which has no dynamic solution and its linearized equation, which has a dynamic solution. The conflict is because the second order terms $G^{(2)}_{\mu\nu}$ cannot be eliminated in the Einstein equation. Thus, a simple solution is the 1995 update of the Einstein equation [8] as follows:

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = - K \, [T(m)_{\mu\nu} - t(g)_{\mu\nu}], \tag{40}$$

where $t(g)_{\mu\nu}$ is the energy-stress tensor for gravity.[17] From the Lorentz-Levi-Einstein equation (40), in vacuum it is

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = K t(g)_{\mu\nu}. \qquad (41)$$

Note that $t(g)_{\mu\nu}$ is equivalent to $G^{(2)}_{\mu\nu}$ (and Einstein's gravitational pseudotensor) in terms of his radiation formula.

Historically, equation (20) was first proposed by Lorentz [60] and later by Levi-Civita [61] in the following form,

$$\kappa t(g)_{ab} = G_{ab} + \kappa T_{ab} \qquad (42)$$

such that the gravitational energy-stress tensor $t(g)_{ab}$ takes a covariant form although they have not proved its necessity. However, Einstein [62] objected to this form on the grounds that his field equation implies $t(g)_{ab} = 0$. A problem of Einstein is that he has never calculated a dynamic solution explicitly and thus failed to see its nonexistence.

In vacuum, the gravitational energy-stress tensor $t(g)_{\mu\nu}$ carries the energy-momentum as physics requires. Note that the linearized equation provides a valid approximation of the modified Einstein equation (40), but not the Einstein equation [12, 13]. This also solves Einstein's dilemma that his equation does not have an gravitational wave solution. Note also that the radiation of the binary pulsar can be calculated without detailed knowledge of $t(g)_{\mu\nu}$ [7-9].

It should be noted that the necessary existence of an anti-gravity coupling for a dynamic situation means the energy conditions in the singularity theorems [2] are not valid. Thus, the existence of a singularity is incorrect. Moreover, the claim of inevitably breaking of general relativity for microscopic phenomena is baseless since the notion of photons is based on gravitation. In other words, the contributions of Hawking and Penrose to physics are essentially zero if not negative.

VIII. The Absence of the Reaction Force for Gravitational Radiation

It has been shown that the existence of photons implies the existence of gravitational waves. Thus, the non-existence of a gravitational wave solution discovered by Einstein [3] means only that the Einstein equation must be rectified. Hence, another problem is that, just as in Maxwell's classical electromagnetism, there is also no radiation reaction force for gravitational waves in general relativity. Although an accelerated massive particle would create radiation, the metric elements in the geodesic equation are created by particles other than the test particle. In other words, not only the field equation, but also the equation of motion must be modified. Thus gravity cannot be just Riemannian geometry. *Therefore, general relativity is not yet complete, independent of the need of unification due to the existence of the charge-mass interaction (see next section).*

IX. The Existence of Repulsive Gravitation

Because the electromagnetic energy is not equivalent to mass, such energy must generate a different kind of gravitation.

On the other hand, due to believing in unconditional $E = mc^2$, nobody seriously studied repulsive gravitation generated by the electromagnetic energy before Lo [63] in 1997.

For a particle with charge q and mass M, the metric known as the Riessner-Nordstrom metric [1] is as follows:

$$ds^2 = \left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right) dt^2 - \left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right)^{-1} dr^2 - r^2 d\Omega^2, \qquad (43)$$

(with $c = 1$) where r is the radial distance (in terms of the Euclidean-like structure [30]) from the particle center. In this metric (43), the gravitational components generated by electricity have not only a very different radial coordinate dependence but also a different sign that makes it a new repulsive gravity in general relativity [64].

Nevertheless, some still argued that the effective mass could be considered as $(M - q^2/2r)$ because the total electric energy outside a sphere of radius r is $q^2/2r$ [65], and thus (43) could be interpreted as supporting $m = E/c^2$. However, the strength of a gravitational force decreases everywhere after an increase of the electric energy.

Moreover, the gravitational forces would be different from the force created by the "effective mass" $M - q^2/2r$ because

$$-\frac{1}{2} \frac{\partial}{\partial r}\left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right) = -\left(\frac{M}{r^2} - \frac{q^2}{r^3}\right) > -\frac{1}{r^2}\left(M - \frac{q^2}{2r}\right). \qquad (44)$$

Thus Will was defeated because he could not defend his interpretation of $m = E/c^2$ [63].

Nevertheless, theorists such as Herrera, Santos, & Skea [66] argued that M in (43) involves the electric energy. Then their metrics for a charged ball would increase its weight as the charge q increased [64]. (Their approach is essentially the same as that of Pekeris [67] in 1982. Apparently, theorists have run out of means that can be used against the repulsive force.) However, experiments support the opposite [68]. Nevertheless, Herrera et al. [66] are not alone in such an error. Nobel Laureate G. 't Hooft even claimed that the electric energy of an electron contributed to the inertial mass of an electron [69].[18] In fact, many Nobel Laureats incorrectly believed the validity of $E = mc^2$.[19] Nobody questioned this simple but incorrect result.

On the other hand, if the mass M is just the inertial mass of the particle, the weight of a charged

metal ball can be reduced [64]. Thus, as Lo expected [63], experiments on two metal balls [68] confirm the charged ball has reduced weight. This is an experimental direct proof that the electric energy is not equivalent to mass. We recommend that the details of such experiments [70] should be continued such that this static case of general relativity is fully verified.

The existence of repulsive gravitation is important since it would solve a puzzle as to why we have never seen a black hole. Assuming gravity is always attractive to mass, simulation convinces Wheeler that a black hole must be formed [44]. More important, this new repulsive force is crucial for establishing the unification of gravitation and electromagnetism [65].

X. The Weight Reduction of a Charged Capacitor and the Current-Mass Interaction

Moreover, the weight of a charged capacitor is also reduced [71] instead of increased as Einstein claimed [72]. In fact, for a capacitor under the influence of a high electric voltage, the repulsive force would be able to lift its own weight plus a payload, but without a continuous supply of electric energy [73]. It is found that the lifting force is proportional to the square of the voltage difference V, and is diminishing faster than the attractive gravitational force. Moreover, this repulsive force is actually independent of the direction of the electric field since the force exists beyond a charged rolled-up capacitor, whose electric field has no definite direction [65]. Considering the charge Q = VC, C is the capacity of the capacitor, the force on a charged capacitor is essentially the same kind of force generated between a charge and a mass in general relativity.

However, a puzzle is why a charged capacitor exhibits the charge-mass repulsive force since a charged capacitor has no additional charges after charging. The difference of the situations is only some moving charges have become static. Thus, before the capacitor is charged, the repulsive force from the charges is canceled by the force generated by the moving charges.

If the static electric energy leads to a repulsive force toward a mass according to general relativity, the magnetic energy would lead to an attractive force from a current toward a mass [44]. Due to the fact that a charged capacitor has reduced weight, it is necessary to have the current-mass interaction be cancelled out by the effect of the charge-mass interaction. Thus, the existence of the current-mass attractive force would solve the puzzle.

The existence of such a current-mass attractive force has been discovered by Martin Tajmar and Clovis de Matos [74] from the European Space Agency. Martin et al found that a spinning ring of superconducting material increases its weight more than expected. Thus,

they believed that general relativity was wrong. However, according to quantum theory, spinning superconductors should produce a weak magnetic field. Thus, they also measured the current-mass interaction to the earth! From their findings, the current-mass interaction would generate a force which is perpendicular to the current.

One may ask what the formula for the current-mass force is. Unlike the charge-mass repulsive force, which can be derived from general relativity; this general force would be beyond general relativity since a current-mass interaction would involve the acceleration of a charge, this force would be time-dependent and generates electromagnetic radiation. Moreover, when the radiation is involved, the electromagnetic radiation reaction force and the variable of the fifth dimension must be considered [75]. Thus, we are not ready to derive the current-mass interaction yet.

Nevertheless, we may assume that, for a charged capacitor, the resulting force is the interaction of net macroscopic charges with the mass [71]. This also explains a predicted phenomenon, as reported by Liu [65] that it takes time for a capacitor to recover its weight after being discharged. Therefore, the electromagnetic energy in matter can reduce or increase its weight. Recently, the temperature dependence of gravitation has been demonstrated by the torsion balance [76].

XI. The Necessary Extension of General Relativity to a Five-Dimensional Space

According to the Reissner-Nordstrom metric for a particle Q with charge q and mass M, the static force that acts on a test particle P with mass m, for the first order approximation (since $g^{rr} \cong -1$) is

$$-m\frac{M}{r^2} + m\frac{q^2}{r^3} \tag{45}$$

Note that the second term is a repulsive force due to the static charge-mass interaction. For a ball with a charge Q and mass M, the repulsive force is mQ^2/R^3, where R is the distance from the ball center [70].

Due to the reaction force being equal to, but in the opposite direction of, the acting force, the test particle P must create a field m/r^3 that couples to q^2. It thus follows that the force to particle Q is beyond current theoretical framework of gravitation + electromagnetism. As predicted by Lo, Goldstein and Napier [75], general relativity leads to a realization of the inadequacy of general relativity, just as electricity and magnetism lead to the exposition of their shortcomings.

If we consider the coupling with q^2, this naturally leads to a five-dimensional space of Lo et al [75]. Einstein & Pauli [77] did not recognize as Maxwell did, that unification necessarily leads to new interactions. Thus, they overlooked that the charge-mass interaction

would be naturally generated in a five-dimensional theory. Unfortunately, their followers repeat their errors. Therefore, they failed to see the necessity, and even claimed Einstein's Unification is not valid.

However, in addition to the repulsive force acting from the test particle P to the charged ball, there is a repulsive force acting on a charged capacitor and the reduction of weight due to the increment of temperature [78, 79]. These forces can be understood only in terms of a five-dimensional theory. Thus, in gravitation, there are three types of forces, namely: 1) the mass-mass attractive interaction, 2) the charge-mass repulsive interaction, 3) the current-mass attractive interaction.

Some theorists have mistakenly assumed that the reduction of weight is due to a reduction of mass [78,79]. However, one can measure the inertial mass directly from acceleration of the subject and/or the period of such a pendulum [80]

XII. Conclusions and Discussions

A common mistake among those who work on gravitational waves is that they incorrectly believed that the linearized equation would give an approximate solution of the non-linear Einstein equation. However, the linearized equation and the non-linear Einstein equation actually are independent dynamic equations [55]. The linearized equation is a valid linerization for the Lorentz-Levi-Einstein equation (40), but not the Einstein equation which has no bounded dynamic solution.

Moreover, since the repulsive gravity can also lead to waves, the problem of gravitational waves is far more complicated. A useful feature of the gravitational wave based on repulsive gravitation is that it can be easily generated on earth. Thus this can be a new tool for communication because gravity can penetrate any medium [65].

Einstein is considered as the most prominent scientist of the 20 century since he has successfully challenged the authorities of sciences and forever changed the way we see the world. Unfortunately, his over-confidence on his theory also led to the invalid covariance principle and misinterpretations of experiments. Moreover, short-comings in physics together with his inadequacy in mathematics led to errors without knowing them. Those "so-called" experts such as Wheeler [1] and Wald [2] give more misinterpretations due to inadequacy in mathematics and physics, and thus add difficulties for understanding. [20]

This analysis shows that there are at least two areas that theoretical physicists should improve. One area is the non-linear mathematics related physics [35]. Another area is the application of the principle of causality. For instance, the failure to obtain the gravitational wave solution generated from an electromagnetic wave and the failure to recognize the non-existence of a dynamic solution are due to inadequate understanding on the principle of causality.

It has been shown that general relativity is still incomplete and its errors remain to be rectified. Moreover, the main obstacles for the development of general relativity are the errors of Einstein's earlier defective work and inadequate considerations, There are at least ten major errors of Einstein that prevent the development of general relativity.

An important interesting discovery is the existence of repulsive gravitation due to the charge-mass interaction [65, 71, 78-81]. Moreover, the electromagnetic energy can also generate attractive gravitation through the current-mass interaction. Thus, the physical picture provided by Galileo, Newton and Einstein is just too simple for gravitation which involves almost everything. Also, the notion of black holes is clearly questionable since gravity is no longer always attractive.

However, it is surprising that after the shortcomings are identified, Einstein's conjecture of unification between gravitation and electromagnetism are proven to be correct [35]. Moreover, since the charge-mass interaction is absent in quantum mechanics, it is not a final theory as Einstein claimed. Thus, Einstein remains the number one theorist in physics.

A lesson to be learned from Einstein is that humans are fallible, and thus over-confidence is often the starting point of a down fall. A problem of the physicists is that they have neglected the pure mathematics for too long, and a catch up program is now necessary. In contrast to the belief of Eric J, Weinberg, [21] pure mathematics is just as indispensible a tool as applied mathematics to physics. We should never forget that experiments and observations always provide us faithful guidance.

Philosopher Hu Shih once remarked that in science, one can have daring assumptions, but one must also be careful in his proof. Unfortunately, a problem of Einstein and many physicists are that they often have only the first half.

XIII. Acknowledgments

Appendix A: Mathematical Foundation of Einstein's Equivalence Principle

Pauli's invalid version [14] has been mistaken as equivalent to Einstein's equivalence principle although Einstein has made clear it is a misinterpretation [82]. In "Gravitation" [1] of Misner et al, there is no reference to Einstein's equivalence principle. Instead, they misleadingly refer to Einstein's invalid 1911 assumption [83] [22)] and Pauli's version [14]. In addition, in their Eq. (40.14) Misner et al. [1] even failed to understand the local time of a particle at free fall.

The mathematical theorems [84] related to Einstein's equivalence principle are as follows:

Theorem 1. Given any point P in any Lorentz manifold (whose metric signature is the same as a Minkowski space) there always exist coordinate systems (x^μ) in which $\partial g_{\mu\nu}/\partial x^\lambda = 0$ at P.

Theorem 2. Given any time-like geodesic curve Γ there always exists a coordinate system (the so-called Fermi coordinates) (x^μ) in which $\partial g_{\mu\nu}/\partial x^\lambda = 0$ along Γ.

In these theorems, the local space of a particle is locally constant, but not necessarily Minkowski.

However, after some algebra, a local Minkowski metric exists at any given point and along any time-like geodesic curve Γ. What Einstein added is that such a locally constant metric must be Minkowski. This is the basis of the Einstein-Minkowski condition that Einstein uses to derive the gravitational redshifts [12].

Note that, Pauli's version [14] is a simplified but corrupted version of these theorems as follows:

"For every infinitely small world region (i.e. a world region which is so small that the space- and time-variation of gravity can be neglected in it) there always exists a coordinate system K_0 (X_1, X_2, X_3, X_4) in which gravitation has no influence either in the motion of particles or any physical process."

He regards a local Minkowski space at a point is the same as the existence of local Minkowski spaces at a small world region.

Thus, an error is that Pauli extended the removal of uniform gravity to the removal of gravity in a small region. This becomes simply incorrect and even impossible in mathematics, but he does not see the difference because of inadequacy in mathematical analysis. He did not recognize that the removal of gravity in a small region, no matter how small, would be very different from a removal of gravity at one point. Apparently, Pauli [14], Eric J. Weinberg, [21)] Witten [46], [11)] the Wheeler School [1], and the British Encyclopedia did not understand the mathematics of the above theorems [84].

Appendix B: The Space-Time Singularity Theorems of Hawking and Penrose

For the convenience of the readers, the singularity theorems of Hawking and Penrose are listed below:

Theorem 1. Let (M, g_{ab}) be a globally hyperbolic spacetime with $R_{ab}\xi^a\xi^b \geq 0$ for all timelike ξ^a, which will be the case if Einstein equation is satisfied with the strong energy condition holding for matter. Suppose there exists a smooth (or at least C^2) spacelike Cauchy surface Σ for which the trace of the extrinsic curvature (for the past directed normal geodesic congruence) satisfies $0 > C \geq K$ everywhere C is a constant. Then no past directed timelike curve from Σ can have length greater than $3/|C|$. In particular, all past directed timelike geodesic are incomplete.

Theorem 2. Let (M, g_{ab}) be a strongly causal spacetime with $R_{ab}\xi^a\xi^b \geq 0$ for all timelike ξ^a, as will be the case if Einstein's equation is satisfied with the strong energy condition holding for matter. Suppose there exists a compact, edgeless, achronal smooth spacelike hypersurface S such that for the past directed normal geodesic congruence form S we have $0 > K$ everywhere on S. Let C denote the maximum value for K, so $0 > C \geq K$ everywhere on S. Then at least one inextendible past directed timelike geodesic from S has length no greater that $3/|C|$.

Theorem 3. Let (M, g_{ab}) be a connected, globally hyperbolic spacetime with a noncompact Cauchy surface Σ. Suppose $R_{ab}k^ak^b \geq 0$ for all null k^a, as will be the case if (M, g_{ab}) is a solution of Einstein's equation with matter satisfying the weak or strong energy condition. Suppose, further, that M contains a trapped surface T. Let $0 > \theta_0$ denote the maximum value of θ for both sets of orthogonal geodesic on T. Then at least one inextendible future directed orthogonal null geodesic from T has affine length no greater than $2/|\theta_0|$.

Theorem 4. Suppose a spacetime (M, g_{ab}) satisfies the following four conditions. (1) $R_{ab}v^av^b \geq 0$ for all timelike and null v^a, as will be the case if Einstein's equation is satisfied with the strong energy condition holding for matter. (2) The timelike and null generic conditions are satisfied. (3) No closed timelike curve exists. (4) At least one of the three properties holds: (a) (M, g_{ab}) posses a compact achronal set without edge [i.e., (M, g_{ab}) is a closed universe], (b) (M, g_{ab}) possesses a trapped surface, or (c) there exists a point $p \in M$ such that the expansion of the future (or past) directed null geodesics emanating from p becomes negative along each geodesic in this congruence. Then (M, g_{ab}) must contain at least one incomplete timelike or null geodesic.

Endnotes

1) Prof. S. Weinberg taught us that general relativity must be understood in terms of physics. This MIT tradition has a long history, starting from Rosen and

Einstein's paper of 1937, followed by Yilmaz, advocated by Weisskopf and Morrison, and so on. It is a pleasure to be able to contribute to such an outstanding tradition. However, repairs to the tradition are urgently needed since it has recently been broken by the Wheeler School [11] after Prof. Morrison passed away. It is hoped that MIT will soon be able to recover the tradition based on physics instead of opinions of the famous.

2) This is a popular mistake of physicists because of inadequate background in pure mathematics [14].

3) P. Morrison is a student of J. Robert Oppenheimer and thus has a very keen sense of physics.

4) C. N. Yang believed that Einstein's covariance principle is valid because he misinterpreted the gauge invariance [24].

5) Now, it is clear that Einstein's understanding of general relativity needs improvement.

6) Now, many theorists seem to have noticed this problem of inconsistency because Einstein's method is no longer used [1], but they choose the wrong choice.

7) This shows that Penrose is only a mathematician, but not a physicist.

8) The 2011 Nobel Prize has been awarded to Saul Perlmutter, Brian P. Schmidt and Adam G. Riess "*for the discovery of the accelerating expansion of the Universe through observations of distant supernovae*".

9) This incorrect implicit assumption was generally accepted because it was believed that $E = mc^2$ was unconditional.

10) Einstein failed to see the non-existence of a dynamic solution. Due to his inadequacy in mathematics, he does not know that for the dynamic case, the nonlinear Einstein equation and the linearized equation are independent [55].

11) From the theorem of Witten [46], it is clear that he also does not understand general relativity.

12) This is a good example that a Nobel Prize does not guarantee the validity of a theory, but only partial validity of a theory.

13) The time-tested assumption that phenomena can be explained in terms of identifiable causes is called the principle of causality. This is the basis of relevance for all scientific investigations. This principle implies that any parameter in a physical solution must be related to some physical causes. In general relativity, the normal metric is the flat metric.

14) In 1993, Yau and I met in the Chinese University of Hong Kong and discussed the non-existence of a dynamic solution [85]. Subsequently, Yau claimed that he has lost his earlier interest on the work of Christodoulou and Klainerman [49].

15) Some mathematicians did not take a responsible attitude toward a Prize. Members of the awarding committee often act on their faith of previous awards, but may not know the subject at all. For instance, Y.-T. Siu of Harvard agreed to award Christodoulou a 2011 Shaw Prize, although he does not understand general relativity nor non-linear mathematics [51].

16) The inappropriate award to Witten shows that the awarding committee of APS is incompetent in mathematics [52].

17) The exact form of the gravitational energy-stress tensor is still not known.

18) This manifests that G. 't Hooft does not understand special relativity and Newtonian mechanics adequately.

19) Another Nobel Laureate Wilczek [86] also applied $m = E/c^2$ without providing a justification. Since this relation in his theory is crucial for his Nobel Prize, Wilczek should work out a justification for its application.

20) The so-called experts often agree with Einstein's errors, but disagree with Einstein when he is correct [6, 11, 47, 52].

21) Eric J. Weinberg, editor of the Physical Review D, invalidly insists [7-9] that there is no difference in physics between Einstein's equivalence principle and Pauli's version [14] although Einstein pointed out that it is a misinterpretation [82]. He also accepts the unbounded solution because of inadequate understanding the principle of causality [7]. The root is that Eric J. Weinberg does not understand pure mathematics and thus failed to understand Einstein's equivalence principle as Pauli did [14]. Moreover, he does not understand not only non-linear mathematics, but also his calculus is defective. In addition, he simply does not have the wisdom to see that admitting past mistakes is the best choice for the APS as a scientific institute. Apparently, he is unaware of the 2003 work of Dmitriev et al. [78] on the weight reduction of the brass due to heat. As a result, erroneous papers on gravitation are still often published in the Physical Review D. Similarly, established journals such the Proceedings of the Royal Society, Annalen der Physik, etc. also just have too much blind faith on Einstein, and over-confidence on their out-dated knowledge in gravitation and experiments. Thus, they failed to adjust themselves to deal with new situations such as the non-linear mathematics.

22) Since the 1911 assumption of Einstein has been proven incorrect by experiments [12], it is beyond my comprehension that the Wheeler School [1] used it as the reference for Einstein's equivalence principle.

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Bi-Directional Unitary and Holographic Lorentz-Friedman Black Hole Radiation

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Abstract- Previous discussion on the inflationary origin of matter-antimatter asymmetry in the Lorentz-Friedman cosmology is extended to describe the evolutionary history of the black hole by extending the squared line element of the world line of the observer in bi-directional form.

GJSFR-A Classification: FOR Code: 020109

BIDIRECTIONALUNITARYANDHOLOGRAPHICLORENTZFRIEDMANBLACKHOLERADIATION

Strictly as per the compliance and regulations of :

Bi-Directional Unitary and Holographic Lorentz-Friedman Black Hole Radiation

Noboru Hokkyo

Abstract- Previous discussion on the inflationary origin of matter-antimatter asymmetry in the Lorentz-Friedman cosmology is extended to describe the evolutionary history of the black hole by extending the squared line element of the world line of the observer in bi-directional form.

I. Introduction

The recent paper[1] discussing the inflationary origin of the matter-antimatter asymmetry is extended to describe a bi-directional evolutionary history of the Lorentz-Friedman black hole.

II. Bi-Directional Black Hole Radiation from Extragalactic Source

Write the line element ds^2 of the Lorentz-Friedman cosmology in two-component form:

$$ds^2 = ds_+ ds_-$$

$$= c^2 g_{tt\pm} dt^2 - g_{rr\pm} dr^2 \quad (g_{rr\pm} = g_{rr\pm}^{-1})$$

$$= (1 - r^2/r_g \pm l_\theta\, l_{pl}^2/r^2)^{-1}. \qquad (1)$$

Here $r_g = 2GM/c$ is the gravitational radius of the semiclosed Friedman universe of mass M and radius $R > r_g$. The universe is closed for $R = r_g$. The Lorentz-Friedman universe is maximally closed for $r = l_{pl}$ and $r = r_g - l_{pl}$, where the light velocity $(ds^2 = 0)$ $cg_{tt\pm} dr/dt$ is superluminal (inflational).

III. Unitary and Holographc Black Hole Radiation from Quasar

Then the information content (entropy)[2] $(R/l_{pl})^2 = 10^{120}$ acquired by an observer approaching the matter distribution from infinity $r = \infty$ through empty space, is given as

$$l_{pl} = \int^R g_{rr\pm}^{1/2} dr$$

$$= \int^R dr\, (1 - r^2/r_g \pm l_\theta\, l_{pl}^2/r^2)^{-1}. \quad (2)$$

While ds_+ determines the world line of the evolutionarily late observer going backward in time from $r = \infty$, ds_- gives the world line from evolutionarily early observer going forward in time from $r = -\infty$ detecting the extragalactic black hole radiation from a quasar.

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IV. Acknowledgement

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The Stages of the Universe Formation: A Matter/ Energy Interaction Function

By Wassim S. Daher

Abstract- This paper endeavors to explain the Universe creation stages and aims to complement the model proposed in 'A Single System Universe: A Cognitive Approach' adopting the same cognitive approach. The stages are the initial pre-compression era from the infinite realm, compression era, and the finite Universe era. The explanation is a function of the matter/energy interaction modes. Matter changed in the three processes from particles with an essence of mass into 'massable' particles of Dark Matter. Energy transformed from crude into functional energy, referred to as Dark Energy, responsible for matter integration and universal expansion. Matter and Energy are different in essence and non reciprocal. Finally, the paper calls for empirical evaluation of the proposed model.

Keywords: dark matter, dark energy, origin of universe, mass of photons, universal expansion.

GJSFR-A Classification: FOR Code: 020199

THESTAGESOFTHEUNIVERSEFORMATIONAMATTERENERGYINTERACTIONFUNCTION

Strictly as per the compliance and regulations of :

The Stages of the Universe Formation: A Matter/ Energy Interaction Function

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Abstract- This paper endeavors to explain the Universe creation stages and aims to complement the model proposed in 'A Single System Universe: A Cognitive Approach' adopting the same cognitive approach. The stages are the initial pre-compression era from the infinite realm, compression era, and the finite Universe era. The explanation is a function of the matter/energy interaction modes. Matter changed in the three processes from particles with an essence of mass into 'massable' particles of Dark Matter. Energy transformed from crude into functional energy, referred to as Dark Energy, responsible for matter integration and universal expansion. Matter and Energy are different in essence and non reciprocal. Finally, the paper calls for empirical evaluation of the proposed model.

Keywords: dark matter, dark energy, origin of universe, mass of photons, universal expansion.

I. Introduction

This paper comes in an endeavor to present a new perspective to the human understanding of the Universe and its formation stages. It complements the ideas presented in 'A Single System Universe: A Cognitive Approach' [1]. It follows the same cognitive approach and intends to shed light on the ideas related to the relation of matter and energy. Comprehending the Universe and its formation stages requires much more than the most advanced tools humans can build. The reason is simple; the Universe is expanding and advancing at a much faster pace than man's advance.

Modern science relies heavily on empirical approaches and ignores human's greatest asset, the cognitive approach. Man's deficiency in his approaches has rendered cosmology and the understanding of the Universe into sets of contradicting theories [1]. The human mind remains the only tool that can roam among huge structures such as galaxies and planets; and at the same time, it can roam among the smallest particles of matter. It can also venture safely, efficiently, iteratively, and in a timely manner among the furthest structures and within the most extreme universal objects.

It is not intended to reiterate the reasoning introduced in the previous study but to complement it. The Universe is a complex system of interacting subsystems. To comprehend the main system, one should decipher the subsystems and their contribution in the big picture. The subsystems are numerous and each requires its dedicated analysis. This study explores the Universe formation dynamics as a function of energy and matter interactions.

The creation of the Universe has passed through different stages. These stages may be divided into 3 eras depending on the energy/matter interaction processes. The first stage is the pre-compression era, the second is the compression era, and the third is the post compression era.

Before venturing deeper into these eras, it is essential to set some guidelines for this study. Whether one believes that the creation of the Universe is the product of a deliberate or a random endeavor, one is expected to abide to simple logical interpretations that avoid emotional intercepts. If some people relate, for example, human existence to some alien seed from outer space, this implies that, in order to understand human existence, one has first to discover alien life, if it exists; then, one has to identify the alien that comprises the origin of the humans' seed; then, one has to search for the origin of that alien that itself maybe another alien from another place in the Universe… This obviously defies the purpose of the initial enquiry.

If, on the other hand, one believes that everything is the blunt endeavor of a 'Creator', then there is no reason to enquire further. A more inquisitive perception leads the inquisitor to the rule of natural laws according to which all universal objects behave. The dynamo that manipulates the universal resources with respect to these natural laws in order to achieve a goal is referred to as 'Nature'. Whether behind nature there exists a Creator or not is a discussion that remains beyond the scope of this paper.

Nature 'owns' resources that consist of matter and energy. It manipulates its resources, in order to maintain and develop itself. However, the interaction between matter and energy, at that stage, can only happen under the governance of natural laws. These interactive resources are finite within the Universal boundary. Nature, as defined in this paper, essentially exists in the post compression era.

The Universal macro dynamics are more elaborated in 'A Single System Universe: A Cognitive Approach' [1]. The micro systems are the subject of this study that commences with an argumentative model. Then a theoretical model condenses the argument into a hypothesized foundation of the study.

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II. Literature Review

The origin or starting point of the Universe has long been a controversial issue. Some scientists tried to avoid it by claiming that the Universe is eternal, without a beginning or end, where matter was created out of nothing [2] [3]. This, steady state theory, was later refuted by empirical science [3] [4] [5].

The 'ylem', or cosmic egg, idea was adopted [6] as a representation of the Big Bang theory. This theory claims that the ylem contained the entire Universe [7] [8] before reaching explosion conditions. After the explosion the Universe expanded and cooled until atoms clumped together to form planets and stars [6]. Scientists adopted the idea and theorized about the Big Bang theory [9] [10]. Some believe that this theory lost momentum because it is short of answering many questions [11] [12] [13] [14] [15] [16]. Other theories claimed that the Universe could have started from within a black hole [17].

Physicists can claim whatever they want as long as there are no bounding criteria [18]. There remain many details that can be reviewed in this section, such as the red shift, Einstein's cosmic constant, and Hubble's constant among others. However, since this paper is proposing a new model and approach, the review remains on the guideline level without venturing into the details of mathematics and empirical interpretations at the present stage.

Dark matter, in the present literature, though still unidentified, is assumed to be the source of the prime gravitationally attractive force of the Universe [19]. Cosmic microwave studies imply that dark matter is abundant [20] [21] [22] [23]. It comprises 23% of the Universe, 74% of dark energy, and 4% of baryons [19] [24]. Experiments imply that dark matter should have electromagnetic neutrality [19] [25] [26], self-interaction constraints [19] [26] [27] [28] [29] [30], and clumping on small scale [19] [26] [31].

There are also a number of guisses among the scientific community on the identity of dark matter. The candidates may be weakly-interacting massive particles (WIMPs) [19] [26] [32], axions [19] [26] [33], gravitinos [19] [26] [34], and sterile neutrinos [19] [26] [35] among other numerous objects. Different detection means were applied to confirm the existence of dark matter. Gravitational lensing [37], hot gas in galaxy clusters, and motion of galaxies in galaxy clusters are among other means that try to detect the gravitational influence of dark matter [38] [39] [40] [41] [42].

Newtonian gravitation theory fails to explain the universal expansion. This expansion has been attributed to a mysterious energy referred to as dark energy [43] [44]. There are lots of speculations about the real existence of dark energy. Till date, dark energy remains elusive to trace or define [34]. Some theories claim that dark energy is a property of space; others claim that it is a dynamical energy fluid or field [26]. Quantum theory claims that space is filled with temporary matter that forms and disappears [26].

III. The Model

Argumentative ideas follow in order to found a construct for the theoretical model. The proposed cognitive construct tries to present a coherent mechanism for the different creation phases. Energy/matter interaction systems are proposed as the basis for the discussion.

a) The Phases of Universal Creation

At the first era, the pre-compression era, time and space are not identified [1]. It is referred to as a time era though it is an existing geographical infinite area (universe, with a small u) in which the Universe floats. The coordinates and age of the Universe in universe are irrelevant unless other Universes exist [1]. The existence of other Universes is beyond the scope of this paper. In universe, with a small u, two possibilities exist. The first possibility is that matter only existed until energy was introduced to compress matter into the compression era. The second possibility is that both matter and energy coexisted without any 'constructive' interaction between them.

Whichever possibility one considers, matter, at that stage, consists of its simplest form. At its simplest form, matter cannot display any properties, nor is it expected to interact with itself or with any other thing, if this other thing existed. Matter, in that realm, may have possessed the essence of mass, but not mass as is known in the Universe.

A finite sum of this matter was then contoured by an energy field and the second era commenced. During this stage matter was compressed to form the basic masses through which energy could manifest itself. Matter was compressed and molded into particles that could interact with other forms of existence, or be utilized by other essences (energy), in order to form together the basic building constituents of the Universe. In other words, matter was subdued to energy.

This necessarily implies that matter has been compressed to form a finite lump of particles with 'identity' and 'constructability'. This process should have consumed large quantities of energy. It seems difficult to comprehend the reason behind persisting compression beyond this stage. The initial reason of compression has been to convert matter into usable particles. It defies logic that compression persists beyond this stage that it consumes more energy to destroy the essential particles that were created. Whatever exists within the contour of compression is finite and is supposed to be invested efficiently. This poses serious doubts, to say the least, on the Big Bang theory.

At this stage two questions may arise: How did the compression process initiate (and stop)? And where

did the energy come from? The compression process is the effect of an exerted directional energy towards a center, for a sphere, or two centers, for an ellipsoid. Whatever matter trapped within the energy contracting contour becomes finite. Matter at that stage is like pieces of a broken cup that need to be glued together (by energy) in order to be filled and utilized for a role. Just enough energy is introduced to transform matter into the simplest usable building blocks. If more energy is exerted, then it will either destroy the formed building blocks or it will be wasted as it exceeds the capacity of building blocks created.

i. The Compression Process

Matter and energy are two distinct non-interchangeable and non equivalent entities in essence. Matter cannot be changed into energy and vice versa. Else one entity would have been sufficient to interact and develop itself irrespective of the other entity. Therefore one would expect to find an area where sole matter develops itself, other area where sole energy develops itself, and other areas where different combinations of both energy and matter would develop themselves. It is logically impossible for systems to develop themselves into more complex systems without external input. As such, the only possible alternative would be a combination of both mutually exclusive matter and energy for development.

This, however, does not contradict the results of Einstein's general relativity equation ($E=mc^2$). This contradicts the explanation. Mass has returned into one of its less energy content structures, that remain undetectable on the present measure scales. The Energy released is the integrating energy required to upgrade the mass structure as is explained further hereafter.

Energy cannot manifest itself without mass. The manifestation of energy can only be exhibited through the development of mass that can then be colonized by more energy. The colonization capacity per unit of mass is finite. As such, energy compressed initial matter comprising the essence of mass into "massable" Matter, with a capital M, referred to as the Dark Matter. The compression process stopped when this stage was realized. It is a stage where the maximum possible energy has colonized the created Universe as dark energy.

At the early stage of the compression process, energy created a "massable" contour first then tightened it, through its "attract" function, and dissipated into the bounded area to create a "massable" circumferential grid that expanded towards the center. This rendered all particles within the contour to acquire mass. At this stage the shape of the universe may have been spherical in order it optimizes the energy required for compression.

b) The Compression Energy

The energy before compression could not have existed within the 'sea' of matter. Energy colonizes massable Matter for it to exist. It also requires massable Matter for it to travel and develop. The initial energy should have come from a source, a source with abundant crude energy. The interaction of this energy with matter seems to have created a sole 'attract' function in order to transfer matter with mass essence into massable Matter. Energy tends to act, and should be thought of, like a living creature that thrives to keep and develop its kind, or potential.

So when the contraction process stopped, the created space was completely packed with energy saturated particles of Matter. The compressed space has its initial volume. Crude energy stops from being dissipated into the new saturated space as it cannot be further absorbed or stored. The crude energy may have been directed to create other similar space/spaces somewhere else in the realm of infinity.

The potential energy, at this stage is what is referred to as Dark Energy. Matter, at this stage, is what is referred to as Dark Matter. They are both finite in the compressed space; therefore, no infinite activity can take place; and, no singularity points can exist. If a singularity point is formed, the new space will consume itself and disintegrates into its initial state. However, an energy absorbing singularity requires 'matter' with storage potential that resembles the crude energy storage source. This contradicts the logic of the matter/energy interaction process. The formed Matter lacks the potential of having such storage capacity. Infinite mass cannot be formed also as this requires infinite energy. This contradicts the assumption that Energy and Matter are finite in the formed Space.

At this exact moment, t=@, when energy could not be absorbed anymore and the compression process ended, the Universe was created. It comprised of totally packed volume of dark matter which was totally colonized by dark energy. This energy charged and turbulent volume that existed within a contour in a null resistive medium can only expand. The Universal expansion started but under the control of natural laws.

c) Dark Matter and Dark Energy

Matter has been transferred to the minimum structural threshold, which is dark matter, below which dark energy cannot colonize. Dark matter is the simplest structure of matter that can react to dark energy. The subsystem that held the Universe packed together and protected it from explosion and scatter could not be a gravitational force among the particles, if it existed, but the contour itself [1]. The contour during expansion differs in role, essence and structure from the contour of compression. The reason is the difference of the matter acted upon during compression from the Matter acting on the contour during expansion.

When the expansion process started, the shape of the Universe should have transformed into ellipsoidal by an array of expansion ripples [1]. The additional energy stored in the ripples, and that was released during the clash of the ripples, transformed dark matter into more complex forms of structured matter. The structured matter required much more space than what was consumed by the same mass before the transformation. Though an atom is a gigantic complex structure compared to a particle of dark matter, an atom's mass, for example, is concentrated in its nucleus; however, its volume is dictated by its orbiting electrons. Such spacious structuring of matter may further fuel the Universal expansion by acting as mass/energy storages that maybe processed at some stages [1]. Dark matter is expected to flow freely through most formations of massable structures due to its small structures.

As expansion ripples clash together, dark matter concentrations are created. Part of this concentration gets transformed by the extra boost of energy into more complex forms of Matter. Formations of nutrinos, baryons, and other forms of Matter constituents start to appear among more complex structures, such as atoms. The extent of Matter formation relies on the energy of the ripple clash.

The formation of different particles from the integrated dark matter/ dark energy interaction may propose one of two possibilities. The first possibility is that dark energy may be composed of different energies, with different strengths and different effects on the dark matter. The second possibility is that dark matter composes of different shapes, for example, that produces different structures when exposed to the same energy. The second possibility seems to be much more favorable because same structures of Matter that require the same energies to be formed, may exhibit different behaviors, such as the quarks that build the protons and neutrons. This implies that dark matter may have a differentiating agent within, such as shape, or may be something similar to a DNA.

Dark energy manifests itself through the Matter structures it builds. It may appear as a 'repel' force, 'attract' force, or energy packets. The repel force can be exhibited in the universal expansion or, for example, when two particles of the like charge meet. The attract force, which is a very essential function of energy, can be exhibited in building the particles and the objects of the Universe, such as the bonding energy of a nucleus. Energy packets are, for example, in photons and gamma rays. In all these three functions, energy manifests itself through massable matter. Even energy radiation, through photon-based particles, involves carriage mass particles. Energy cannot travel bare without a carrying and wrapping structure of dark matter. The carrying media can be a relatively condensed structure of dark matter particles that can carry the photon energy. When this structure is compromised through impact, it disintegrates into scattering dark matter particles each carrying its share of energy.

As the Universe expands it sends energy infested ripples towards its interior. This energy is carried by dark matter particles that build up into more complex structures with each clash of ripples. The clash area, in which universal objects are created, becomes rich with accumulated dark matter. The dark matter particles, under the massive pressure of the clash, integrate into more complex particles. The dark energy within builds up until it reveals itself as a specific form of energy through the function of the built particle. The function of the built particle may be defined by the shapes of the initial building dark matter particles.

Energy cannot exist stand-alone and requires a massable carrier. So as these particles build up, and two or more particles come together and merge, they share their energy content. The energy causing the merger of the building particles may have essentially modified their shape in the process. The new shared energy resists any disintegration of the new built up particle because it requires preserving its carrier. The initial carriers may also have been subjected to a change of shape in the fierce interactions caused by the clash. Because of the changes in shape, and eventually, changes in energy absorbing capacity or containment ability of the geometry, some of the initial particles, if released, might not be able to carry their initial capacity of energy. Since energy cannot stand alone, it will resist the disintegration of the new built up particles that integrated into a new cluster of Matter (of 'A' particles), above dark matter (in complexity).

The A particles interact, for example, and build up into more complex forms of Matter, B and C. Suppose that C particles, for instance, were made up of combinations of three B particles. Suppose also that a B particle consists of one A particle and of slightly deformed packed dark matter particles such that they can retain their initial load of energy. Under certain conditions, one can expect the C particle to disintegrate, for example, into two B particles, one A particle, and one photon or gamma particle.

The integration of particles continues to form different Matter constituents, such as neutrons, protons and electrons. Electrons are similar to photons in the structural sense. Neutrons and protons are bound together by energy. The bigger the nucleus, the greater the binding energy required, the stronger the ripple clash should be. The formation of particles is expected to be a very turbulent nuclear process into which dark matter particles are absorbed and processed to form more complex structures of Matter. These structures can be as complex as planets, black holes, galaxies…etc. The absorption of Matter from the surrounding triggered by the ripple clash reactions can be referred to as

'streaming' [1]. The streaming effect mobilizes dramatic quantities of Matter towards the reaction center, the 'sink'. Any particle crossing the area, such as photons, can be absorbed towards the sink. If the sink is as severe as a black hole, the passing photons, among other particles will be absorbed with the streaming particles into the sink and processed [1].

IV. THEORETICAL MODEL

1. The Universe is a finite subset of an infinite universe that consists of matter only. Matter in the infinite universe consists of particles with the essence of mass.

2. Energy dissipated from a source and compressed the particles with essence of mass to form massable particles. Energy and matter are different in essence and strictly mutually exclusive.

3. The compression process halted when all bounded matter was transformed into Matter and got fully charged with energy. Singularity was never achieved.

4. The first formed massable Matter is what is referred to as Dark Matter. It is fully colonized with energy referred to as Dark Energy. Dark matter particles have a finite capacity of dark energy absorption. The amount of dark energy in the Universe is directly proportional to the absorption capacity of dark matter.

5. The Universe is a finite closed system of interacting Matter and Energy. Dark matter and dark energy cannot dissipate to the initial universe. Dark matter particles may exchange dark energy; however, they have no other mutual interaction.

6. Dark matter cannot exert a gravitational force, if it exists, against Universal expansion. Dark matter is the carriage charged by dark energy to fuel the expansion.

7. The compression phase energy and the dark energy are the same in essence but different in function.

8. The compression contour and the expansion contour are different in structure and function.

9. Dark matter charged with dark energy acts like a compressed spring, that once and since released, has been expanding in a non restrictive environment. This causes the bounded Universe to accelerate in expansion.

10. Dark energy manifests itself through the integration of dark matter into complex structures. Dark matter structure is the minimum threshold for building more complex structures.

11. Dark matter particles may differ in shape; thus, dark energy may exhibit different functions through the integrated structures. Dark energy transforms its identity into detectable energy in integrated massable matter.

12. Dark energy is converting into other forms of Universal energies. As such, the relative amount of dark energy should be decreasing.

13. Energy cannot exist effectively without massable matter. Photon based particles comprise dense dark matter structures with a concentrated energy load. Electrons resemble photons in structure.

14. Universal ripples initiated by the Universal expansion process clash into each other transforming dense dark matter into universal objects.

15. Nature and natural laws started strict application at the instant the Universe started to expand.

V. HYPOTHESIS

1. Dark energy exists as a constructive agent of the Universe. It is directly proportional to the absorption capacity of dark matter.

2. Dark matter particles are the simplest massable particles of the Universe. They exist in different shapes that allow energy to manifest itself in different functionalities.

3. Photons are concentrated forms of dark matter colonized with concentrated forms of energy.

4. The contraction of the initial matter never reached a singularity. It stopped when all matter became massable and fully energized. Infinities do not exist in nature.

5. Matter and Energy are not equivalent.

VI. DISCUSSION

The presented ideas refute a good sum of ideas that are adopted in present sciences of the Universe. The division of universal constituents among different percentages of dark matter, dark energy, and baryons does not fit well with the proposed model. Dark energy is not believed to exist independent of dark matter. 'From astronomical observations, we know that dark matter exists, makes up 23% of the mass budget of the Universe, clusters strongly to form the load-bearing frame of structure for galaxy formation, and hardly interacts with ordinary matter except gravitationally' [19]. The proposed model agrees, however, with the idea that dark matter is the founding basis for galaxy formation; and, it explains the mechanism.

This model claims that dark matter is the simplest massable indivisible particle that exists in the Universe. It is the simplest building block existing. Present scientific ideas claim that WIMPs, for example, with masses close to the mass of a silver atom [19] [33], are dark matter candidates. The model agrees with some ideas that propose different 'identities' of dark matter [19] [40] [41] [42], but it claims that the difference may be in the shape of the particles.

This study claims that energy cannot exist as an independent entity that occupies its own space. It

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requires massable matter in order that it functions. Photons are forms of energy particles that necessarily colonize and utilize massable condensed structures of dark matter [45] [46]. This contradicts the outcomes of the special relativity theory [47].

Nature is an efficient 'investor' of resources that cannot afford to waste finite sources of energy and matter within a finite Universe. As such, this study considers that the compression of matter beyond a certain point defies the reason of efficient matter formation. Since massable matter was formed at a certain stage, there could be no logical reasoning for a continuation of the compression process. This, if it is assumed that the aftermath of the Big Bang would be the Universe, is refuted in this model. This agrees with the doubts of many scientists [11] [12] [13] [14] [15] [16].

Following the above logic, infinities cannot exist within a finite Universe with finite resources. Otherwise the Universe would consume itself and disintegrate to a scatter of particles into the initial universe. Since the Universe exists, then infinity cannot exist.

This model claims that matter and energy are distinct in essence. Matter cannot be transformed into energy, and vice versa. Einstein's equation of Energy relates its value to the transformation of mass. The difference in mass has been proven empirically; however, the interpretation of the phenomenon was not accurate. According to this model, the mass disintegrates into one of its less complex structures, maybe to dark matter, and releases the energy associated with its former integration into its degradable structure. This does not agree with Einstein's interpretatin of the phenomenon [48] [49].

VII. CONCLUSION

Human capabilities are still modest when it comes to detection of particles or objects beyond certain thresholds. The volume of the Universe humans perceive is extremely small and cannot in any way be a prototype of what exists in the vast corners of the Universe. Added to this, scientific assumptions in the last century created glass ceilings for the advance in cosmology. Certain taboos were created around certain figures whose ideas can never be refuted.

This study calls for releasing the human mind from constraints. This led to the proposition of a logical perspective that perceives the Universe as a single system of interactive subsystems. Dark matter and dark energy have to be the building blocks of the Universe. The role of dark energy exceeds that of Universal expansion to matter integration.

The finite Universe cannot tolerate infinities within its borders. Mathematical equations can never lead cosmology but the other way round. Mathematics and observations are the modern sources of theories in

cosmology [34]. Matter and energy are non-reciprocal in essence. Thus this paper calls to revisit many ideas and interpretations adopted in cosmology.

The limitations of the study are the difficulties associated with testing some of the ideas empirically in order to set firm ground for the model. The data available of some phenomena remain minimal for proper interpretation. The sources and references include lots of speculations that can be misleading.

The cognitive approach is an open call for more cognitive input to expand or properly direct certain ideas. Empirical scientists can confirm or negate the model building ideas in order to refine it further. The subject is as wide as the Universe and requires researchers from different backgrounds to expand on the model.

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Dark matter and generation of secondary electrons and positrons in the near-Earth space environment from the data of experiments PAMELA, FERMI and AMS

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DARKMATTERANDGENERATIONOFSECONDARYELECTRONSANDPOSITRONSINTHENEAREARTHSPACEENVIRONMENTFROMTHEDATAOFEXPERIMENTSPAMELAFERMIANDAMS

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Dark Matter and Generation of Secondary Electrons and Positrons in the Near-Earth Space Environment from the Data of Experiments PAMELA, FERMI and AMS

Stanislav Konstantinov

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I. Introduction

Primary high-energy electrons in cosmic rays are formed during acceleration in supernova remnants. Secondary electrons and positrons are generated in the cosmic medium by relativistic protons of the Earth's radiation belt and cosmic radiation and are within the boundaries of the Earth's magnetosphere, which is assumed to be 25000 km. It was established that the generation of secondary particles increases with increasing altitude (by decreasing the magnetic field B below 0.215 G). The obtained results are difficult to explain in the framework of the model of inelastic interactions of protons of a radiation belt with a residual atmosphere [1, p.224]. Electron-positron ratios of secondary particles increase with the proton energy, starting from 5 GeV, which contradicts the standard model of generation and can mean the existence of another source of positrons [2, p.173]. And such a source is - this resonant scattering in intergalactic plasma, formed by physical vacuum [3]. There is a mechanism for the generation of secondary particles in the physical vacuum - this is a resonance, there are also theories that allow describing the irreversible process of

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particle formation [4, 5,6]. All this represents The modern theory of resonance scattering in intergalactic plasma (or in a dark matter) is born at the interface of elementary particle physics, quantum electrodynamics (QED) and astrophysics and allows us to assert that the space medium can act as a support medium for the of cosmic microwave EmDrive engines.

II. Experiments

The PAMELA magnetic spectrometer was launched aboard the Resurs-DK satellite to an elliptical near-polar orbit with a height of 350-600 km to study the fluxes of particles and antiparticles of cosmic radiation in a wide energy range from tens of MeV to hundreds of GeV. Continuous measurements of cosmic ray fluxes were carried out. The PAMELA device consists of a magnetic spectrometer based on a permanent magnet of $\sim$ 0.4 T, surrounded by anti-coincidence detectors, an electromagnetic calorimeter, a time-of-flight system, scintillation counters and a neutron detector. The magnetic spectrometer has six silicon strip planes that measure the coordinates of the track with an accuracy of 3 mkm, which allows us to determine the sign of the charge of the particle and their stiffness by the deviation in the magnetic field. The electromagnetic calorimeter makes it possible to separate the electromagnetic and hadronic cascades and measure the energy of electrons and positrons with an accuracy of not worse than 10% from several GeV to hundreds of GeV. The time-of-flight system has a resolution of about 300 ps and makes it possible to separate low-energy protons from positrons up to 0.8-1 GeV. The authors of the PAMELA device assert that "the use of a full set of criteria provides a proton-screening coefficient at the level of 10^{-5}, which makes it possible to reliably isolate electrons and positrons against a background of protons." [1,2].

In my article, I will allow to disagree with the statement made by the creators of the PAMELA device about the reliable separation of relativistic protons of the Earth's radiation belt from secondary positrons. In doing so, I rely on two factors:

1. Conclusions to which the researchers come when analyzing the results of the PAMELA experiment:

"PAMELA, FERMI and others detect an increase in the relative share of positrons in the total flux of positrons and electrons in the cosmic medium, starting with photon energy above 30 GeV. According to new data, the AMS detector installed onboard the ISS, the positron spectrum becomes more rigid with increasing energy, while the electron spectrum varies little. The maximum increase in the number of positrons takes place at an energy $W_p \approx 200 GeV$." [7]. "Recent measurements of electron-positron ratios in PAMELA, FERMI and AMS experiments have shown that it increases with energy growth starting from 5 GeV…" [2, pp. 173];

2. The problem of the interaction of the cosmic medium with the electromagnetic energy of a moving charge and the replacement of the controversial idea of an increase in the mass of a moving charge to infinity as the speed of light approaches, to a more acceptable idea of the deformation of the electric field of a moving charge and the reduction to zero of the interaction force with it. The interaction of a moving electric charge q with an electric field E0, taking into account retarded potentials and deformation of the electric field E of a moving charge, can be described by the dependence [8]:

$$F = \mathbf{E}_0\, q\, \sqrt{1 - v^2/c^2} \qquad (1)$$

Taking into account the mass of the charge and acceleration α, the dependence (1) can be written in the form:

$$F = \mathbf{E}_0\, q\, \sqrt{1 - v^2/c^2} = m_v \alpha = \frac{m\alpha}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (2)$$

Within the framework of the relativistic concepts of modern electrodynamics dependence (2) is interpreted as the effect of "increasing the mass" m_o moving charge to infinity when approaching the speed of motion of the charge to the speed of light. However, equation (2) is a relativistic effect of reducing the force interaction of the moving charge with the electric field E0, formed by a stationary charge. The effects of delayed potentials and deformation of the electric field of moving charges leads to a restriction of the growth of the mass of the charge, at $v \to c$. The increase in particle mass at a rate occurs for other reasons (non-relativistic effect). When the oscillation frequency of the electromagnetic field arising when a particle moves in a medium (dark matter) $\omega_B = \frac{mv^2}{\hbar}$, approaches the natural oscillation frequency of the particle $\omega_S = \frac{mc^2}{\hbar}$, resonance arises. Resonance is accompanied by an increase in the additional particle mass $\Delta m = \hbar\, \omega_S / c^2$. The graph of the dependence of the mass of a particle on its velocity is simply a half of the amplitude-frequency characteristic of the forced oscillations of a harmonic oscillator without dissipation, while the increase in mass is absolute [6].

The most common instruments for the accurate measurement of the energy spectrum of constant and pulsed beams of charged particles are magnetic spectrometers. This method is based on the dependence of the radius of the cyclotron orbit on the kinetic energy of the particle. The equality of the Lorentz force and the centrifugal force when the particle moves around the circumference in a homogeneous magnetic field leads to the equation:

$$qvB = \frac{mv^2}{r} \qquad (3)$$

where q is the particle charge, v is its velocity, B is the magnetic field induction,
r is the radius of the cyclotron orbit, $m = m_o / \sqrt{1 - v^2/c^2}$, m_o = rest mass,
c is the speed of light.

From the known q, r, B, we can calculate the kinetic energy of a particle:

$$W = m_o c^2 \left\{ \sqrt{\frac{q^2 \mathbf{B}^2 \mathbf{r}^2}{(m_o c^2)^2} + 1} - 1 \right\} \qquad (4)$$

In modern spectrometers, an approximate relation is used to estimate the kinetic energy of ultrarelativistic charged particles in a magnetic field when $qBr \gg m_o c^2$ [9].

$$W \approx q\mathbf{B}r \qquad (5)$$

where q is the particle charge,
B is the induction of a homogeneous magnetic field,
r is the radius of a circle described by a particle.

It is seen from expression (5) that the kinetic energy of a charged particle in a magnetic spectrometer is directly proportional to the charge value, which in classical electrodynamics does not depend on the velocity of the particle and the radius of the cyclotron orbit.

Thus, the reliability of the conclusions about the complete elimination of relativistic protons from the total flux of secondary electrons and positrons in the PAMELA magnetic spectrometer is doubtful. The tracks of relativistic protons in the magnetic field of the PAMELA spectrometer will be close to the positron tracks and, therefore, starting from 5 GeV, the PAMELA experimenters observe the growth of secondary positron fluxes (more precisely, protons and positrons). This can also be confirmed by the fact that the positron spectrum becomes more rigid with increasing energy, while the secondary electron spectrum varies little.

III. Data Analysis

Secondary electrons and positrons are generated in the cosmic medium by relativistic protons and cosmic radiation. It was established that the generation of secondary particles increases with

increasing altitude [1, p.224]. The obtained results are difficult to explain in the framework of the model of inelastic interactions of protons of a radiation belt with a residual atmosphere. It is necessary to expand the framework of the model and, in addition to the residual atmosphere, include dark matter entering into it, interacting with cosmic radiation and relativistic protons of the radiation belt. Moreover, there is also a mechanism for generating secondary electrons and positrons-this is resonance [10, 11].

1) Generation of secondary particles has two characteristic features [1, p.22³]: The energy spectrum of these particles is very "soft" with a sharp drop above 100 MeV, which can be explained by the resonance mechanism of particle generation.
2) Positrons predominate in the secondary particle flux. The ratio of positron fluxes to electron fluxes (Np / Ne) reaches 5, at a primary radiation energy

W≥30GeV. In addition, the generation of secondary particles from relativistic protons of the Earth's radiation belt is almost 100 times higher than that from of cosmic radiation.

a) *Prevalence of positrons in secondary electron and positron fluxes*

"Recent measurements of electron-positron ratios in PAMELA, FERMI and AMS experiments have shown that it increases with energy growth starting from 5 GeV, which contradicts the standard model of generation and distribution of cosmic rays" [2, pp.173-174].

On the one hand, the predominance of positrons may indicate a more effective capture of electrons by the cosmic medium and the presence of a source of primary positrons, but on the other hand, the red branch in Fig. 1 may indicate that, at energies above W = 5 GeV, relativistic protons in a PAMELA magnetic spectrometer are summed up with secondary positrons.
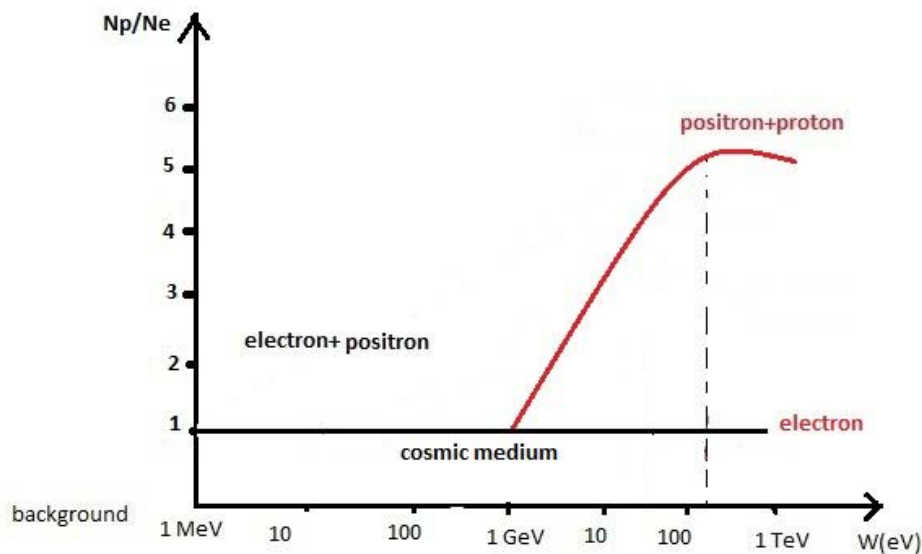
Fig. 1: Graph of secondary electrons and positrons from the data of PAMELA, FERMI and AMS

b) *Resonance effect of generation of secondary electron and positron fluxes*

Figure 2 shows the relative growth curves of the secondary electron and positron fluxes in the cosmic medium, beginning with the cosmic-ray energy W≥ 1 MeV and ending with the energy W = 200 GeV. They allow us to conclude that the process of production of electrons and positrons in a cosmic medium is resonant [5, 10]. The maximum of the total flux of electrons and positrons at the photon energy Wp ≈20 GeV corresponds to the natural frequency of the structural element of the cosmic medium (physical vacuum) v_r = 4.6911 • 10^{24} Hz obtained by professor A.V. Rykov based on the parameters of the structural element of the cosmic medium (physical vacuum), including the charge of the dipole, as well as its electromagnetic parameters μ_o (magnetic permeability) and ε_o (dielectric

constant) as early as 2000. [5]. According to Rykov, with the size of the structural element of the cosmic medium dipole r = 1.3988 • 10^{-15} m, the ultimate deformation (destruction boundary) dr = 1.0207 · 10^{-17} m. is related by the relation dr = α r , where α = 0.0072975 is the fine structure constant. Destruction boundary corresponds to the external photon energy W ≥ 1 MeV (the initial boundary of the photoelectric effect in the physical vacuum. The photon frequency v_i = 2.4891·10^{20} Hz). The deformation in physical vacuum is less than dr should be of an electroelastic character, and at higher values, deformation leads to the destruction of the dipole and to the creation of an electron-positron pair. Today this fact has been confirmed experimentally. The resonant maximum of the total spectrum of electrons and positrons at an external radiation energy Wp≈ 20 GeV was detected by Yu.V.

Galaktionov during its accurate measurements in the detector AMS experiment at the International Space Station [3, Fig. 16]. Thus, Yu.V. Galaktion managed to

prove experimentally the presence of dark matter in the near-Earth environment.

Figure 2: Graph of resonance curves of generation of secondary electrons and positrons

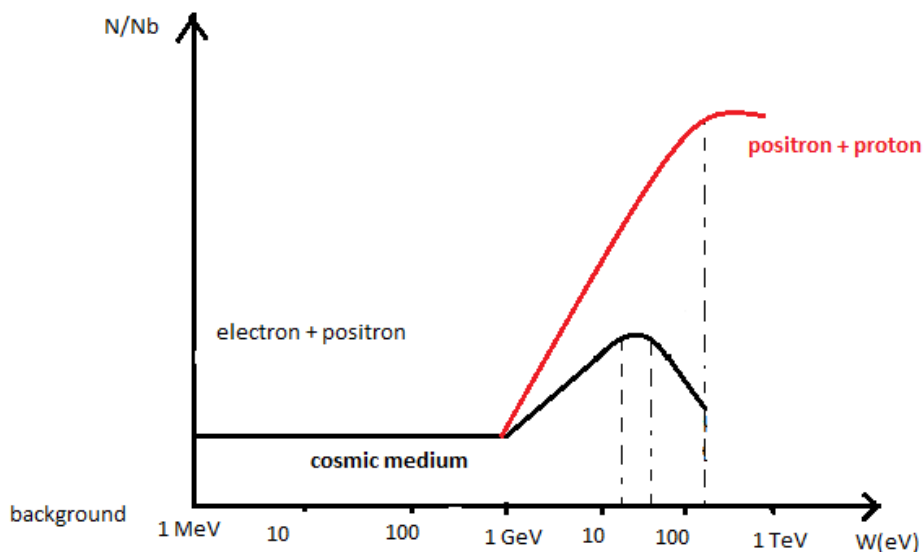The summation of relativistic protons, starting at W = 5 GeV, with secondary positrons in the PAMELA magnetic spectrometer (the red branch of Figure 2) distorts the results of the experiments and masks the resonant maximum of the generation of secondary electron and positron fluxes relative to their background values (N / Nb). A similar graph is presented in Ref. [3 p. 56, Fig.16 (the result of measuring the total spectrum of electrons and positrons)].

Analysis of the resonance curves shown in Fig. 2 and Fig 16 [3] allows to determine the photon frequency corresponding to the natural frequency of the structural element of the space medium (dark matter) and its wavelength. The frequency corresponding to the resonance energy of the photon (ν) and the natural

frequency of the structural element of the cosmic medium (dark matter) is defined as the frequency of the Schrodinger and de Broglie wave functions (for resonance, they describe the same probability density for finding the particle at any point in space):

$$\nu = W / h \text{ or } \quad \omega = W / \hbar \quad \text{and} \quad \lambda = 2\pi c / \omega \qquad (6)$$

where W - the photon energy
h - Planck constant $h = 6.6260 \cdot 10^{-34}$ J / Hz
$\hbar = h / (2\pi)$ $\hbar = 1,0546 \cdot 10^{-34}$ J / Hz
c - the speed of light $c = 299792458$ m / s

Thus, it is possible to determine the natural frequency of the structural element of the cosmic medium (dark matter) and wavelength:

$$W_r \approx 20 \text{ GeV} = 33 \cdot 10^{-10} \text{J}, \quad \nu_r = 4.7 \cdot 10^{24} \text{ Hz}, \quad \omega_r = 2.82 \cdot 10^{25} \text{ Hz}, \quad \lambda_r = 6.39 \cdot 10^{-17} \text{ m}$$

IV.   Conclusion

Experiments PAMELA, FERMI and AMS give the researcher a unique opportunity to simultaneously measure secondary electron and positron fluxes, which is extremely important for the development of a standard model for the generation and distribution of cosmic rays. Direct experimental determination of the resonance dependence of birth N elementary particle pairs of frequency ν is almost completely silenced by modern physics. Following the deceptive logic of the modern theory, this dependence is drawn as a monotonically increasing curve.   The same processes should be observed in accelerators and colliders [8]. An experimental confirmation of this is the appearance of a

flow of backward electrons with a "soft" energy spectrum in multi-wave Cherenkov generators, with the primary-electron energy W = 2 MeV [12]. The resonant nature of the secondary electrons and positrons under the influence of external radiation is a fundamental process of the universe is birth in the space environment divergent flows or drains and sources. The instability of the physical vacuum in external fields is a purely quantum phenomenon. In [13], details of exact numerical, as well as asymptotic calculations of the vacuum instability effect in the presence of the so-called peak electric field are given. In quantum electrodynamics (QED), this phenomenon is characterized by the production of electron-positron pairs from a physical vacuum. Experiments allow us to

state that cosmic medium can act as a support medium for engines EmDrive. Here is the conclusion of NASA researchers, obtained by studying the mechanism motion of the microwave Roger Shawyer engine EmDrive in a vacuum: "The quantum physical vacuum a dynamic medium and could potentially be modeled at the microscopic scale as an electron-positron plasma. If the vacuum is indeed mutable and degradable as was explored, then it might be possible to do / extract work on / from the vacuum, and thereby be possible to push off of the quantum vacuum and preserve the laws of conservation of energy and conservation of momentum" [14]. A new theory of intergalactic plasma is born at the junction of the three directions of physics: elementary particle physics, quantum electrodynamics (QED) and astrophysics, and it is necessary to unite the efforts of scientists engaged in the study of the of mechanism of formation of electron-positron pairs in a physical vacuum when exposed to cosmic radiation, relativistic particles or electric field.

V. Acknowledgements

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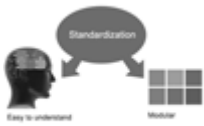
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3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

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- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
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