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Electric Field Energy

Symmetric Black Hole Radiation

Highlights

Variance of Extreme Values

Current Mass-Energy Composition

Discovering Thoughts, Inventing Future

VOLUME 15 ISSUE 6 VERSION 1.0

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The Electric Field Energy of an Electret

By Katsuo Sakai

Abstract- The new electrostatic generator that is driven by Asymmetric electrostatic force is a very interesting new idea, because it will continue to generate electricity by an electret without any adding energy. This expectation means that the electric field energy of the electret exists even if the electric energy is changed to a kinetic energy. However, this phenomenon has not yet been confirmed by a real experiment.

Therefore, a simple experiment that confirm this phenomenon was performed. As a result, the possibility was recognized by the experiment.

Keywords: *electrostatic generator, asymmetric electrostatic force, electrets, electric field energy.*

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THEELECTRICFIELDENERGYOFANELECTRET

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The Electric Field Energy of an Electret

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Therefore, a simple experiment that confirm this phenomenon was performed. As a result, the possibility was recognized by the experiment.

Keywords: electrostatic generator, asymmetric electrostatic force, electrets, electric field energy.

I. Introduction

"Electrostatic generator" has long history and it had been greatly studied in 17th and 18th century, after that it has been almost forgotten because electromagnetic generators become very popular. Today, safety pollution-free and low cost energy is strongly required. Therefore, electrostatic generator must be reconsidered.

The idea behind an electrostatic generator has been defined by lifting the charge to a high potential by a mechanical force against the electric force that acts on this charge. It is impossible for the mechanical force to carry the charge directly. Therefore, the charge is packed into a suitable body. This body is called the charge carrier.

The most popular electrostatic generator that is driven by a mechanical force is the Van de Graaff type electrostatic generator [1].

On the contrary, a new electrostatic generator that is driven by an electrostatic force was recently invented by this author [2]. Even if it is said as a new electrostatic generator, the basic principle of the generation is the same as the former electrostatic generator. Namely, the generator picks up charges into a charge carrier at a low electric potential place and transports the charge carrier to a high electric potential place.

Usually, the magnitude of the electrostatic force is the same when the direction of the electric field is reversed. However. This is true only for a point charge or a charged spherical shape conductor. On the contrary, the magnitude of the electrostatic force that acts on a charged asymmetric shape conductor is different when the direction of the electric field is reversed.

This very interesting new phenomenon was found by a simulation [3] and was recently confirmed by a experiment [4] This phenomenon was named Asymmetric electrostatic force. The new electrostatic generator is driven by Asymmetric electrostatic force in place of a mechanical force.

A basic unit of the new electrostatic generator that is driven by Asymmetric electrostatic force is concretely shown in figure 1.

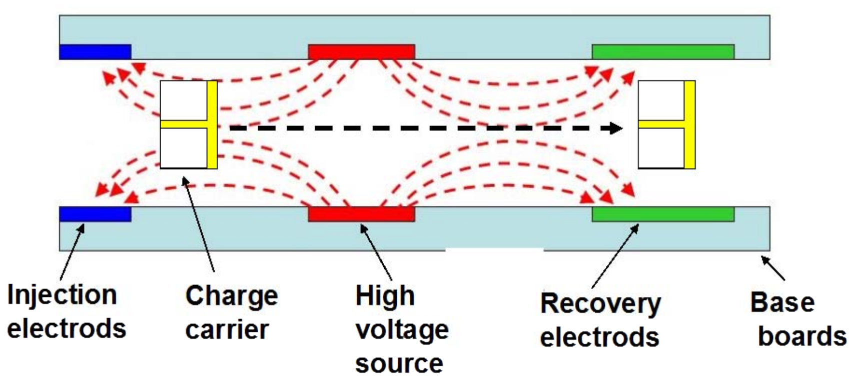

Figure 1 : Schematic layout of a basic unit of the new electrostatic generator

This generator mainly consists of charge injection electrodes, high voltage sources, charge recovery electrodes and charge carrier. Those electrode and the high voltage source are disposed on insulating base board.

The high voltage source give a positive high voltage. The injection electrodes are grounded. The recovery electrodes are kept at a negative low voltage. As a result, the high voltage source and the injection electrodes produce a forward electric field for a negative charge between them. The high voltage source and the recovery electrodes produce a backward electric field for a negative charge between them. The line of electric force is depicted as red arrow dotted lines in figure 1.

Author: Electrostatic generator Laboratory, Yokohama, Japan. e-mail: gy7a-ski@asahi-net.or.jp

A "T" character shape conductor is used as a charge carrier that carries negative charge (electron) from the injection electrodes to the recovery electrodes through the high voltage source.

Asymmetric electrostatic phenomenon produces a large electrostatic force in the forward field and it produces a weak electrostatic force in the backward field. Therefore, the charge carrier gains large kinetic energy in the forward field. Then, it loses some of its kinetic energy in the backward field. As a result, the charge carrier maintains extra kinetic energy, when it arrives between the recovery electrodes . The carried charge can be lifted to a higher potential by this extra energy.

At the first step of the development of the new electrostatic generator, a experiment instrument confirmed that Asymmetric electrostatic force can work as a driving force of the new electrostatic generator. Namely, the charge carrier could reach at the recovery electrode [5]. If Asymmetric electrostatic force did not work, the charge carrier could not reach at the recovery electrode.

And at the second step, it was recently confirmed that charges were really carried from the injection electrode to the recovery electrode [6]. However, this confirming experiment was performed with using a friction charged Teflon sheet as the high voltage source. And, the charges on the Teflon sheet leaks quickly. As a result, the charge carrier can be transported only one time from the injection electrode to the recovery electrode.

Therefore, at the third step, an electret will be used as the high voltage source, because the charges in the electret will be kept for a long time.

The lifetime of the electret is expected over 10 years at the room temperature.

An electret condenser microphone that was produced 40 years ago can be used today.

However, it is not yet confirmed by a real experiment that the same electret can transport a charge carrier repeatedly for a long time.

This is the subject of this experiment.

II. Experiment

a) Experimental instrument

Figure 2 shows a photograph of the main part of the experiment equipment and. figure 3 shows the front view of the experimental instrument

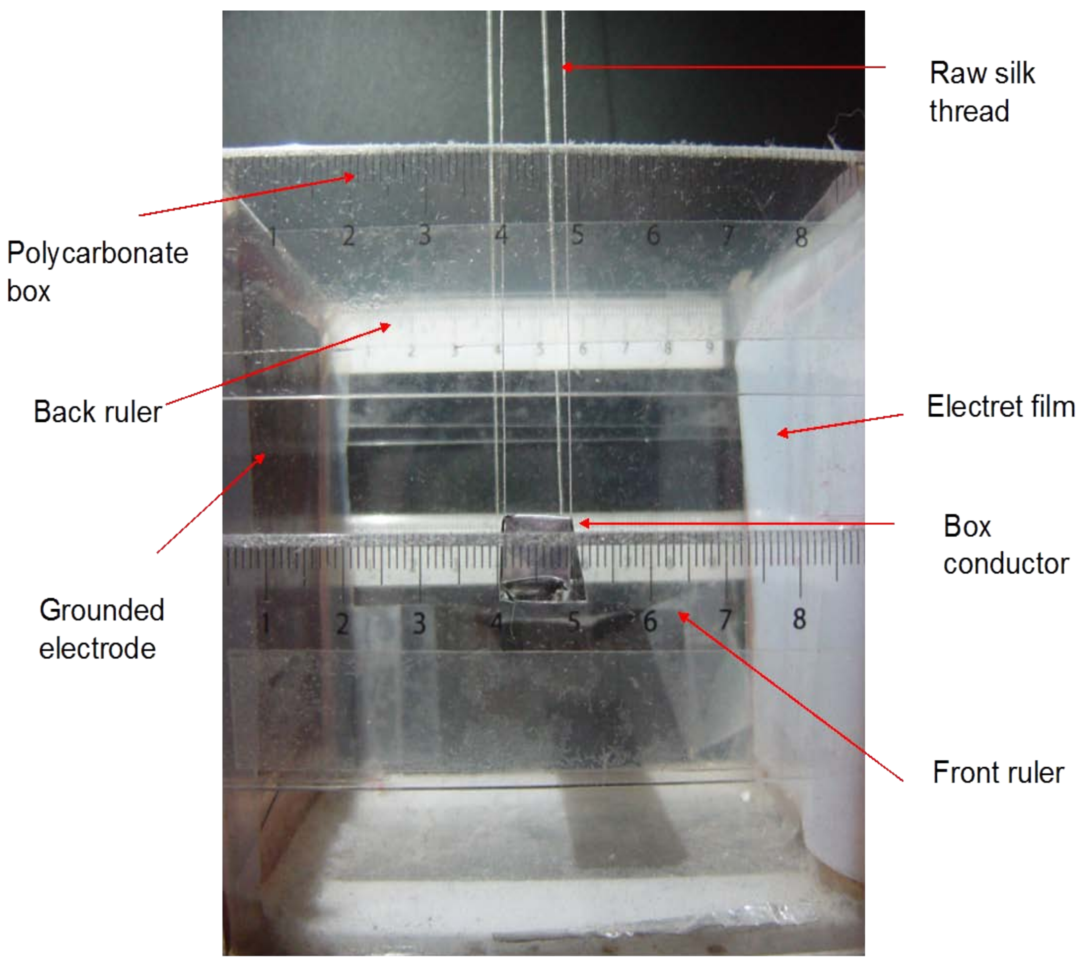

Figure 2 : A photograph of the experiment equipment

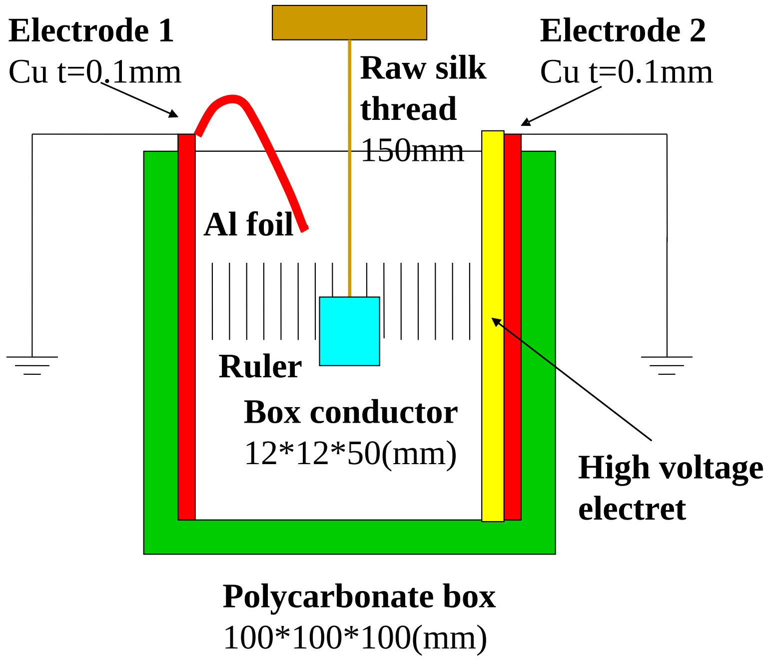

Figure 3 : The front view of the experimental instrument

This instrument consists of two parallel electrodes, an electret and a box conductor. They are arranged in a large box. A large transparent polycarbonate box was prepared. This box protects the small box conductor from wind that was blown from outside.

The thin copper plate 100mm*100mm with a thickness of 0.1mm was attached to the left and right wall of the large box as a left and right electrode. The distance between both electrodes was 100 mm. The both electrodes were grounded. A small box conductor was floated by an insulating raw silk thread with a length of 150mm at the center of both electrodes. The width, the height and the length of the conductor was about 12 mm, 12mm and 50mm respectively. The material of the conductor was aluminum, and the thickness was 0.1mm.

An electret (TOHFLON ELT SHEET made by TOHO KASEI Co., Ltd. Japan) was attached on the right electrode. This special electret was used as high voltage power supply. The potential of this electret was 14kV. Usually, this high voltage can not gain by one sheet of electret. Therefore, 4 sheets were superimposed. Each sheet had 3.5kV. Charge density of the sheet was about 0.8mC/m^2. Thickness of the sheet was 75 micron meter. Material of the sheet was fluorine resin.

b) Experimental procedure

Figure 4 shows an explanation drawing of the procedure of the experiment.

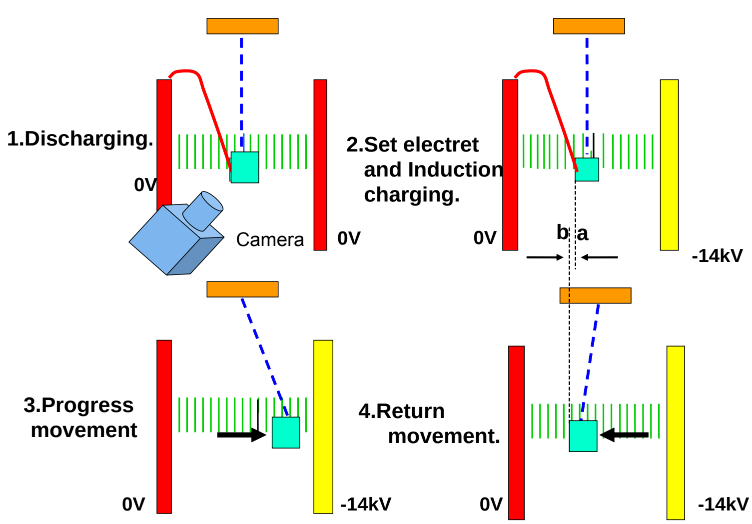

Figure 4 : A schematic of the experimental procedure

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The experiment was performed using the following procedure:

①. The left and right electrodes were grounded, and the box conductor was touched to the grounded aluminum foil for discharging.

②. The electret was superimposed on the right electrode, and the box conductor was touched to the grounded aluminum foil again for induction charging. This position was defined as the start point "a" as shown in figure 4.

③. Then, the conductor was progressed toward the right side by the electrostatic force that acts on this charged box conductor.

④. Then, the conductor was returned toward the left side by the tension of the thread that acts on this box conductor. The terminal of the return movement was defined as the return point "b" as shown in figure 4.

⑤. Finally, the distance between the start point "a" and the return point "b" was measured from the movie that recorded those movement. The distance a-b was named as the overrun distance.

This experiment was repeated 48 times. These experimental results and the following simulation results will be shown later in the same graph.

III. SIMULATION

Figure 5 shows four different forces that act on the charged box conductor.

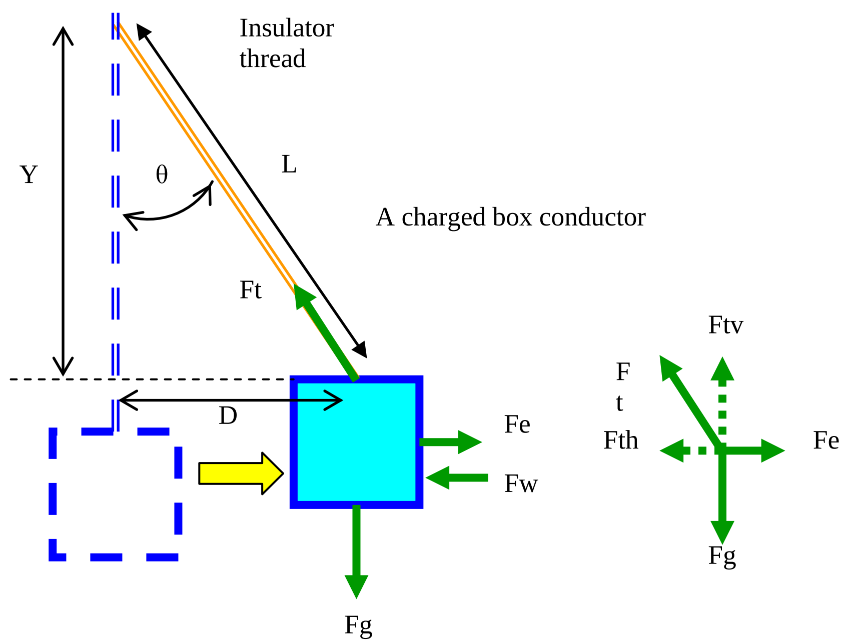

Figure 5 : Schematic diagram of the electrostatic force, the gravity force, the tension and the air resistance force that act on the charged box conductor on progress path

There are four different forces that act on the charged box conductor of moving.

Namely, they are the electrostatic force fe, the gravity force fg, the tension ft and the air resistance force fw. The direction of the electrostatic force is x-plus. The direction of the horizontal component of the tension, and the air resistance force is x-minus. The direction of the vertical component of the tension is y-plus and the direction of the gravity force is y-minus. The strength of the vertical component of the tension is the same as the strength of the gravity force always. As a result, there is no force that acts on the charged box conductor in y-direction. Therefore, the charged box conductor is moved by the total force of the electrostatic force, the horizontal component of the tension and the air resistance force horizontally.

The electrostatic force was simulated with two dimensions finite difference method. I learned this method from Dr. Matsubara's papers [7], [8], [9] and wrote a two-dimensional program by myself. The reliability of this handmade simulation program was confirmed by simulating a physics problem that can be solved analytically [4]. Therefore, only the final results of this simulations are represented in this report.

Quantity of charge that was inducted in this box conductor was simulated as -6.72nC. Then, the strength of the electrostatic force that acts on this charged box conductor was simulated as 0.722mN.

The strength of the horizontal component of the tension Fth can be calculated by the following formula (1) from the moving distance D, the thread length L and the gravity force Fg.

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$$Fth = Fg \times \tan \vartheta = Fg \times \frac{D}{Y} = Fg \times \frac{D}{\sqrt{L^2 - D^2}} \qquad (1)$$

where L=150mm, and Fg=10.22mN, which was calculated using the measured weight of the box conductor (1.04 g).

The strength of the air resistance force can be calculated by the following formula(2):

$$Fw = \frac{Cd \times \rho \times S \times v^2}{2} \qquad (2)$$

where Cd is air resistance constant, ρ is air density, S is the front space of the box conductor and v is velocity of the box conductor. Actually, Cd =1.0 ρ=1.2kg/m^3 and S=0.0006m^2 was used in this calculation.

Figure 6 shows the simulated electrostatic force, the calculated horizontal component of the tension that was calculated from the formula (1) and the total force that acts on the charged box conductor. The air resistance force was not represented in this figure because the strength of it is very small.

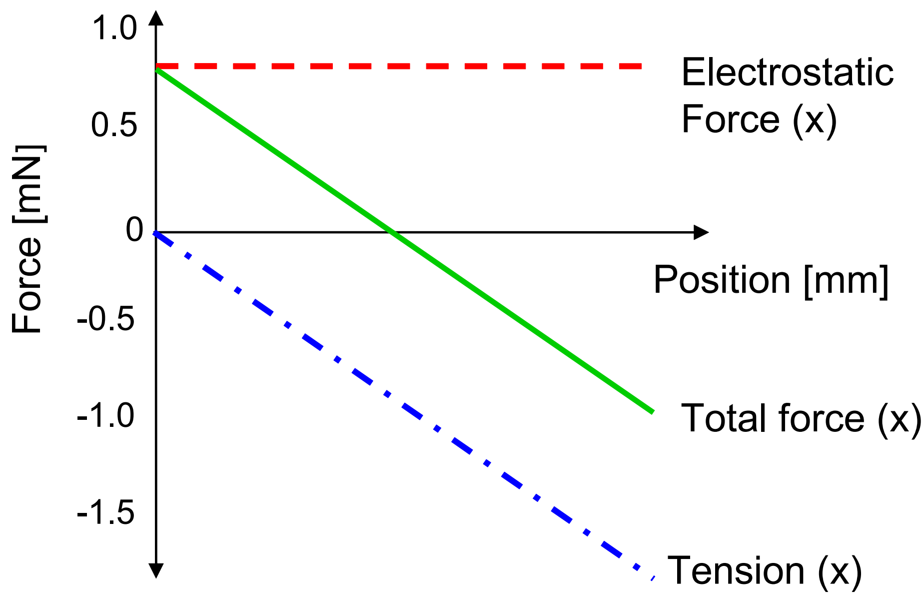

Figure 6 : The electrostatic force, the tension and the total force that acts on the charged box conductor

It is apparent from figure 6 that the charged box conductor was accelerated from 0mm to 11mm and decelerated from 11mm to 22mm. The velocity of this charged box conductor was calculated from the total force that acts on this charged box conductor by solving a kinetic formula.

Figure 7 shows the calculated velocity of the charged box conductor.

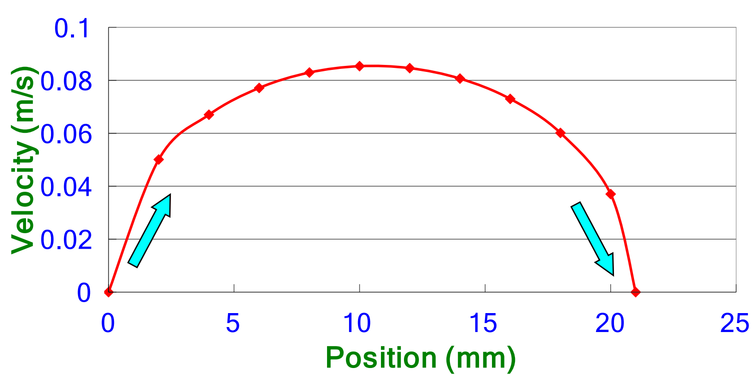

Figure 7 : The calculated velocity of the charged box conductor from the total force that acts on it by solving a kinetic formula

It is apparent from figure 7 that the velocity of the box conductor becomes maximum at 11mm and it decreases to zero at 22mm (This is a simulation result. Actually, the stop positions were less than 22mm or more than 22mm). At this position, the charged box conductor stops, and it starts return movement to left.

On this return path, does the energy of the electric field exist ? The energy density W of the electric field can be calculated by the following formula (3) from the strength of the electric field E and the vacuum permittivity, ε0.

$$W = \frac{1}{2}\varepsilon 0 \times E^2 \quad (3)$$

The potential of the electret is 14000 Volts and the distance between the grounded electrode and the electret film is 0.1 m. As a result, the strength of the electric field is 140000 V/m and the energy density W becomes 0.087 J/m^3 . The volume of the progress path of the box conductor is 0.0000132 m^3. Then, the energy on this progress path becomes 1.15μJ. However, the used energy w that transported the box conductor was 15.88μJ that was calculated by the following formula (4) from the electrostatic force f and the transport distance s.

$$w = f \times s \quad (4)$$

where f=0.72mN, and s=22mm,

This result means that the box conductor was transported by the energy on the progress path and the around energy. Therefore, if the energy of the electric field is kept still, there is no energy not only in the progress path but also its around area. On the contrary, if the electric field consists of photons [10], energy will be reproduced rapidly.

Accordingly, the return movement of the box conductor was simulated with two different conditions, namely with energy and no energy.

Figure 8 shows the electrostatic forces that are corresponding for the two conditions, the calculated horizontal component of the tension that was calculated from the formula (1) The air resistance force was not represented in this figure because the strength of it is very small.

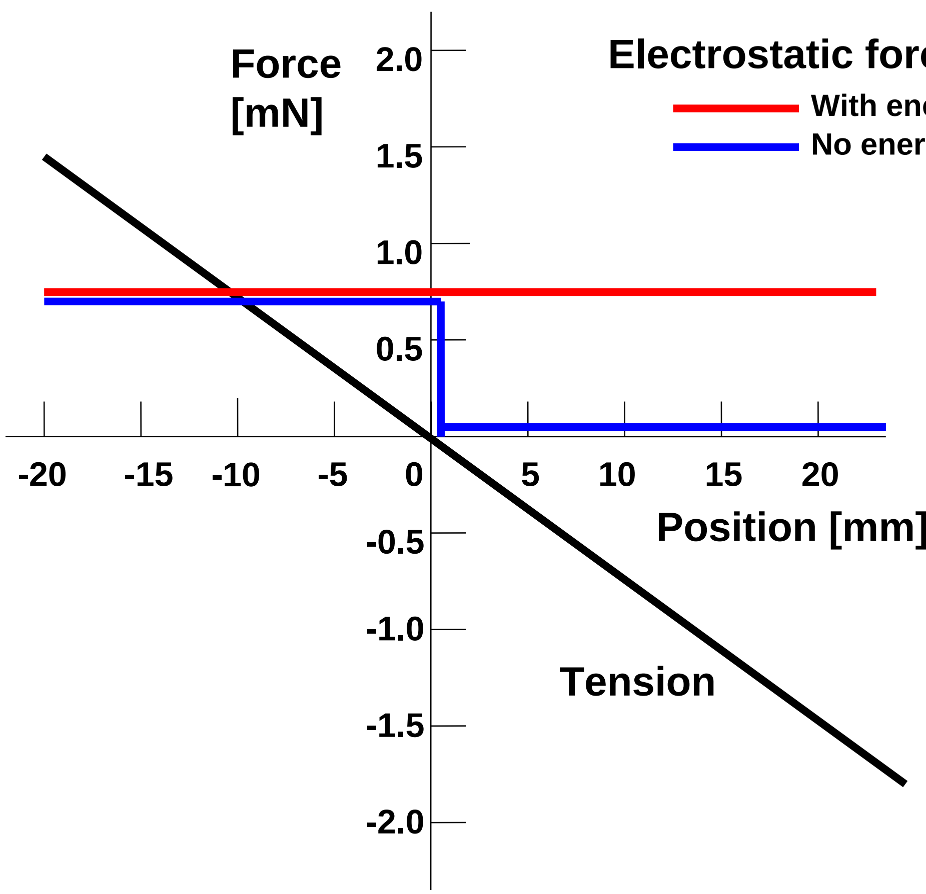

Figure 8 : The electrostatic forces that are corresponding for the two conditions, the calculated horizontal component of the tension that acts on the charged box conductor in the return path. The air resistance force was not represented in this figure because the strength of it is very small

Figure 9 shows the total forces that are corresponding for the two conditions.

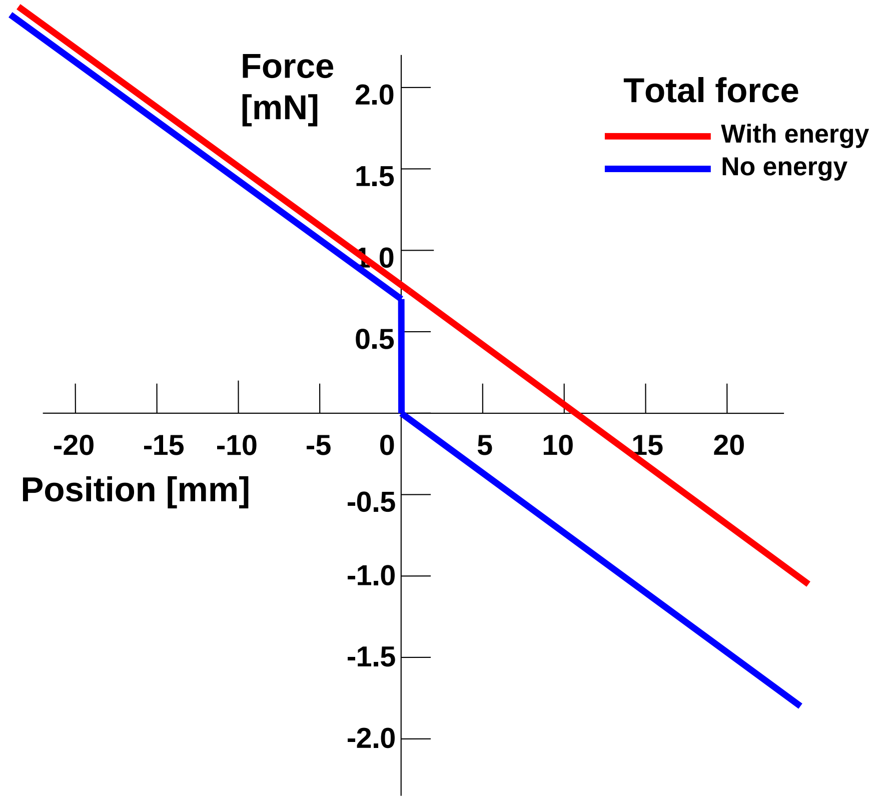

Figure 9 : The total forces that are corresponding for the two conditions. Those forces act on the charged box conductor in the return path

It is apparent from figure 9 that the charged box conductor will be accelerated from 22mm to 11mm and decelerated from 11mm to -22mm on the return path that has an electric field energy. On the contrary, it will be accelerated from 22mm to 0mm, and decelerated from 0mm to -22mm on the return path that has no electric field energy from 22mm to 0mm. The velocity of this charged box conductor on the two conditions was calculated by solving a kinetic formula.

Figure 10 shows the calculated velocity of the charged box conductor in the two conditions.

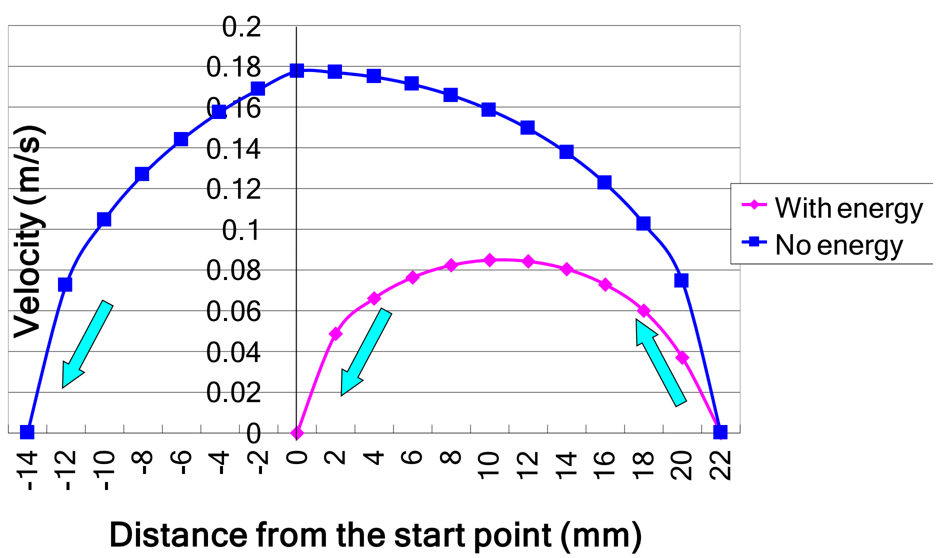

Figure 10 : The calculated velocity of the charged box conductor on the return path of the two conditions of the electric field

It is apparent from figure 10 that the charged box conductor returns to the starting point (0mm) when the electric field energy exists. On the contrary, it overruns the starting point when the electric field energy was lost. The simulated overrun distance is 14mm.

The actual overrun distances were measured by the simple experiment as described before. Figure 11 shows the simulated two overrun distances and the measured 48 overrun distances.

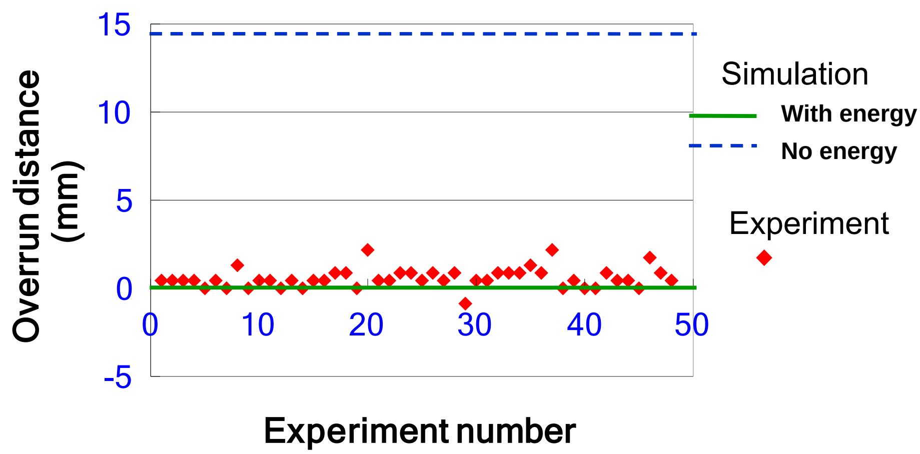

Figure 11 : The simulated overrun distances of the two conditions and the measured overrun distances by the simple experiment

IV. Cosideration

It is apparent from figure 11 that the 48 measured overrun distances almost agree with the overrun distance that was simulated with energy. On the contrary, the overrun distances that was simulated without energy, does not agree with the measured overrun distances. Therefore, it should be recognized that there is the same energy on the return path. Namely, the energy of the electric field was not changed even if the charged box conductor was moved by the electric force originated from the electric field.

Of course the measured overrun distance is not zero. The average of the 48 measured distances is 0.7mm.

This a few difference can be explained by a charge leak phenomenon. It is well known that charges on the surface of a conductor leak gradually into the air with time. The leak speed depends on the humidity. The experiment was performed in low humidity. It was 30%RH. This was not perfect condition for preventing the charge leak phenomenon. If 5% charge leaks on the progress path, the simulated overrun distance becomes 1mm or less. This result agrees well with the average of the 48 measured overrun distances.

V. Conclusion

It was confirmed by a simple experiment that there is the same energy on the return path even if the electric field energy of the electret on the progress path was used to transport the charged conductor.

This experiments were repeated with the same electret. The repeating were only 48 times. However, we can expect that the new electrostatic generator that is driven by Asymmetric electrostatic force of the electret will produce electricity for a long time.

VI. Acknowledgements

Author would like to thank Mr. Susumu Kawato and Mr. Satoshi Shimizu (TOHO KASEI CO., LTD.) for the effort of trial manufacture of the very high voltage electret.

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Issues of Variance of Extreme Values in a Heterogeneous Teletraffic Environment

By D. E. Bassey & Rufus C. Okoro
University of Calabar, Nigeria

Abstract- The reliability of various teletraffic data-analytical devices in communication systems is relevant to all stakeholders. Among other key external variables, the performance of the network evaluated under a variety of traffic scenarios is the focus of the study: data/video traffic generated by subscribers, who ordinarily subscribed voice bandwidth services. This study, therefore views teletraffic data as complete random and in-deterministic variables, and examines its continuous dependence on configuration of fixed engineering values by equipment innovators/operators. The study was carried out by examining if core equipment techniques for processing traffic data on real-time basis vary in accordance with the bandwidth required to deliver the service (voice, data and video). Four Line Trunk Groups (LTG01, LTG02, LTG03 and LTG04) and 16 Digital Line Units (DLUs) were used for the study. Close examination of the activated DLUs configured to carry voice bandwidth generated daily traffic values of 0.1Erlang to 0.2Erlang, while others generated traffic rates of 0.01Erlang to 0.05Erlang per line; during the non-busy-hour period. This traffic rates, though subscribed for voice services, were shared among voice, data and video. The study concludes that the time consistent busy hour is not truly consistent in the present heterogeneous traffic environment. New concepts were examined and recommendations made for review.

Keywords: *average daily peak hour, busy hour, digital line unit, line trunk group, peak values, time consistent busy hour.*

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ISSUESOFVARIANCEOFEXTREMEVALUESINAHETEROGENEOUSTELETRAFFICENVIRONMENT

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Issues of Variance of Extreme Values in a Heterogeneous Teletraffic Environment

D. E. Bassey [α] & Rufus C. Okoro [σ]

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Keywords: average daily peak hour, busy hour, digital line unit, line trunk group, peak values, time consistent busy hour.

I. Introduction

A switching unit or group of switching modules are usually determined by the rate at which traffic arrive and the length of time for which they are held. These two key qualities account for the term "traffic (or teletraffic)" in telecommunications engineering.

Since traffic arrive at random and they last for a random length of time, mean values are usually used in practice. Inter-arrival and holding time are determined by taking measurements over a long period and monitoring the pattern over traffic parameters. This approach, though lengthy and accurate within the place of measurements, forms the foundation of the teletraffic theorists' model.

The probability that a call/data arrives in an interval t, is not dependent on the time that has elapsed since the last call/data, or the holding time. The probability that a call releases in a given interval, t is not related to the time for which the call has been in progress. The mean inter-arrival time is the inverse of the mean calling intensity, and therefore depends on the level of offered traffic. Usually, teletraffic theorists and administrators assume values ranging from 20 sec. to 180 sec. These values are dependent on time consistent voice calls [2].

In line with this theory, CCITT/ITU-T defined a representative hour called the Busy Hour [1]. Traffic density of this hour is used as the basis for network planning/ dimensioning. Traffic density is measured per quarter of an hour during a period of up to 15 working days. The representative hour, consisting of four consecutive quarters is chosen as the busiest hour. Two methods are usually used with respect to traffic measurements:

a. Time Consistent Busy Hour (TCBH), and
b. Average Daily Peak Hour (ADPH).

In TCBH, the measurements per quarter are averaged. The Busy Hour that is determined remains constant in time, while traffic calculated is the average traffic value of the busy hour. TCBH is the most commonly used method. The ADPH adapts the method where a peak hour is determined and the traffic is calculated using the average traffic values of the daily peak hours. ADPH has no well determined busy hour as TCBH; rather, it has a busy period that can be one hour, or larger.

The reliability of the setele traffic-data measuring devices in communication systems is very important. These require the consideration of the effects of different external disturbances and a variety of traffic scenarios on the performance of the network. One of such scenarios is data/video traffic generated by subscribers who ordinarily subscribed low bandwidth services. Example: charting in face book, other social interacting web sites, and low band width Internet users.

This study therefore views the present data dominated signal streams as completely random and in-deterministic. It further examines the rationale for the continuous dependence on fixed engineering service criteria by equipment innovators/operators. Should core equipment techniques for evaluating traffic data on real-time basis,vary in accordance with the present heterogeneous teletraffic environment? The objective is to ensure that modern traffic measurements, used for evaluating performance indicators may not need to

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activate restriction common with electro-mechanical switches, or digital switches with low bandwidth utilization; and real-time dependent. Fundamental concepts in traffic flow pattern between voice, data and video were evaluated. New concepts such as a review of the time-consisted busy hour as a catalyst to modify engineering and operational contents in communication networks analyses were examined and recommendations made for review.

II. Methodology

The study was conducted using an EWSD switching system hardware, consisting of External Line Plant Terminal of 960 subscribers' interface Line-modules, 2000-digital communication pots, Operation and Maintenance Terminal, a Plug-in or Plug-out terminal with output registers for 32 Line Trunk Group Modules, located in the central equipment room, at the Calabar Export Processing Zone, Calabar-Nigeria. It serves both foreigners and indigenous workers. Using the real-time traffic hourly mode, time consistent hourly traffic data were obtained to validate the process. Another, un-automated traffic measurements were simultaneously activated with the aid of a Dial-Tone Delay Recorder. The device measured traffic by placing test calls to selected routes and measured service delays over 3 seconds. Digital Line Units (DLUs) selected for these tests were configured to carry traffic for two distinct subscribers separated by nationality and volume of traffic usage. Through this unit, a deliberate step-by-step test calls were made and a measure of the proportion of time that all the subscriber line modules were found busy in each Line Trunk Group noted. The resulting occupancy of all DLUs found busy is a direct measure of the probability of a delay > 0. The peak mode configuration was activated throughout the process.

The main processor load measurement provides an overview of the load situation regarding selected DLUs or LTGs. The required load per DLU is recorded using the man-machine language command: Traffic measurement of DLU- 01 to DLU-10 (CR MPLDME DLU 01-10).

START TIME: Time of output of the first report for 60mins.

Interval: 0000hrs to 2400hrs.

The output data were recorded using the magnetic disk drive and the magnetic tape drive.

III. Results and Discussion

Subscriber observation command (ENTR DNOBS) generated data records for all incoming and outgoing traffic under observation. It provided information about how subscriber traffic was distributed over the various traffic routes and supplied values relating to traffic behavior. Post processing of data can be used to determine traffic variables for individual subscriber or group of subscribers.

Figure1 is a comparative data acquired under similar conditions using two different measuring devices: computerized system and the manually operated device. Measurements were carried out to determine the traffic busy hour of the switch. Fig.2 to Fig. 11 are mean traffic values in Erlang recorded using the time frame of the two major traffic dips recorded in Fig. 1., 0800hours to 1500 hours and 1500 hours to 2400 hours. The readings were taken in three consecutive days, each, under a stretch of six weeks.

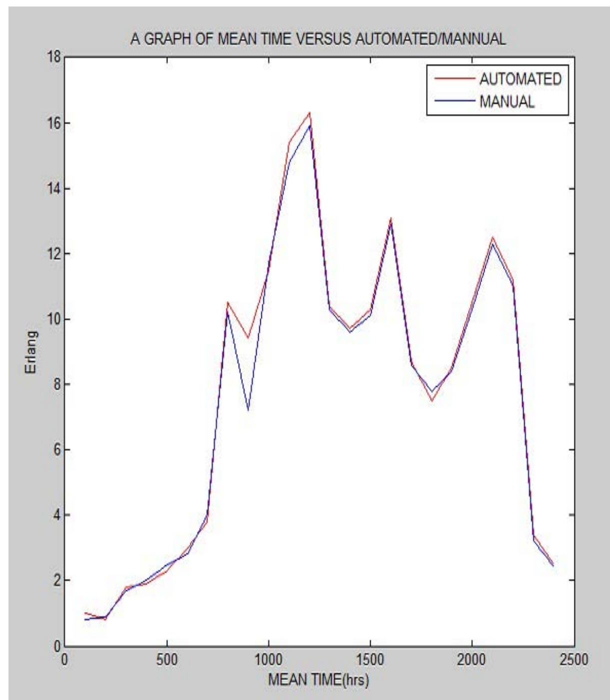

Fig.1 : Comparative mean values of traffic carried (Erlang) using automated / manual devices in a day

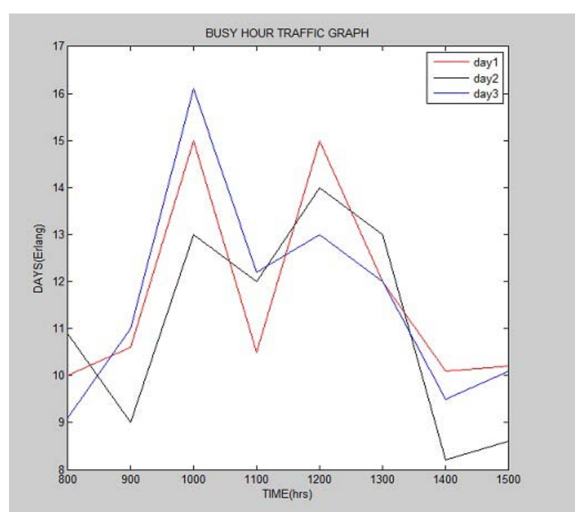

Fig.2 : Mean traffic values in Erlang recorded from 0800 hours to 1500 hours for three consecutive days

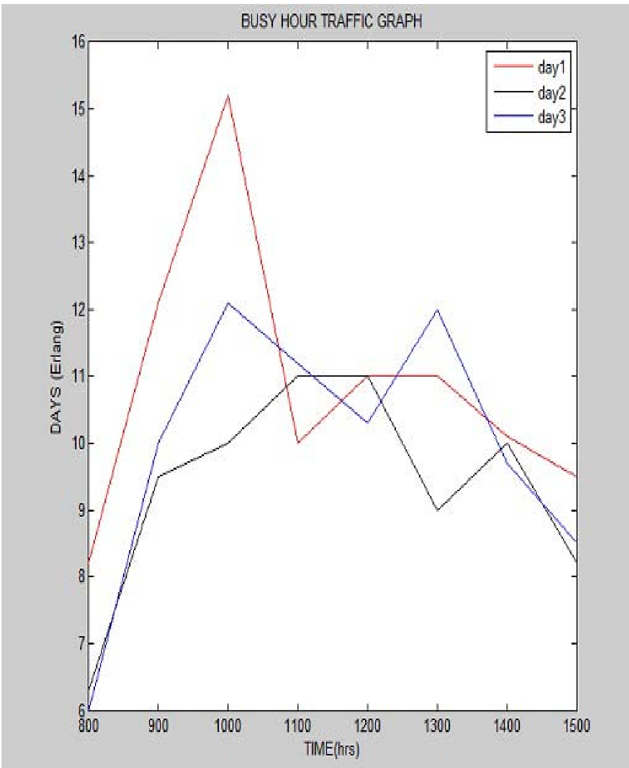

Fig.3 : Mean traffic values in Erlang recorded from 0800 hours to 1500 hours for three consecutive days

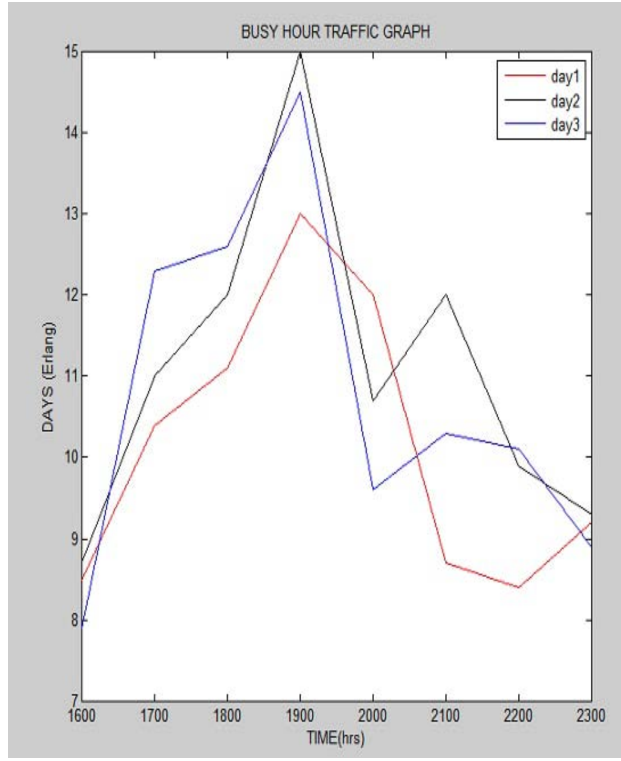

Fig.5 : Mean traffic values in Erlang recorded from 1600 hours to 2400 hours for three consecutive days

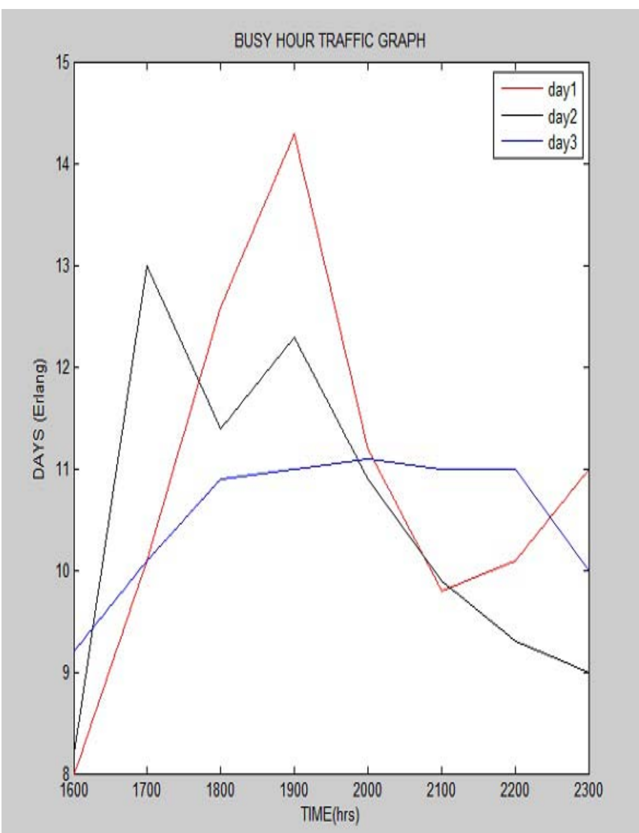

Fig.4 : Mean traffic values in Erlang recorded from 1600 hours to 2400 hours for three consecutive days

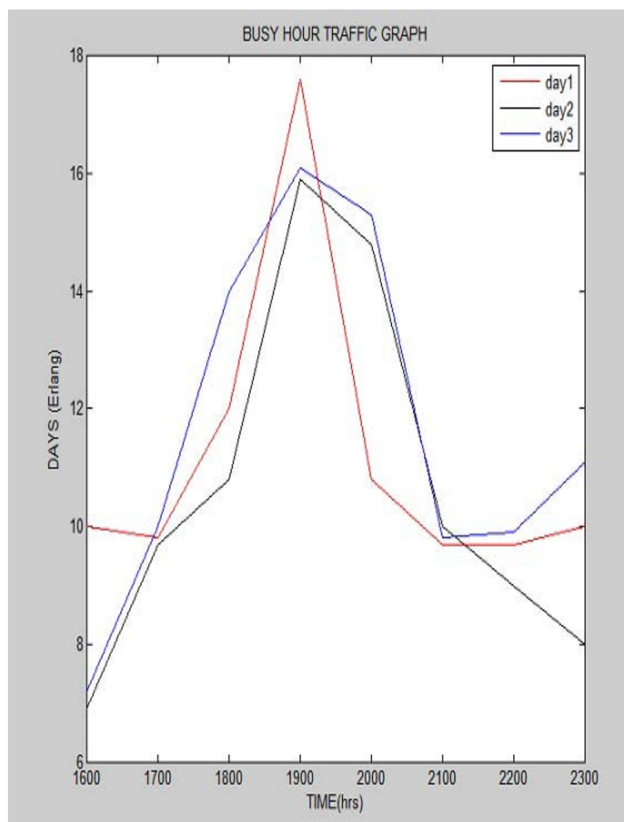

Fig.6 : Mean traffic values in Erlang recorded from 1600 hours to 2400 hours for three consecutive days

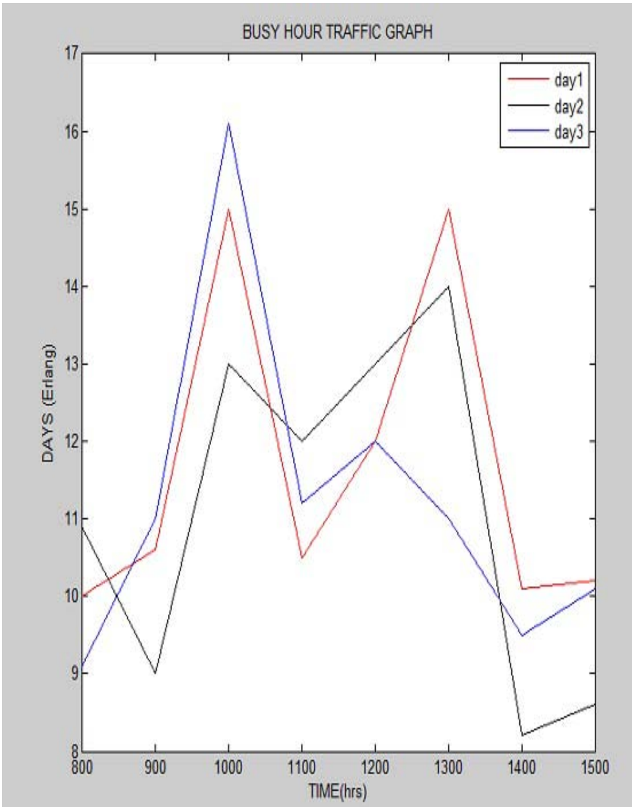

Fig.7 : Mean traffic values in Erlang recorded from 0800 hours to 1500 hours for three consecutive days

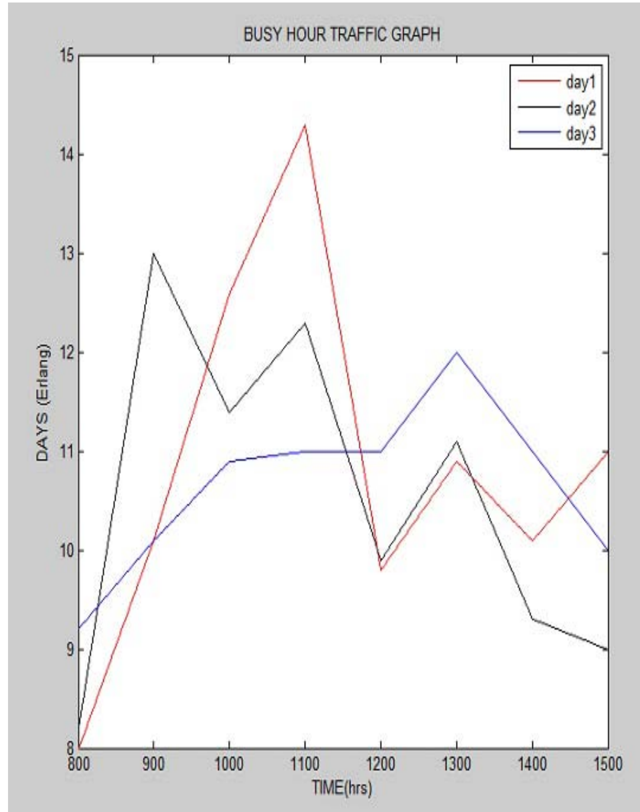

Fig.9 : Mean traffic values in Erlang recorded from 0800 hours to 1500 hours for three consecutive days

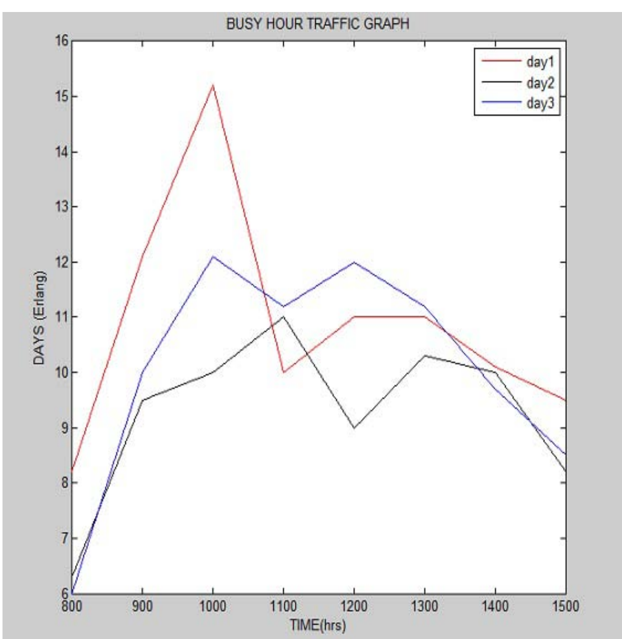

Fig.8 : Mean traffic values in Erlang recorded from 0800 hours to 1500 hours for three consecutive days

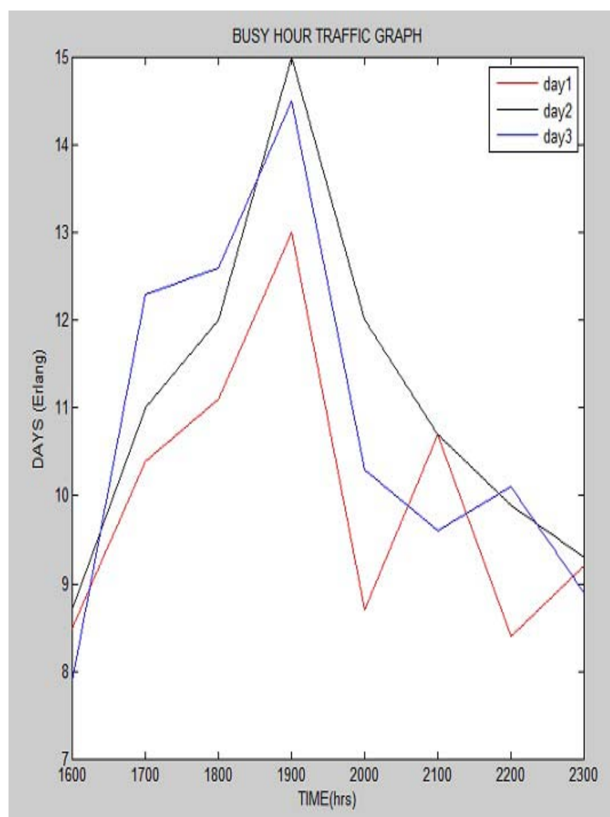

Fig.10 : Mean traffic values in Erlang recorded from 1600 hours to 2400 hours for three consecutive days

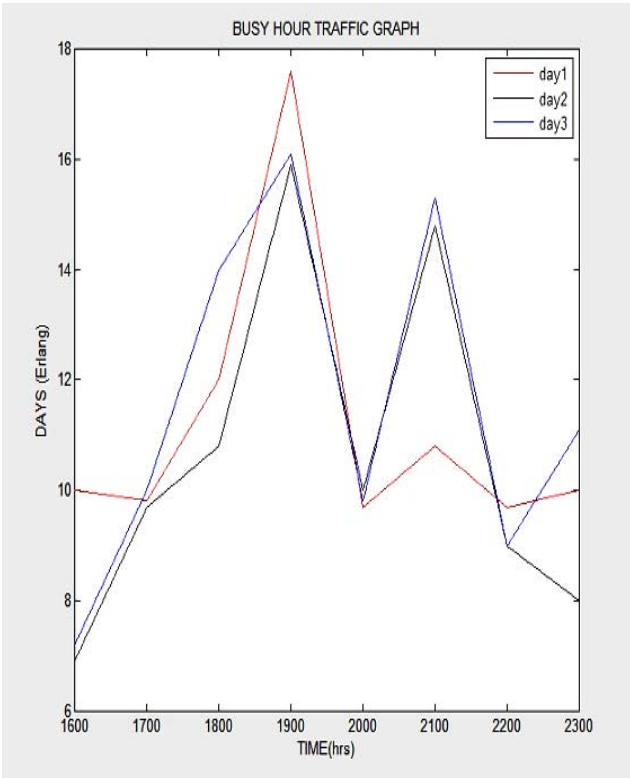

Fig.11 : Mean traffic values in Erlang recorded from 1600 hours to 2400 hours for three consecutive days

Fig. 1 is a comparative data acquired under similar conditions using two different measuring devices: computerized system and the manually operated device. Certain devices in common control switches such as markers and translators, though with very short holding times, are frequently seized. It is important to compare the accuracy of these manual devices with the automated values before deploying them. Measuring traffic data is expensive and earns no revenue for the network operator. It is therefore vital to organize it properly and efficiently in order to achieve the best GoS. As much as possible, measurements must be as accurate as possible, and any unavoidable inaccuracies or distortions must be clearly explained. In order to achieve both purposes, it is important to perform traffic measurements on a regular basis. Figures 2 to 11are mean traffic values in Erlang, recorded using the time frame of the two major traffic busy period (dips) recorded in Figure 1. , 0800 hours to 1500 hours and 1500 hours to 2400 hours. The readings were taken in three consecutive days each under a stretch of six weeks. As shown in these figures, there were inconsistencies in the traffic occupancy of these days. They revealed unsuspected features not reflected by limited routing measurements that are usually dependent on the busy hour alone; or assist to pinpoint the area of trouble when congestion threatens. As demonstrated by Fig. 1 to Fig. 11, the traffic carried on each group or route is a direct measure of the flow of traffic in Erlang. The traffic carried (T) on each route is equal to the time-average of the number of busy circuits. If E is the grade of service offered and A, the offered traffic, then: T = A (1 –E). When E is small, A approximates to T. Thus, if we can measure the average number of busy circuits, the traffic carried can be the estimate of the traffic offered.

The traffic curves are based on measurements usinga medium – sized telephone exchange in a mixed business/residential area (60% business) during working days and nights. The busiest hours were situated between 8 and 10.30 am. After a dip during the lunch period (from noon till 1pm), traffic increased again but did not reach the morning level. There was also a peak at about 4pm. From these analyses, pure residential areas showed the highest peak occurring in the evening (between 6pm and 8pm).Private Internet users can shift the busy hour also to the evening period (7pm to 8.30 pm). Access to Internet can also increase the average call duration(up to 20 minutes to 2hours)by a single subscriber. It is also possible that seasonal influences can occur. Example: traffic increases in touristic resorts during holidays.

Standard traffic theory proceeds on the assumption that during the busy-hour, traffic process is on statistical equilibrium with only random fluctuations and no systematic variations. That successive days in a measurement period are comparable. However, this study showed that this assumption cannot be true, considering the wide variability of traffic between busy hours and other period.

Furthermore, the study has demonstrated that if Fig. 2 to Fig. 11 were dependent on the busy hour traffic alone, necessary traffic details would have been omitted.

The time-consistent busy hour reduces the quantity of data to be collected and processed mostly in large capacity switching centers. This measure affects the overall result of data collected; which invariably distort the interpretation of data. However, in a mini switching module environment, this becomes less important, in view of the need to reduce data base and cost.

Busy – hour time consistent traffic scheme has worked in modern switching environment, using the simple assumption that the service provided during the determined busy hour was randomly distributed to other hours. Another assumption is that subscribers were more concerned with those times when they were significantly delayed or repeatedly blocked. Indications by this study showed that this scenario can be reliably practiced in a voice dependent bandwidth networks, and not in the present heterogeneous networks. It is therefore inferred that service criteria based on the average mean holding time, a consistent parameter used to determine the busy hour isa concept that is recommended for modification.

IV. Conclusion

Often, customers are irritated whenever the network experiences peak load hours. Researchers have demonstrated that traffic peak loads follow the extreme value–distribution. However, new data system and technology have made measurements, collection and fitting of peak hour distributions to be easily processed with less dependence on the customized time/call consistent busy hour.

The EWSD–2000, switching system, used for this study routinely provides various reports without user intervention. Reports on each peak value observation were compared with control limits which are functions of the extreme engineering value distribution. Printed data were coded to identify observation on low and high day control limits. The rejection of a high day service usage by the switch is critical; and thus, the high day control limit of the switch counter was set at P (highest of N peaks > x) = 1 – $P^N(x)$ < 0.2. The counter is incremented once for each value either exceeding the 14–day peak load threshold, $\bar{X} + 1.86588$, or the 14–day peak usage capacity which is a function of the number of facilities provided and the service criteria. For any observation lower than these, the counter is decremented by one to a lower limit of zero. This standard is the universal engineering practice that is hereby considered obsolete and recommended for modified. The modification can form the basis for further studies on configuration of mega-traffic networks by stake holders.

From the above presentations, daily traffic analyses are deemed better in determining the actual network usage and real-time customers' behavior. These variables are very relevant for maintenance, operation and planning forecasts. The study, therefore, counters the current general practice of using fourth-nightly time consistent peak engineering value distribution.

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PCT Symmetric Black Hole Radiation from Semiclosed Friedman Universe and Zitterbewegung of Radiating Particle

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Abstract- Einstein's early thought experiment of a tiny clock ticking (quantized) around a closed loop in Newton potential $-GM/r$ (gravitational Bohr atom), is revisited and its cosmological implication is considered by first replacing the point mass M by a magnetc flux confined within a slender tube standing perpendicular to the plane of the paper, indicating probable existence of a pair of magnetic monopoles at the north and the south poles of the double-valued Friedman universe projected on 2-dimensional plane. The clock is next replaced by a wavelike test particle ticking with Planck period and the Newtonian mass M by a Planck scale proper mass of the semiclosed Friedman black hole joined onto asymptotically flat outer space in early and later inflationary epochs of expanding and contracting universe, emitting radiation from P (left-right)-C (particle-antiparticle) and T(future-past) symmetric path of the test particle zigzagging in time (Zitterbeweging). A direct imaging of trembling motion of a laser-activated ion clock trapped by strong electrodynamic potential in Bose-Einstein condensates, simulating Dirac's monopole and Zitterbewegung, followed by energy emission, simulating Hawking radiation, is briefly mentioned.

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Keywords: quantum theory; general relativity; cosmology; black hole; dark energy.

I. Introduction

In previous discussions[1,2] we considered a formation of Planck scale black holes in early and later stages of the expanding and contracting semiclosed Friedman universe joined onto asymptotically flat outer spaces through Schwarzschild bottleneck. We here consider a gravitational Bohr atom as a model of the metastable Friedman black hole emitting radiation on the background of perturbed cosmic radiation. PCT-symmetric interpretation of Hawking radiation from the Planck scale test particle zigzagging in time (zitterbewegung) on the event horizon is also given.

II. Einstein's Clock and Monopole

In an attempt to incorporate electromagnetism into general relativity, Weyl[3] proposed in 1918-9 an idea of spacetime dependent scale variations of particle paths. But Einstein[4] rejected the idea and proposed a thought experiment: Consider two clocks ticking around their respective loops L_1 and L_2. The Newton potential $-GM/r$ of a point mass M is contained in the loop L_2. These clocks, originally identical at O, would go at different speeds after they brought about their respective loops and meet at the starting point O. Thus: "The length of a common ruler or the speed of a common clock would depend on its history."[4] A common clock with mass m ticking along the hyperboloid of world lines with spatial period $l_m = \hbar/mc$ crossing the time axis at $ct = l_m$ of the light cone was considered by Penrose.[5]

Later in 1986 Yang[6] replaced Einstein's clock by an electron and M by a magnetic flux Φ confined within a slender tube standing perpendicular to the plane of the paper, and emphasized the role of the integral around the loop as the phase factor (wave function) in quantum mechanics:

$$\exp i\oint \mathbf{A}d\mathbf{r} = \exp i\Phi, \qquad (1)$$

explaining visible Aharonov-Bohm (AB) interference fringes on the detector plane, restricting Maxwell's vector potential **A** to have discrete values in double-connnected space or all space minus r = 0:

$$e \quad \mathbf{A}d\mathbf{r}/hc = e\Phi/hc = n = \text{integer}, \qquad (2)$$

telling that the AB experiment is dependent only on the flux modulo hc/e:

$$\Phi(\text{modulo } hc/e). \qquad (3)$$

The magnetic monopole having magnetic charge g = hc/e, predicted by Dirac[7] in 1931 by considering a magnetic flux crossing a cap bounded by a closed loop, was recently created experimentally as an electrodynamically stimulated ion clock confined within strong Coulomb potential in super-cold spinor Bose-Einstein condensate and spin ice.[8]

We note that the semiclosed Friedman universe, contracting and expanding between asymtotically flat outer spaces, can be projected onto 2-dimenional plane of the paper: evolutionarily earlier upper hemishere filled with dark energy and the evolutionarily later lower hemisphere filled with dark matter underneath the paper with probable existence a pair of magnetic monopoles at the north and the south poles of the double-valued Friedman universe, connected or diconnected, by Dirac string.

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III. Nambu's Mass Formula

Dirac considered a magnetic monopole of charge g creating a magnetic flux Φ crossing a cap bounded by a closed loop, getting the mass spetrum of the monopole.

$$m_{mono} = n(\hbar c/2e), \quad n = \text{integer}, \tag{4}$$

Numbu's similar mass formula[9] was proposed for elementary particles discovered before 1952: μ, π, K, τ (mesons), P/N (proton/neutron), Λ, Σ, Ξ, Ω, Λ_c (baryons):

$$\begin{aligned} m_n &= n(\hbar c/2e^2)m_e \\ &= (137n/2)m_e,\ m_e = \text{electron mass}, \\ n &= 3, 4, 14, 15, 16, 17, 18, 19, 24, 33 \end{aligned} \tag{5}$$

as "a convenient aid to memory." The relation (5) was reexpressed as[10]

$$\begin{aligned} m_n c^2 &= (n/2)(\hbar c/L), \\ &= (n/2)Gm_{pl}^2/L, \end{aligned} \tag{6}$$

where $m_n c^2$ is the relativistic rest energy of relatively stables "point-like particles"[11] around us; $L = e^2/mc^2$ is the classical electron radius and m_{pl} the Planck mass, relating classical electrodynamics, quantum theory, relativity and Plackian cosmology.

IV. Stellar Mass and Hawking Temperature

A typical stellar object has a mass[12]

$$\begin{aligned} m_{stellar} &\sim (m_{Pl}/m_p)^2 m_{pl} \\ &= (l_P/l_{pl})^2 m_{pl} \sim 10^{33}\text{g}, \end{aligned} \tag{7}$$

where

$$m_{pl} = (c\hbar/G)^{1/2} \sim 10^{-5}\text{g} \tag{8}$$

is the Planck mass; $l_P = \hbar/m_{pl}c \sim 10^{-33}$cm the Planck lengh; $m_p \sim 10^{-24}$g and $l_P = \hbar/m_P c \sim 10^{-12}$cm are the proton mass and wavelength, $(l_P/l_{pl})^2 \sim 10^{38}$ being the number of Planckeons contained on the surface of the proton or the holographic information content of the proton related to entropy $S = \pi\kappa(l_P/l_{pl})^2$, where κ is the Boltzman constant. That is, the most stable point-like particle, proton, has entropy,

Consider Hawking radiation[13,14]of the Schwarzschild black hole of a typical cosmological object, static or collapsing, with Newtonian mass M, radius R and gravitational radius $r_g = 2GM/c^2$. Then the Hawking temperature T_H is given by

$$\begin{aligned} T_H &= \hbar c/\kappa r_g = Gm_{pl}^2/\kappa R. \\ &= 10^{-28}\text{K} \end{aligned} \tag{9}$$

for $R = H/c = 10^{28}$cm, the radius of the universe expanding with Hubble velocity H. The maximum tempeature

$$\begin{aligned} T_{max} &= Gm_{pl}^2/\kappa l_{pl} \\ &\sim 10^{32}\text{K} = (R/l_{pl})^2 T_H. \end{aligned} \tag{10}$$

is obtained for $R = R_p = l_{pl}$, realized by almost closed Friedman universe with proper radius $R_p \sim l_{pl}$ and mass $M_p \sim m_{pl}$ having holographic information contents $(R/l_{Pl})^2 = 10^{120}$.

V. Holographichic Hypothesis

The holographichic hypothesis states that, "If $V = 4\pi R^3/3$ is the region of space with boundary surface $\delta V = 4\pi R^2$, there is a description of nature in which all the information contents of the black hole is stored outside the imaginary surface just outside the event horizon of the black hole in degrees of freedom."[15] The number $(R/l_{Pl})^2$ is regarded as the number of Planckeons on the surface of the event horizon of the semiclosed Friedman universe, joined onto aymptotically flat outer space through Planck scale Schwarzschild bottleneck, a topological structure developped in the Planck scale Lorentz sphere at the poles of the universe allowing spacelike hyperboloid extending to asymptotically flat outer space. The present Big Bang universe is regarded to have expanded from a timelike hyperboloid in Lorentz sphere at the north pole of evolutionarily earlier upper hemisphere of the universe. But it is conceivable that the universe arose from a collision between spacelike hyperboloids where a timelike 3-vector is undefined.

VI. Radiation from Friedman Black Hole

The semiclosed Friedman universe was intended to explain the origin of extragalactic quasistllar radio sources with large radius and mass defect filled with low density dust-like matter or dark energy. We here consider a Planckeon as a test paticleon on the surface of the Friedman universe having Newtonian mass M and radius R forming a gravitational Bohr atom described by the radial line element

$$ds^2 = g_{rr}c^2dt^2 - g_{rr}dr^2 \tag{11}$$

where

$$\begin{aligned} g_{tt} &= g_{rr}^{-1} \\ &= 1 - r^2/r_g^2 + L^2/(m_{pl}c^2 r)^2 \\ &= 1 - r^2/r_g^2 + L^2 l_{pl}^2/r^2. \end{aligned} \tag{12}$$

Here $r_g = 2GM/c^2 = R$ for closed universe, $R < r_g$ for semiclosed universe. $R = r_g/2$ is the equator dividing lower and upper hemispheres of the univese joined respectively onto asymptotically flat outer spaces through Schwarzschild throat $(0 < R < r_g/2)$ and double-valued bottleneck $(r_g > R > r_g/2)$.

The angular momentum

$$L = m_{pl} r^2 d\theta/dt \quad (13)$$

is quantized as

$$L^2 = l_\theta (l_\theta + 1),\ l_\theta = \text{integer.} \quad (14)$$

The kinetic (free) energy of the test particle moving on the elliptic Bohr orbit is given by

$$E_\theta = (1 - g_{tt}^{1/2}) m_{pl} c^2. \quad (15)$$

where $g_{tt}^{1/2} m_{pl} c^2$ is the proper rest energy of the Planckeon for local observer. This energy is liberated in the transition from elliptic ($l_\theta >> 1$) to circular ($l_\theta \sim 1$) Bohr orbit.

We notice that the E_θ has two local maxima at $r_B \sim r_g = R = 10^{28}$cm where the light velocity ($ds^2 = 0$) vanishes: $dr/dt = c(g_{tt}/g_{rr})^{1/2} = 0$ and at

$$r_C = (l_\theta l_{pl} r_g)^{1/2} \sim l_\theta^{1/2} 10^{-2}\text{cm}, \quad (16)$$

where $dr/dt = c$, to be compared to the radius of the causally related area in inflationary universe:

$$(T_0/T)R = (3/10^{27})10^{28} \sim 30\text{cm} \quad (17)$$

reached after Big Bang when the temperature of the cosmic back ground radiation was $T_C \sim 10^{27}$K compared to the presently observed temperature $T_0 = 3$K.

VII. Black Hole Radiatiion from Zigzagging Particle

Dirac's P (left-right) C (particle-antiparticle) T(future-past) symmetric photon propagator[2,16] D is defined as

$$D(r,t) = \alpha(t)\delta(c^2t^2 - r^2)$$

$$= [\delta(ct - r) - \delta(ct + r)]/r$$

$$= D_{ret} - D_{adv} = D_+ - D_-, \quad (18)$$

where

$$\alpha(t) = t/|t| = 1 \text{ for } t > 0 \text{ and } - l \text{ for } t < 0 \quad (19)$$

is the step function annihilating a photon incoming from $r = -\infty$ at the origin $r = 0$ of the past light cone $\delta(ct+r)$ and creating another photon on the future light cone $\delta(ct-r)$; D_+ and D_- are the Fourier contributions to D from positive and negative frequency sheets; D_{ret} and D_{adv} are retarded and advanced propagators.

To allow Stückelberg-Feynman[17]interpretation of an antipaticle as a negative energy particle going backward in time, Feynman proposed a PC and T-symmetric propagator which we denote as D_F:

$$D_F = D_{ret} + D_-,$$

$$D_F = D_{adv} + D_+ \quad (20)$$

so that

$$D_F = D_+ \text{ if } t > 0 \text{ and } D_F = D_- \text{ if } t < 0. \quad (21)$$

The role of D_F in "V-shaped bi-directional EPR correlation" P↔S↔Q between events at P and Q, separated by a spacelike distance but sharing a common source at S in the past, was discussed at the 1983 Tokyo conference.[18] We here visualize a PC and T-symmetric interpretation of Hawking radiation by a "Feynman diagram" of a test particle "zigzaging in time against causal wind." There the retarded particle wave $\exp i(\omega t-kr)$ incoming from a source A at $r = -\infty$ with propagator D_{ret} is captured by the gravitational potential of the black hole at B, and from there goes backward in time ($t \rightarrow -t$) by D_- as a negative frequency wave ($\omega \rightarrow -\omega$) $\exp i(|\omega||t|+kr)$ on the left arm of the past light cone of B to meet the advanced wave $\exp i(\omega t+kr)$ incoming at C from the detection point R at $r = \infty$ on the right arm of the future light cone of C; The retarded wave $\exp i(\omega t-kr)$ from C is annihilated by the detector at R by the counter-propagating advanced wave $\exp i(\omega t+kr)$ from R, forming a combined wave $D = D_{ret} - D_{adv} = D_+ - D_- = \exp i\omega t \sin kr$ on the double light cone where the right arm of the future light cone of C and the left arm of the past light cone of R share a common light path between C and R, creating a PC and T symmetric and bi-directional information flow C↔R of Cauchy data at C and R.

To describe the transition B→C going backward in time, we replace the step fuction $\alpha(t)$ (19) by the square (step-up and down) function:

$$\beta(t) = 1 \text{ for } t_B < t < t_C$$

$$= 0 \text{ for } t_B > t \text{ and } t > t_C, \quad (22)$$

creating a particle at B and annihilating the same particle at C. The amplitude of the N-shaped particle transition, A→B→C→R, can be expressed as

$$\int_A^R d\tau = \int_A^B (g_{tt+})^{1/2} cdt \int_B^C (g_{tt-})^{1/2} dt \int_C^R (g_{tt+})^{1/2} cdt$$

$$= \int_A^B d\tau \int_B^C d\tau \int_C^R d\tau$$

$$\rightarrow \int_A^R \exp i[(\omega_A + |\omega_B| + \omega_C)] d\tau. \quad (23)$$

While equation (23) gives a time-dependent spectrum of emitted radiation, the accumulation of successive phase changes in the integral tells that the proper time τ continues to increase with the phase $|\omega||t|$ as one follows the particle path from one scattering point to the next, zigzaggig in time.

VIII. Gravitational Zitterbewegung

To visualize 1-dimensional Zitterbewegung, write the radial line element of Friedman metric as

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

$$= (g_{tt+} g_{tt-})^{1/2} c^2 dt^2 - (g_{tt+} g_{tt-})^{-1/2} dr^2, \quad (24)$$

where $g_{rr+} = 1 - r/r_g$,

$$g_{tt-} = 1 + r/r_g \quad (25)$$

so that

$$g_{tt} = (g_{tt+}g_{tt-})^{1/2} = 1 - r^2/r_g^2. \qquad (26)$$

Here ds_+ and ds_- are line elements going respectively forward (expanding) and backward (contracting) in time. That is, ds has two-sheeted structure represented by 1x2 state matrix $ds = (ds_+ \; ds_-)$. The flip-flop between two states is decribed by 2x2 matrix $\sigma = ({}_1{}^1)$ so that $\sigma ds_+ = ds_-$, $\sigma ds_- = ds_+$ and $\sigma^2 = ({}^1{}_1) = 1$.

The transition amplitude between ds_+ and ds_- is

$$<ds_+|E|ds_+> = (r/l_g)^2 \exp(i2E\tau/\hbar). \qquad (27)$$

Here $E = (g_{tt+})^{1/2} m_{pl}c^2$ is the local energy varying from 0 to $m_{pl}c^2$ with light velocity $dr/dt = c(g_{tt+})^{1/2} = c/n(r)$ where n(r) is the refractive index of the medium.

Zittebewegung of the test particle is represented by

$$<ds_+|\sigma(\tau)|ds_+> = \exp(i2E\tau/\hbar)$$

$$= 1 \text{ if } 2E\tau/\hbar = 2\pi n, \ n = \text{integer} \qquad (28)$$

giving uncertainty relation between E and τ:

$$E\tau = nh. \qquad (29)$$

A direct imaging of Zitterbewegung of a super-cold and laser-activated ion clock trapped by strong electrodynamic potential, simulating a black hole, in Bose-Einstein condensates followed by energy emission, simulating the Hawking radiation, was reported recently.[20]

IX. Conclusion

Previous discussions[2,16] of PCT-symmetric and V-shaped EPR correlation is extended to PCT-symmetric black hole radiation from N-shaped zigzagging particle path on the basis of local accuracy of special relativity (weak equivalence) and asymptotic accuracy of Friedman solutions joined onto flat Euclidean space (strong equivalence) of Einstein's general relativity equations including singularities in particle source, detector and event horizons, allowing topological (non-Hasdorff) nature of the Lorentz sphere at the origin of the light cone and the bottleneck structure of the Einstein-Rosen bridge[21] intended to create a particle from the universe.

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A Posteriori Speculations using Current Mass-Energy Composition of the Universe

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Keywords: universe composition, dark matter, red shift, visible matter, dark energy.

GJSFR-A Classification : *FOR Code: 291802*

APOSTERIORISPECULATIONSUSINGCURRENTMASSENERGYCOMPOSITIONOFTHEUNIVERSE

Strictly as per the compliance and regulations of :

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Abstract- According to Planck Mission, the observable universe comprises of 26.8% dark matter, 68.3% dark energy and 4.9% ordinary matter. By calibrating or fine-tuning a speculative equation of matter composition, this work confirmed observable consequences of our theoretical insights, as the equation was solved for roots corresponding to 4.915% ordinary matter, 26.785% dark matter, and 68.300% dark energy, thus achieving nearly 100% overlap with the Planck Mission Statement. The equation also confirmed some of the earlier NASA Science Astrophysics statements.

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I. Introduction

Modern cosmology is in the process of revising the Big Bang model of space and time, [1,2]. This is due to the fact that based on the general theory of relativity the theoretical predictions do not correspond with observations at far away, i.e., at cosmological distances. The universe that we observe is a surprisingly homogeneous and isotropic in all directions and locations—parameters such as density, brightness, etc., do not differ: so-called cosmological principle holds. Based on this principle, the prediction of the contraction of the universe is not supported. On the contrary, cosmological observations not only confirm the cosmic expansion but the expansion with acceleration, see Nobel prize backgrounds, Saul Perlmutter, Brian Schmidt and Adam Riess [3]. This paper describes an alternative to the Big Bang model based on some speculative equilibrium equation or stable state of matter.

We propose a disputable thesis that a new matter must emerge as soon as the matter stable state has been established, since the old matter composition violates equilibrium equation or stable state criterion. Based on this premise, the previous stable state violates itself, resulting in a new matter formation inside the FLRW[1] *topology*. As a result of this newly created matter, the Universe, on average as a whole, achieves a lower *quasi-density* μ of matter compared to that of the previous state. This violation arises due to gravitational potential energy induced into the topology, providing a theoretical foundation for a stable states evolution, as a dynamics of some speculative equation roots. In view of this thesis, the declining quasi-density serves as an indicator of matter formation. Thus, it provides the means for replacing the time component of metric evolution—typically established by the time dynamics—by quasi-density μ. While this is a far-reaching and highly unconventional assumption, it promotes more diverse ways of understanding of the dynamics of the evolution of matter and energy in the Universe. In view of the aforementioned assumption, the time variable will be omitted from all further considerations.

We have confirmed some of NASA statements regarding the Universe evolution. By calibrating equilibrium equation, the percentages of the visible and dark matter in their proportions to dark energy yielded nearly a 100% overlap with the latest Planck Mission data. Second, the model supported the Big Bang inflation stage. Using our theoretical foundations we have shown that tiny lump of space was first inflated solely by the dark matter. Third, we predicted that after the inflation stage, the topology was expanding, with decreasing quasi-density, but with accelerating quasi-velocity. This has been established from the equation, the outcomes of which confirm that the topology was also expanding more slowly in the past. Next, we posited a critical value of the quasi-density at which the dark energy will be exhausted. In such an event, the space topology would allegedly collapse into a quasi-critical composition. This is likely to occur in line with the standard cosmological LCDM model [4], albeit earlier than typically predicted. In quasi-critical composition, the dark matter will contract rather than expand, in contrast to visible matter, which will continue to expand. Finally, since superposition of dark and visible matter was postulated, albeit separated by cosmological distances in FLRW metric, this provided conditions for the two forms of matter evolution undergoing on opposite sides of topology, analogous to Moebius strip. Each Speculation has been derived graphically.

Before we proceed, we wish to outline our narrative, consisting of seven sections, including introduction. In Section II, via pedagogical exercises, we describe phase transition of a hypothetical dark energy field into the matter inside the FLRW topology. In Section III, we present the equilibrium equation. Section IV is dedicated to fine-tuning the parameters of our

[1] FLRW—Friedmann-Lemaître-Robertson-Walker

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equilibrium equation with regard to the alleged mass-energy composition of the Universe. To consolidate our Speculations with the current data pertaining to cosmological observations, we have implemented a calibration of unconventional parameters that facilitates the use of roots of our speculative equilibrium equation. In Section V, we challenge our Speculations, concluding that their rejection is likely implausible, as they confirm rather than deny NASA statements about the composition of the Universe in the past. The paper ends with concluding remarks, given in Section VI. Finally, in Section VII, we provide mathematical derivation of three-dimensional globes' volumes in the FLRW metric that in accord with our Speculations, are filled with matter.

II. Pedagogical Foundations

In this section, we try to explain our geometric model's foundation using pedagogical exercises relating to three unconventional parameters Λ, λ and μ. We are attempting to explain the basic postulates of our model via plausible examples.

We highlight the view regarding the possibility of describing events implying that one event took place prior or after another. Nuclear physicists can determine the age of a material by noting the average number of atoms that have undergone radioactive decay. In this way, geologists can determine the age of a rock by observing unstable atoms undergoing a decay, recording the half of the atoms still present in the rock and comparing samples that have undergone the decay—referred to as radioactive half-life. Assume that we are able to count not only of the average number of atoms undergoing the decay but an exact number of atoms belonging, for example, to a Sn isotope in a rock. Assume also that we can do so with an high accuracy by taking into account every single atom remaining after the decay. We cannot perform such an experiment. However, we can establish the *quasi-number* of atoms remaining after the decay as some *quasi-time* equivalent to the age of the rock under observation. Looking at different parameters characterizing the rock, such as size, temperature, etc., we can establish the *quasi-velocity* of these parameters by noting the number of atoms that have not yet undergone decay. In the same vein, we can establish the *quasi-age* of the Universe without recourse to the clock. Suppose we pointed our telescope toward some portion of three-dimensional sky on which we superimposed a grid cell. This would allegedly allow us to count the *quasi-number* of photons, electrons, and all atoms of various types of matter, including galaxies. Once the process is complete, we can focus the same telescope on some other part of the sky. Assuming that the Cosmological Principle [5] is true, we can expect the results to match at the same distances from the centre and in all directions of our observations. In particular, our *quasi-measurements* will be useful when the observations made are incompatible with Newton's dynamics—i.e., the measurements made at cosmological distances. In this scenario, the key challenge is to compare the densities measured at closer and longer distances as indicators of the age dynamics of the Universe.

Assume that the density—henceforth denoted as *quasi-density*—of various particles (photons, electrons, etc.) measured in the first observation at closer distances differs from the second, taken at far away distances. We can now assert that, at closer distances, the quasi-density in the grid cell is less than that of the same cell at far away distances. This assumption is in line with the Hubble's law [6]. Thus, we can discover the age dynamics of the Universe because the *quasi-densities* of matter at these two locations are indicating that the areas of lower quasi-density (at closer distances) have emerged later than similar areas with a greater quasi-density (at a far away distances). Our aim is thus to emphasize that the quasi-density of matter can be chosen as an indicator of the age of the Universe. This will allow us to investigate the evolution of the Universe in terms of the quasi-density instead of a time parameter.

Matter exists in four fundamental states—solid, liquid, gas and plasma—and can undergo a transition from one state/phase to another. At normal atmospheric pressure, water turns to ice at temperatures below $0^{\circ}C$, whereby the water state symmetry transforms into crystal symmetry. Super-cooling is the term applied to describe the cooling of a liquid below its freezing point without it becoming solid, e.g., cooling the water below $0^{\circ}C$. Thus, when undergoing a phase transition to ice, a super-cooled water can release a latent heat [7]. As the ice floe can be measured linearly by three-dimensional coordinates, the volume of water must be measured in litres, rather than in cubic meters, etc. Pedagogically speaking, for the *Creatures* in the form of ice crystals, the water undergoing a phase transition is allegedly invisible, as they can neither observe nor measure liquid matter phenomena. They can, however, feel the heat or matter formation effects. From the mathematical perspective, a dark energy can undergo a phase transition from zero to a positive measure state. Measure theory is a way to assign a numerical value to every subset of a set, which allows examining the unions of subsets as a sum of their measures. An example of a positive measure is given by the mass of matter.

In modern cosmology, as previously noted, the Universe corresponds to Cosmological Principle of a homogenous and isotropic space, implying the same distribution of galaxies at each point and in all directions, universality of the laws of physics, etc. The Principle further acknowledges that all the laws of physics are applicable at all points in the Universe with the same precision because there is no point of reference (although any point within the Universe could be used for this purpose). It is pedagogically correct to recall a two-dimensional surface for flat Creatures, like that chosen by Einstein [8], implying that flat Creatures cannot imagine a three-dimensional world by walking on the flat surface of a balloon. The case seemingly suggests that we as three-dimensional Creatures inhabit a three-dimensional space. In reality, we are moving in a three-dimensional bounded surface of radius r, $0 \le r \le R$, embedded into four-dimensional hyper-sphere in the form of three-dimensional topology. All topology points are equal in all directions, without a centre and without a terminal point.

Suppose that our three-dimensional topology of radius R—we prefer to denote it as a globe of radius R—comprises of a kind of dark energy field that is not accessible to existing measuring instruments (a case akin to the crystal creatures not being able to use liquid measuring system in their solid world). As a result of some accident, at a given point within the globe, the energy field transitions into a seed lump of solid matter, which represents a transition of a 0-measure to a positive one. By supposition, lump of matter has to be in a dynamic equilibrium with dark energy field.

Einstein introduced the necessity of so-called cosmological constant Λ into his equations to ensure a static equilibrium of matter. According to the latest data [9], Λ represents the energy density, and equals to $\Lambda = 2.036 \cdot 10^{-35} s^{-2}$ in vacuum. A similar quasi-constant Λ would denote a similar stabilization effect representing the alleged dark energy potential level. We emphasize, that the lump of matter and the potential energy field embedding the lump must preserve the stable state while undergoing rapid inflation from zero and progressing with further expansion similar to [10a, 10b]. However, the matter formation singularity problem—the initial inflation of phase of Big Bang—has not been addressed.

We argue that the singularity does not exist because our equation permits a zero solution. We can thus assume that, starting from a state described by this zero solution, the matter suddenly inflates [11] the topology in phase transition from the aforementioned dark energy field. According to this postulate, when a *"lump of matter"* emerges, it will create an additional pressure on the previously allegedly *frozen energy*, thereby causing an additional *inflating effect*. We assume a presence of further matter formation akin to an "avalanche" rolling down the hill and gaining mass (and thus weight) due to *"potential energy of dark energy field."* The avalanche of the matter formation has to remain in a dynamically stable condition in accordance with our equation. This assumption confirms that the phase transition of dark energy into matter suddenly starts and will begin to move forward if the density of the *frozen energy* is incredibly high. Seemingly, an avalanche has occurred, shaping the matter formation inside the topology. In doing so, a *friable ball* cannot roll down a slope forever, as it would eventually crumble into pieces. While the snowball dynamic is just a pedagogical illustration of the matter evolution—depicting its origin and terminal state—it is advisable to examine a more rigorous reasoning next.

III. Equilibrium Equation

In formulating Speculations using our equilibrium equation reflecting the current mass-energy composition in the Universe, we are attempting to identify some stable states resolving equilibrium equation as topologies among three-dimensional globes of radius r, $0 \le r \le R$, embedded into the four-dimensional hyper-sphere of a curvature radius $R >> 0$, given by:

$$x_1^2 + x_2^2 + x_3^2 + x_4^2 = R^2 . \qquad (1)$$

Cosmological principle is an attribute of two-dimensional surface of a three-dimensional sphere. Extending the principle to three-dimensional slices of a four-dimensional hyper-sphere preserve the same properties. Therefore, the three-dimensional globes embedded into four-dimensional hyper-sphere (1) correspond to "surface slices," which are in accordance with the cosmological principle of homogeneity and isotropy.

According to Newton's laws it is well known that, for a globe of mass M with radius r, if the mass converges into a zero point, the potential energy of a gravitational field, at a distance r from 0, equals $-G \cdot \frac{M}{r}$, where $G = 6.67384^{-11}$ is the gravitational constant. Based on the Cosmological Principle, we can thus assume that our topology embedded into four-dimensional hyper-sphere (1), as a three-dimensional globe of radius r, is embedded into unknown energy field. Hereby, we able to hypothesize the process of matter formation, which occurs on the surface of the topology—that is, at a distance r from some centre. It should be reiterated that one can take any point for the centre, even the location of an observer. Hence, it is plausible to suggest that, at a distance r from the zero point, the matter formation takes place if the potential gravitational field intensity is strong enough—below the value of an universal constant Λ, i.e., at $-G \cdot \frac{M}{r} \le -\Lambda$. The matter formation dynamics, according to our thesis, is thus determined by a speculative equation $-G \cdot M + \Lambda \cdot r = 0$. Once the process of matter formation starts, it cannot be arrested or terminated, because increasing M requires

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increasing r in order to maintain the equilibrium of the speculative equation.

Given the gravitational constant $G = 6.67384^{-11} \cdot m^3 \cdot kg^{-1} \cdot s^{-2}$, the curvature $R > 0$ and G are supposed to be constrained by $G \cdot R^3 = 1$. Irrespective of the grid scale adopted, i.e., $(km)^3$ or $(light\ year)^3$, etc., the curvature R and constant G must match—e.g., for $(m)^3$ grid, $G = 6.67384^{-11}$ and $R = 2465.32816$ apply, whereas for $(km)^3$ grid, it follows that gravitational constant is $G = 6.67384^{-20}$ and $R = 2465328.16025$, etc. In other words, by imposing the equality $G \cdot R^3 = 1$ we are attempting to eliminate the grid ambiguity for the gravitational constant G. Considering the topology characterized by a positive curvature R, the value $R > 0$ is irrelevant, as choices of R and G are transparent. When constraining the curvature radius R, the validity of $G \cdot R^3 = 1$ is crucial for our further considerations.

Let us now turn our attention to the crucial energy level on the globe surface that forms the FLRW topology of three-dimensional vectors (x_1, x_2, x_3), i.e., to the level of potential energy at the distance r from the centum of the globe of radius r. As already assumed in our speculative thesis, there matter-energy composition undergoes change, which allegedly occurs on the three-dimensional surface embedded into the four-dimensional hyper-sphere denoted by Equation (1). More precisely, we introduce a parameter λ, which will allegedly represent a fine-tuning or calibrating parameter of the dark energy field defined by Newton, and features in the "modified potential energy" $-G \cdot \frac{M}{r^{\lambda}}$ like in MOND model [12]. In accordance with the Speculation of the matter-energy composition change, let us assume that the change occurs at the energy level equal to $-\Lambda$, i.e., at some universal constant discussed above. Thus, the change occurs by violating the equation $-G \cdot \frac{M(r)}{r^{\lambda}} + \Lambda = 0$, where $M(r)$ does correspond to the mass of a globe of radius r. This equation represents the stable set equilibrium applied to the matter-energy composition. Below, we will replace M by $M = U(r) \cdot \mu$, where $U(r)$ is the volume of the globe that is allegedly inflating/expanding. Hereby, we refer to the parameter μ as a quasi-density of matter. Consequently, the equilibrium equation might be rewritten in the form $-G \cdot U(r) \cdot \mu + \Lambda \cdot r^{\lambda} = 0$. Finally, we refer to the mathematical derivation of the latter equation upon our surface globe topology, presented in Section 7. We proceed as follows.

The surface rod ds^2 of three-dimensional globe of radius r, $0 \le r < R$, in accordance with Eq. (1), yields time independent part with the rod length of

$$ds^2 = \left(1 - \frac{r^2}{R^2}\right)^{-1} dr^2 + r^2\left(d\phi^2 + \sin^2\phi\, d\theta^2\right).$$

By the replacement of radius r in the form of $r = R \cdot \rho \cdot \left(1 + \frac{\rho^2}{4}\right)^{-1}$ [2], the resulting replacement transforms this rod to

$$ds^2 = R^2\left(1 + \frac{\rho^2}{4}\right)^{-2}\left[d\rho^2 + \rho^2\left(d\phi^2 + \sin^2\phi\, d\theta^2\right)\right],$$

which guarantees that the topology is embedded into a flat metric at short distances. Hereby, the rod volume is given by $ds^3 = R^3\left(1 + \frac{\rho^2}{4}\right)^{-3} \rho^2 d\rho \cdot \sin(\phi) \cdot d\theta \cdot d\phi$, $0 \le \rho < \infty$, $0 \le \phi \le \pi$ and $0 \le \theta \le 2\pi$. Thus, $s(\rho) = \frac{2}{\pi}\int_0^{2\rho}\left(1 + \frac{\xi^2}{4}\right)^{-3} \xi^2 d\xi$ represents a share in respect to the whole hyper-sphere volume $2\pi^2 R^3$, i.e., the volume of three-dimensional globe/topology of radius ρ filled with matter equals $U(\rho) = 2\pi^2 R^3 s(\rho)$. Taking the integral into account, we obtain

$$s(\rho) = \frac{2}{\pi}\left[\tan^{-1}(\rho) + \rho\frac{\rho^2 - 1}{(\rho^2 + 1)^2}\right].$$

Hence, with regard to $U(\rho)$, the equilibrium equation can now be rewritten as:

$$-4\pi \cdot \left[\tan^{-1}(\rho) + \rho\frac{\rho^2 - 1}{(\rho^2 + 1)^2}\right] \cdot \mu + \Lambda \cdot \rho^{\lambda} = 0, \qquad (2)$$

assuming that the equality $G \cdot R^3 = 1$ holds.

IV. Current State Calibration

Parameters Λ, λ and μ represent a triplet in Equation (2), where $-\Lambda$ is a mass-energy emerging quasi-level that speculatively characterizes dark energy

[2] This replacement is related to Landau and Lifshits, p. 435, The Field Theory, Russian ed., 1967.

field, λ is a tuning or calibrating parameter for the allegedly potential energy of the field itself, and μ denotes our speculative quasi-density of the topology. By introducing the constraint $G \cdot R^3 = 1$, we have succeeded in calibrating the roots of the equation, adopting the triplet $\Lambda = 0.91499$, $\lambda = 0.83751$ and $\mu = 0.12457$. The modified potential energy $-G \cdot \frac{M}{\rho^{\lambda}}$ declines for $\lambda < 1$ more rapidly at shorter distances (i.e., when $0 < \rho \le 1$) than for far away distances (when $1 < \rho < \infty$). This parameter value set provides the best fit to the Planck Mission Statement.

With respect to roots of the speculative equation (2), in order to calibrate it, the roots must point at the latest Plank Mission data of the mass-energy composition in the Universe with high accuracy. By implementing a ratio scale of quasi-density on the x-axis as a ratio of quasi-density μ to somewhat critical density $\mathcal{C}$, i.e., $\mu \cdot \mathcal{C}^{-1}$, while moving from higher to low quasi-density values, the roots should confirm, or at least not contradict, the already known statements about the Universe dynamics. In fact, Equation (2) can almost always be solved for two roots $\rho_0 < \rho_1$. The case with one root $\rho_0 = \rho_1$, as well as that described by $\rho_s = 0$, exist as well, as do those including no roots at all. For the triplet above, the roots $\rho_0 = 0.67535$ and $\rho_1 = 3.06548$ solve Equation (2). It can thus be verified that:

$$vm\% \,\big|\, s(\rho_0) \approx 26.785\%,$$

$$de\% \,\big|\, s(\rho_1) - s(\rho_0) \approx 68.300\%,$$

$$dm\% \,\big|\, s(\infty) - s(\rho_1) \approx 4.915\%.$$

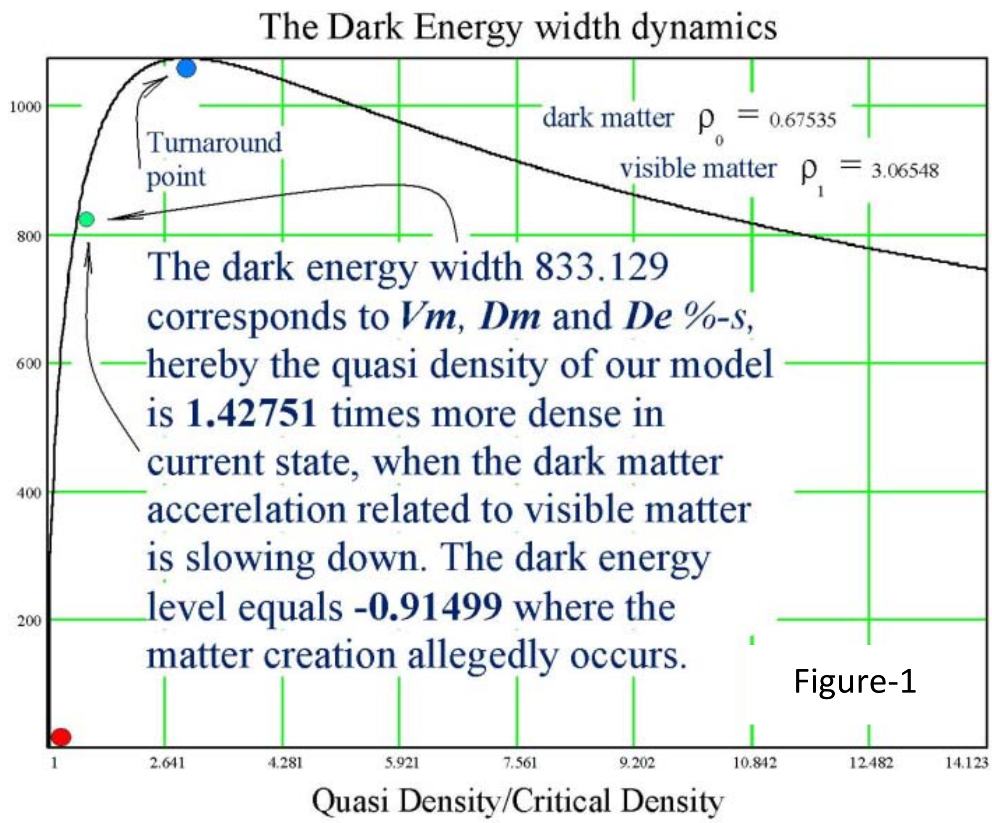
These percentages, with regard to the Plank Mission Statement, allow us to refer to ρ_1 as a visible matter starting point, which terminates at ∞. We can refer to ρ_0 as the dark energy starting point, whereby the dark energy terminates when it reaches ρ_1. In r-reference system $r = 2R\rho \cdot (1+\rho^2)^{-1}$, $r_0 - r_1$ denotes the dark energy width. From the above, it can thus be inferred that, while the percentages provide almost a 100% overlap with the Planck Mission Statement, the roots ρ_0 and ρ_1 produce a good fit only when $\mu = 0.12457$. Whatever the value $\mu = 0.12457$ of the quasi-density parameter proposes or is interpreted to imply, this Speculation points at $\mu = 0.12457$ as an alleged current state of the Universe.

a) *Comments on Figure-1*

Figure-1 shows the dynamics of dark energy as a function of quasi-density. The scale of the quasi-density on the x-axis extends from its critical value 1, and will continue to reflect the dark energy width while shifting to the right. If one moves in the opposite direction (to the left), using the analogy implied by the proposed scale, the figure shows that the formation of dark matter [13] precedes that of the visible matter because the gap between the two forms increases. When the distance

$$2\mathrm{R} \cdot \left(\rho_1 (1+\rho_1^2)^{-1} - \rho_0 (1+\rho_0^2)^{-1}\right),$$

which equals $\mathrm{r}_1 - \mathrm{r}_0$ on the y-axis, reaches some point, it stops increasing, closing the aforementioned gap. The reduction, as indicated in Figure-1, will be most pronounced in the vicinity of 1, where the red circle indicates the end of the evolution of the topology—the moment of reaching the critical density $\mathcal{C}$. Thus, as indicated by the blue circle, at the much later stages of evolution, the gap between the visible matter and the dark matter starts to close. One should pay attention to the state of the topology at the current stage—denoted by the green circle—at which the turnaround point of the present state of the topology has already been passed. When the gap started closing, the quasi-density of matter was about three times greater than that at the present state.



V. Rejection Attempts

a) The Case A. Speculation

The conclusion made here is based on the premise that, in line with this Speculation in question, the topology must stop changing its composition when the quasi-density declines below the threshold $\mu < 0.08727$. In this case, the dark matter will *collapse into or be in contact* with the visible topology when $\mu \approx 0.08727$ because $\rho_0 \approx \rho_1$. Let introduce a scale that commences at the point corresponding to the critical quasi-density ratio $\mu \cdot \mathcal{C}^{-1} \approx 1$, $\mathcal{C} \approx 0.08727$. On this scale, the current composition of the topology points at the ratio ≈ 1.42751. In contrast, when $\mu \cdot \mathcal{C}^{-1}$ exceeds very high values on the quasi-density scale, a negligible or infinitesimally small lump of dark matter suddenly emerges from the zero solution $\rho_s = 0$ of our speculative equation, Eq. (2), yielding

$$dm\% \approx 20.849742 \cdot 10^{-10}\% \text{ and}$$

$$vm\% = 0.00 \cdot 10^{-10}\%$$

for the visible matter. This fits well into the beginning of "*dark ages of the universe*" [14], indicating that dark energy $De\% = 99.99999999791503\%$ constitutes almost the entire topology, as illustrated by Figure-2. At the other end of the scale, when quasi-density decreases, and thus starts approaching the critical level $\mathcal{C} \approx 0.08727$, the roots of the equation cease to exist, while the alleged composition suggests $vm\% \approx 32.67\%$ and $dm\% \approx 67.33\%$. This last opportunity $\rho_0 \approx \rho_1$ for the equation to have a root is reached when $\mu \cdot \mathcal{C}^{-1} \to 1$, where the dark energy width approaches zero $(\rho_1 - \rho_0 \to 0)$. Thus, the roots of our speculative equilibrium equation, Eq. (2), do not contradict but rather confirm the NASA statement that the current density of the Universe Ω_0 on a scale $\Omega \to 1$ is ca. $\Omega_0 = 1.0010 \pm 0.0065$ away from a conventional critical density $\Omega = 1$, required for it to expand forever, as hypothesized according to the standard LCDM model [4].

i. *Comments on Figure-2*

Figure-2 depicts the case of quasi-density exceeding a critical value $\mathcal{C} \approx 0.08727$ 22.918.675 times. Based on the zero solution $\rho_s = 0$ of the equation, while moving to the right along the x-axis, the Speculation states that a positive root $\rho_0 > 0$ can be interpreted as a creation of a small lump of dark matter. To paraphrase this statement, we posit that the dark matter was created first, i.e., it preceded the visible matter creation—that is, the inflation Bang of the Big Bang resulted in the emergence of the dark matter only.

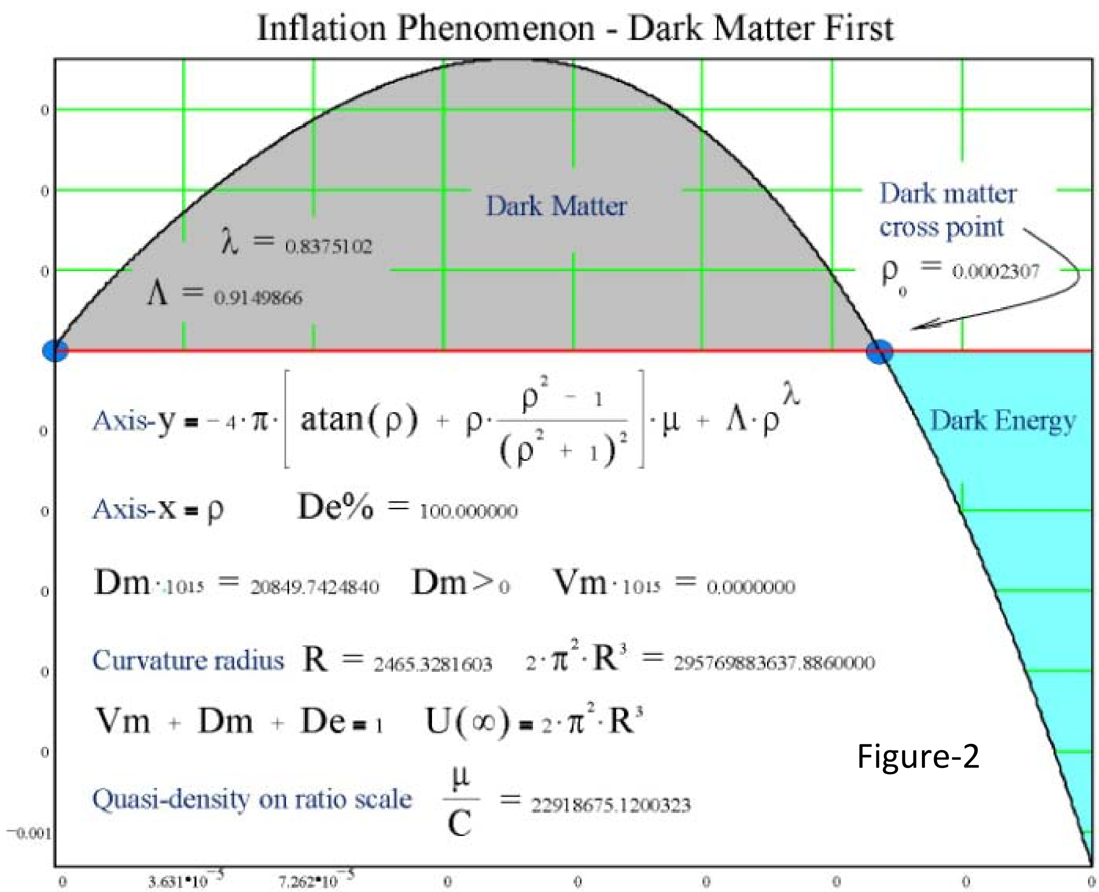


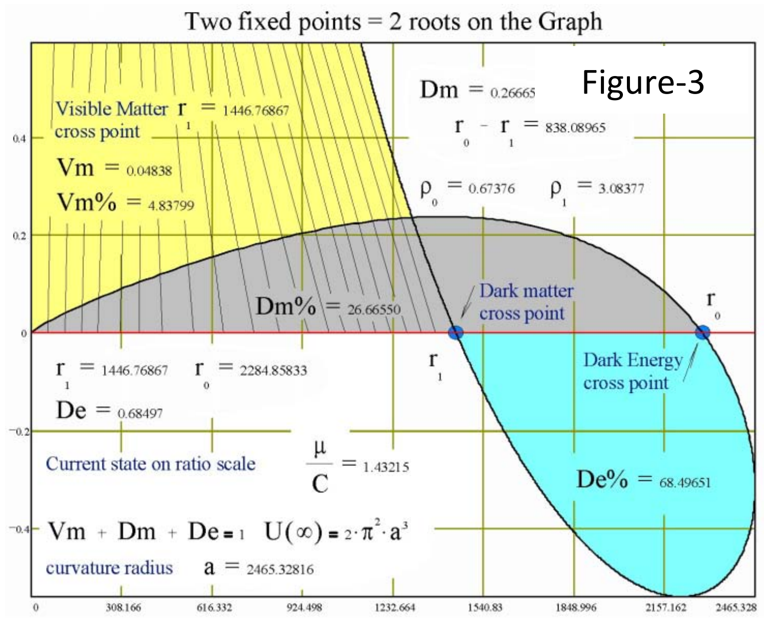
Figure-2

ii. *Comments on Figure-3*

The graphical illustration provided in Figure-3, denoting the link between the FLRW metric space filled with dark and visible matter with regard to dark energy, is the foundation for the study of the essence of all of our Speculations. On the x-axis, the radius r is given in the coordinate system $r = 2R \cdot \rho(1+\rho^2)^{-1}$ on three-dimensional surface of our four-dimensional hyper-sphere. While moving towards coordinate values $1 < \rho \to \infty$ the radius tends to zero $(r \to 0)$. Consequently, there is no one-to-one mapping of $[0,\infty] \to [0,R]$ because $[0,1] \to [0,R]$ and $[1,\infty] \to [R,0]$ and back again to 0 point. The values $0 \le \rho \le 1$ of ρ thus correspond to $0 \le r \le R$.

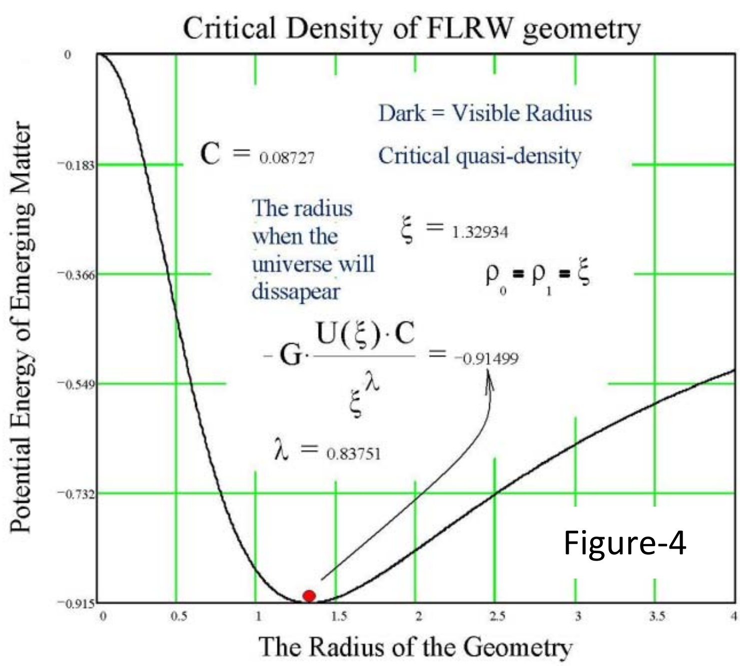
$$\Gamma(\mu,\rho) = -4\pi \cdot \left[\tan^{-1}(\rho) + \rho \frac{\rho^2 - 1}{(\rho^2+1)^2} \right] \cdot \mu + \Lambda \cdot \rho^{\lambda};$$

two roots ρ_0, ρ_1 resolve the equation $\Gamma(\mu,\rho) = 0$, at which the formation of matter allegedly occurs. Hence, it can be seen that Figure-2 corresponds to the quasi-density of matter $\mu = 0.12457$ supposedly representing the current state of the topology. While passing through the area highlighted in grey, we move from $0 \to r_0$. In the ρ coordinate system, when using $0 \to \rho_0$ we are moving along the positive portion of $\Gamma(\mu,\rho)$, which corresponds to 26.8% of dark matter. Positive values $\Gamma(\mu,\rho)$ indicate the region in the FLRW metric space, where the alleged formation of dark and visible matter already occurred. Moving into the region $\Gamma(\mu,\rho)$ denoting negative values (depicted in blue), we move through the dark energy, which accounts for about 68.3% of the total energy, and is sufficient for further evolution of the topology. Reaching the radius r_1, we enter the region of visible matter, occupying about 4.9% and moving away from $\rho_1 \le \rho \to \infty$. As depicted in Figure-2, at the radius r_1 and beyond, visible matter cannot be in contact with the dark energy in a coordinate system $\rho \in (0,\rho_1)$. However, as it can be seen, it is superposed on the dark matter at $0 \le r_1$. In conclusion, the scenario depicted in this figure should be understood as an attempt to visualize the current state in calibrating of the Universe according to the latest available data yielded by the Planck Mission [15-18] measurements.



iii. *Comments on Figure-4*

The case presented by Figure-4 depicts the quasi-potential energy depending on the radius starting point 0 on the x-axis, in the respective coordinate system ρ, when our speculative equation of matter formation allowed only a single root, $\rho_0 = \rho_1$. This is the last *moment* after which the evolution of the topology supposedly ceases, since the formation of the new matter will terminate upon reaching the critical density $\mathcal{C}$. At this last *quasi-moment*, when the radius $\rho_0 = \rho_1 = 1.32934$, as resolved by our equation, the quasi-density of matter in the topology will be critical, $\mathcal{C} \approx 0.08727$. In the current state of the topology, its quasi-density equals $\mu = 0.12457$, which, as already pointed above, is 1.42751 times higher than the critical density $\mathcal{C}$ on the scale with regard to the critical density starting point. The values of the quasi-potential energy $-G \cdot \dfrac{U(\rho) \cdot \mathcal{C}}{\rho^{\lambda}}$ are depicted on the y-axis. The $U(\rho)$ shown in Figure-4 is equal to the volume of a globe of radius ρ multiplied be the critical quasi-density $\mathcal{C}$ at which the potential energy reaches its minimum with respect to the critical condition—i.e., the level when only a single root of the equation exists.



b) The Case B. Speculation

Note that the topology given by Equation (1), in contrast to that usually adopted in cosmology, does not contain the space-time coordinate. Instead, we utilized the quasi-density parameter μ, which declines from very high values—$1.5\cdot10^9$ times greater than $\mathcal{C}$. Next, we attempt to move the quasi-density back towards the critical value $\mathcal{C}\approx0.08727$. Replacing the evolution of our metric space by the quasi-density μ parameter is intuitive, due to the scale of *densities*, where declining values replicate the dynamics of matter formation within the topology. Our calculus shows that, as the quasi-density μ declines towards the current mass-energy composition, it accounts for the μ value pertaining to the current composition, which is only 1.42751 times denser than $\mathcal{C}\approx0.08727$.

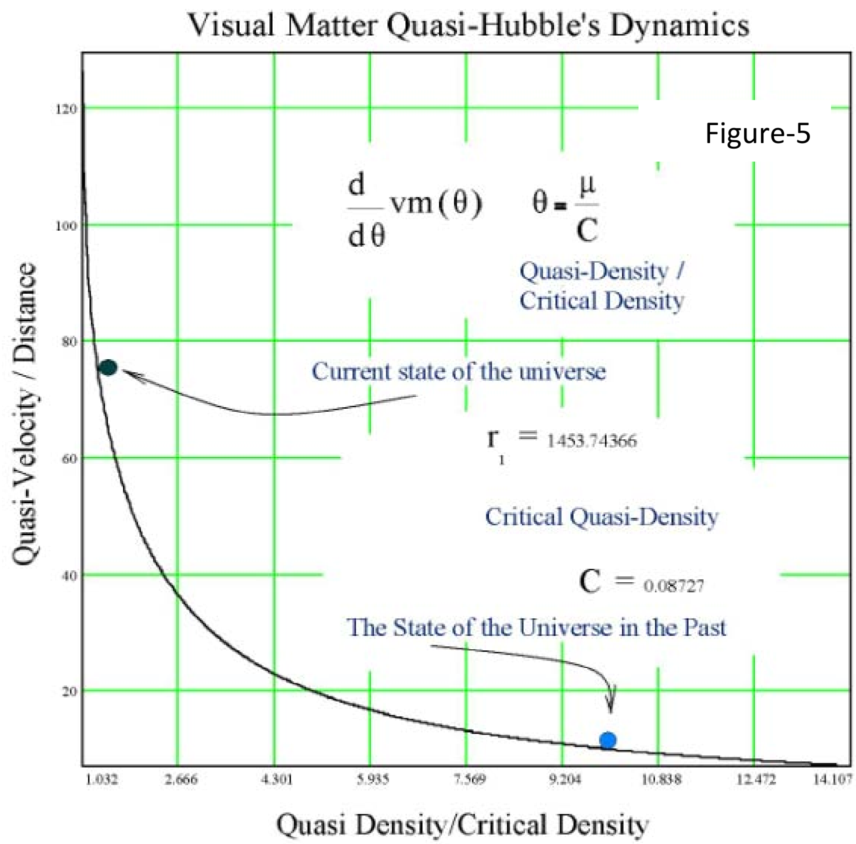
The Hubble's law describes a relationship between the genuine velocity v and the redshift of a galaxy at a proper distance ρ over time t. It denotes genuine $v=H_0\rho$, where H_0 is the Hubble's constant, $H_0\approx\frac{67.15km/s}{Mpc}$. Thus, in our calculus we reproduced the same effect, albeit on the quasi-density scale. While our *quasi-velocity* highlights the topology dynamics differently, it does so in a quasi-density μ reference system similar to Hubble's law. In doing so, our topology allegedly implies that, in the past, the visible $\dot{v}(\mu)>0$ and the dark matter $\dot{d}(\mu)>0$ quasi-velocities were in reverse order relative to the current 1.42751 more *crumbly* composition. This swap leads to a rather unexpected puzzle.

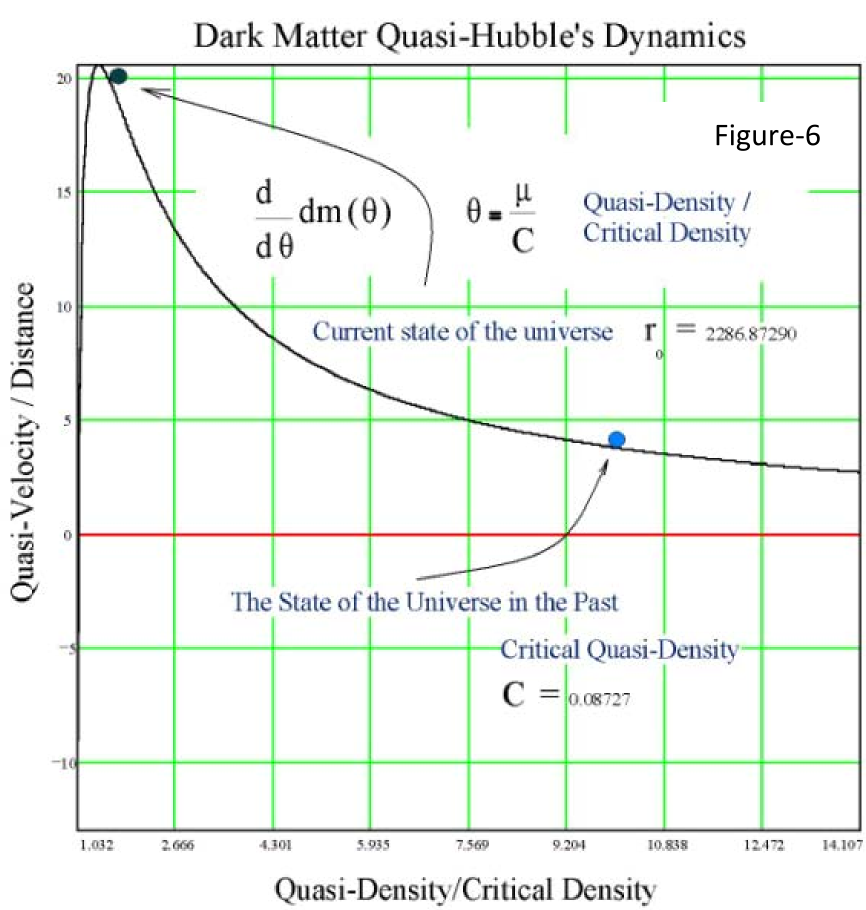
The Speculation suggests that the dark and visible topology are expanding along a *three-dimensional Moebius strip* but from its opposite sides—at the radius $\rho=0$ and $\rho=\infty$. In other words, if an observer in the past was inside the dark part of the strip, the dark matter would be allegedly shifting away from the visible matter. Yet, at some "turn-around or speeding up point," the visible matter gained speed and started to shift towards the dark matter. Thus, the visible matter started to come increasingly closer to the dark matter because the quasi-velocity of the dark part of the matter might have started to decline in relation to that of the visible matter. While both the visible and the dark matter are still expanding with quasi-velocity, the former will collapse into or be in contact with the latter at some future point, as discussed above. After the collapse, both the dark and the visible matter must complete their expanding evolution. The Speculation implies that, owing to not being far away from the collapse point, the dark matter allegedly changed its dynamics to negative quasi-velocity, i.e., merged back.

Our calculus suggests that the turnaround point allegedly occurred in the past when quasi-density on the ratio scale was, as already noted, approximately three times the critical density $\mathcal{C}\approx0.08727$. Currently, our geometric equation resolution suggests that $\mu=0.12457$ and the topology had already passed the turnaround point. This speculative conclusion can neither be rejected nor confirmed by observations. Beyond all these graphical presentations and Speculations, this Speculation does not contradict, but rather supports, the NASA SCIENCE ASTROPHYSICS statement: *"…then came 1998 and the Hubble Space Telescope (HST) observations of very distant supernovae that showed that, a long time ago, the Universe was actually expanding more slowly than it is today."* This indicates that the universe is actually older than implied by a simple calculation using the current Hubble constant.

i. *Comments on Figure-5 and Figure-6*

Our main Speculation, which is illustrated in Figure-5 and Figure-6, reveals the fundamental difference in the dynamics of dark and visible matter. For observers, it is a known puzzle that, in contradiction with the laws of gravity, the visible matter continues to expand. The gravity laws imply that the visible matter should start to contract. Yet, in contrast, the observations suggest that the visible part of the universe continues to expand. On graphs depicted in Figure-5 and Figure-6, this effect is readily apparent—the quasi-velocity of matter formation within the topology continues to accelerate, whereby the topology filled with matter is increasing in size while moving from very high values of the decreasing quasi-density to lower values. When the quasi-density in the vicinity of the critical value is analysed, the alleged dark matter dynamics seem to be better aligned with the laws of gravity. In Figure-5, in the vicinity of the critical value, the dark matter begins to contract. More specifically, the quasi-velocity of the dark matter formation reaches zero and becomes negative, i.e., the radius of the dark matter begins to decrease and its volume begins to contract. In contrast to thermodynamic laws, in the vicinity of the critical value, as evident from Figure-5, the dark matter density continues to decrease as it contracts. We might thus conclude that the dynamics of the evolution of both the dark and visible matter, accounting for the decreasing quasi-density, do not correspond to the known laws of physics. It seems that these laws have been have been violated differently.


Visual Matter Quasi-Hubble's Dynamics
Figure-5
$\frac{d}{d\theta}vm(\theta)$ $\theta = \frac{\mu}{C}$
Quasi-Density / Critical Density
Current state of the universe
$r_1 = 1453.74366$
Critical Quasi-Density
$C = 0.08727$
The State of the Universe in the Past
Quasi-Velocity / Distance
Quasi Density/Critical Density
120
100
80
60
40
20
1.032
2.666
4.301
5.935
7.569
9.204
10.838
12.472
14.107


Dark Matter Quasi-Hubble's Dynamics
Figure-6
$\frac{d}{d\theta}dm(\theta)$ $\theta = \frac{\mu}{C}$
Quasi-Density / Critical Density
Current state of the universe
$r_0 = 2286.87290$
The State of the Universe in the Past
Critical Quasi-Density
$C = 0.08727$
Quasi-Velocity / Distance
Quasi-Density/Critical Density
20
15
10
5
0
−5
−10
1.032
2.666
4.301
5.935
7.569
9.204
10.838
12.472
14.107

c) The Case C. Speculation

Here, we examine the relationship between the radial coordinates r and ρ: $r = \frac{2 \cdot R \cdot \rho}{1+\rho^2}$, $0 \le r < R$, $0 \le \rho < \infty$. The relationship $\rho \to r$ represents a mapping between $[0, R)$ and $[0, \infty)$. It should be noted that, in accordance with this relationship $\rho \to r$, we observe that $\infty \to 0$, $0 \to 0$ and $1 \to R$. One can imagine this topology by recalling a three-dimensional Moebius strip. Actually, for an external observer, $\rho = 0$ and $\rho = \infty$ point at the same location, albeit at allegedly opposite sides of the strip. Hence, the relationship $\rho \to r$ does not represent a one-to-one mapping. Given two roots ρ_0, ρ_1—which were calculated using the quasi-density $\mu = 0.12457$, as explained above—the relationship can be denoted by $\rho_0 \to De$, $\rho_1 \to Vm$. One can verify that, due to the absence of one-to-one mapping between coordinates r and ρ, the dark energy starting at ρ_0 corresponds to the dark matter ending at ρ_0. Another part of the dark matter globe co-exists with higher values in the radial r reference system, which accounts for the visible matter of radius ρ_1. No area in the r reference system exists in which the dark energy and visible matter can coexist.

According to the NASA Science Astrophysics statement: *One explanation for dark energy is that it is a property of space. Albert Einstein was the first person to realize that empty space is not nothing. Space has amazing properties, many of which are just beginning to be understood. The first property that Einstein discovered is that it is possible for more space to come into existence. Then one version of Einstein's gravity theory, the version that contains a cosmological constant, makes a second prediction: "empty space" can possess its own energy. Because this energy is a property of space itself, it would not be diluted as space expands. As more space comes into existence, more of this energy-of-space would appear. As a result, this form of energy would cause the Universe to expand faster and faster. Unfortunately, no one understands why the cosmological constant should even be there, much less why it would have exactly the right value to cause the observed velocity of the Universe.*

Once again, we cannot conclude that this Speculation contradicts the presently known and observable consequences in regard with the exhibits above.

VI. Concluding Remarks

In this work, we presented a speculative equilibrium equation that described the matter composition at the point of emergence from dark energy and as it continues to emerge. Some speculative conclusions with regard to dark matter dynamics were derived by calibrating the equation in accordance with the current mass-energy composition of the Universe.

Finding the equation roots might have some predicting power, since they are nearly 100% compatible with the Planck Mission Statement. None of our Speculations presented here fundamentally contradict the latest measurements of the data composition between the percentages of visible and dark matter in proportion to the dark energy. The absence of contradictions is achieved due to the calibration and imposing the relationship $G \cdot R^3 = 1$ between the radius of curvature of the space and the gravitational constant. The latter ensured that we eliminated the ambiguity of outcomes of the visible and dark matter fractions in proportion to the dark energy in case the grid of measurement for gravitational constant G is changed (i.e., the case when the grid guarantees the correct output irrespective of whether G is measured in meters, kilometres, or any other units). Our speculative equation required fine-tuning or calibration of so-called Λ-parameter of speculative mass-energy phase transition level and λ-parameter characterizing a modified potential energy field. This allowed the optimal values to be determined, with respect to achieving the best tuning effect posited by the Planck Mission.

The next important assumption pertained to the density parameter μ of the emerging matter, to which we referred as quasi-density. While acknowledging that the explanation requires more convincing arguments, we proceeded with our analyses by assuming that the quasi-density was in line with the "normal density" of matter. The concept of quasi-density allowed us to interpret, as well as predict, the dynamics and quasi-velocity of matter formation within the FLRW topology. It was also possible to make assertions that essentially coincide with the NASA statement that, in the past, the topology expanded more slowly than it does presently. As our topology implies, only a tiny globe of dark matter solves the equation at high/right side of quasi-density scale. At high quasi-density, the topology comprised solely of dark energy, since the visible matter radius suggested almost a zero solution. At the low/left end of the scale, approaching the critical value, the dark matter, in contrast to the visible matter, will allegedly start to diminish.

VII. Mathematical Derivation

In what follows, we refer to the work of Landau and Lifshits, page. 430, The Field Theory, Russian, M., 1967, describing homogeneous and isotropic, closed model with positive curvature. We use Landau and

Lifshits modification in transforming the FLRW metric to a flat metric at short distances.

The FLRW metric—the Friedmann-Lemaître-Robertson-Walker metric—starts with the assumption of homogeneity and isotropy. It also assumes that the spatial component of the metric can be time dependent. The generic metric that meets these conditions is given by:

$$ds^2 = dt^2 - s(t)^2\left[\frac{dr^2}{1-\kappa \cdot r^2} + r^2\left(d\theta^2 \sin(\phi)\right)^2 + d\phi^2\right],$$

where κ describes the curvature and is constant in time, and $s(t)$ is the scale factor, which is explicitly time dependent. We do not use the grid in which the speed of light is set to unity. Instead, we adopt the grid factor $s(t) = const = 1$, curvature $\kappa = \frac{1}{R^2}$, where R is the radius of positive curvature. Thus, we eliminate time from all considerations. Our derivation follows.

$$(x_1)^2 + (x_2)^2 + (x_3)^2 + (x_4)^2 = R^2$$

The equation of hyper-sphere in four-dimensional space upon grid = 1 (if $R > 0$, the curvature is positive).

$$ds^2 = (dx_1)^2 + (dx_2)^2 + (dx_3)^2 + (dx_4)^2$$

The lengths of a rod on the sphere

$$(x_4)^2 = R^2 - (x_1)^2 + (x_2)^2 + (x_3)^2$$

Using this equation, we obtain

$$x_4 \cdot dx_4 = -(x_1 dx_1 + x_2 dx_2 + x_3 dx_3)$$

Where

$$dx_4 = -\frac{(x_1 dx_1 + x_2 dx_2 + x_3 dx_3)}{x_4}$$

$$(dx_4)^2 = \frac{(x_1 dx_1 + x_2 dx_2 + x_3 dx_3)^2}{(x_4)^2}$$

$$(dx_4)^2 = \frac{(x_1 dx_1 + x_2 dx_2 + x_3 dx_3)^2}{R^2 - [\ (x_1)^2 + (x_2)^2 + (x_3)^2\ ]}$$

Finally, we obtain:

$$ds^2 = (dx_1)^2 + (dx_2)^2 + (dx_3)^2 + \frac{(x_1 dx_1 + x_2 dx_2 + x_3 dx_3)^2}{R^2 - [\ (x_1)^2 + (x_2)^2 + (x_3)^2\ ]} \tag{7.1}$$

$r = \sqrt{(x_1)^2 + (x_2)^2 + (x_3)^2}$. The spherical coordinates x_1, x_2, x_3 are related to the flat coordinates by $\theta = \tan^{-1}\left(\frac{x_2}{x_1}\right)$, $\phi = \cos^{-1}\left(\frac{x_3}{r}\right)$,

where $0 \le r < R$, $0 \le \theta \le 2 \cdot \pi$, and $0 \le \phi \le \pi$, and the inverse tangent, $\tan^{-1}$ must be suitably defined to take the correct quadrant of (x_1, x_2) into account.

In terms of spherical coordinates, $x_1 = r \cdot \cos(\theta) \cdot \sin(\phi),\ x_2 = r \cdot \sin(\theta) \cdot \sin(\phi),\ x_3 = r \cdot \cos(\phi).$

$$dx_1 = \left[\frac{d}{dr}\left(r\cdot\cos(\theta)\cdot\sin(\phi)\right)\right]dr + \left[\frac{d}{d\theta}\left(r\cdot\cos(\theta)\cdot\sin(\phi)\right)\right]d\theta + \left[\frac{d}{d\phi}\left(r\cdot\cos(\theta)\cdot\sin(\phi)\right)\right]d\phi$$

$$dx_1 = \cos(\theta)\cdot\sin(\phi)\cdot dr - r\cdot\sin(\theta)\cdot\sin(\phi)\cdot d\theta + r\cdot\cos(\theta)\cdot\cos(\phi)\cdot d\phi$$

$$dx_2 = \left[\frac{d}{dr}\left(r\cdot\sin(\theta)\cdot\sin(\phi)\right)\right]dr + \left[\frac{d}{d\theta}\left(r\cdot\sin(\theta)\cdot\sin(\phi)\right)\right]d\theta + \left[\frac{d}{d\phi}\left(r\cdot\sin(\theta)\cdot\sin(\phi)\right)\right]d\phi$$

$$dx_2 = \sin(\theta)\cdot\sin(\phi)\cdot dr + r\cdot\cos(\theta)\cdot\sin(\phi)\cdot d\theta + r\cdot\sin(\theta)\cdot\cos(\phi)\cdot d\phi$$

$$dx_3 = \left[\frac{d}{dr}\left(r\cdot\cos(\phi)\right)\right]dr + \left[\frac{d}{d\theta}\left(r\cdot\cos(\phi)\right)\right]d\theta + \left[\frac{d}{d\phi}\left(r\cdot\cos(\phi)\right)\right]d\phi$$

$$dx_3 = \cos(\phi)\cdot dr - r\cdot\sin(\phi)\cdot d\phi$$

We can thus substitute all the above expressions into $x_1dx_1 + x_2dx_2 + x_3dx_3$

Finally, by collating the sub-expressions, and after performing simplifications, we obtain

$$x_1dx_1 + x_2dx_2 + x_3dx_3 = r\cdot dr$$

$$(x_1)^2 + (x_2)^2 + (x_3)^2 = r^2$$

$$(dx_1)^2 + (dx_2)^2 + (dx_3)^2 = dr^2 + r^2\cdot\left(d\theta^2\cdot\sin^2(\phi) + d\phi^2\right)$$

Substituting the last expressions into Eq. (7.1) yields

$$ds^2 = dr^2 + \frac{r^2\cdot dr^2}{R^2 - r^2} + r^2\cdot\left(d\theta^2\cdot\sin^2(\phi) + d\phi^2\right)$$

It can be verified that

$$dr^2 + \frac{r^2\cdot dr^2}{R^2 - r^2} = dr^2\cdot\left(1 - \frac{r^2}{R^2 - r^2}\right) = dr^2\cdot\frac{a^2}{R^2 - r^2} = \frac{dr^2}{1 - \left(\frac{r}{R}\right)^2}$$

This results in $ds^2 = \dfrac{dr^2}{1 - \left(\frac{r}{R}\right)^2} + r^2\cdot\left(d\theta^2\cdot\sin^2(\phi) + d\phi^2\right)$

Let us make a substitution $r = \dfrac{a}{1 + \dfrac{a^2}{4\cdot R^2}}$ in order to ensure

that the surface rod ds^2 is proportional to a flat space at short distances, $0 \le a < \infty$, $0 \le r < R$. When $a = 0$, then $r = 0$; when $a = 2\cdot R$, then $r = R$; when $a = \infty$, then $r = 0$ once again. The replacement maps two points $a = 0$ and $a = \infty$ into one point $r = 0$ akin to a *three-dimensional Moebius strip* (Please refer to the example given at p. 435, Landay and Lifshits, The Theory of Field, Russian edition, 1967).

$$dr = \left[\frac{d}{dR}\left(\frac{a}{1 + \frac{1}{4}\frac{a^2}{R^2}}\right)\right]da$$

$$ds^2 = \frac{\left\{\left[\frac{d}{dR}\left(\frac{a}{1+\frac{1}{4}\frac{a^2}{R^2}}\right)\right]da\right\}^2}{1-\frac{\left(\frac{a}{1+\frac{1}{4}\frac{a^2}{R^2}}\right)^2}{R^2}} + \left(\frac{a}{1+\frac{1}{4}\frac{a^2}{R^2}}\right)^2 \cdot \left(d\theta^2 \cdot \sin^2(\phi) + d\phi^2\right)^{\cdot}$$

We continue

$$ds^2 = \left[\frac{1}{\left(1+\frac{1}{4}\frac{a^2}{R^2}\right)} - \frac{1}{2}\frac{a^2}{\left(1+\frac{1}{4}\frac{a^2}{R^2}\right)^2 R^2}\right]^2 \frac{da^2}{1-\frac{a^2}{\left(1+\frac{1}{4}\frac{a^2}{R^2}\right)^2 R^2}} + \frac{a^2}{\left(1+\frac{1}{4}\frac{a^2}{R^2}\right)^2}\left(d\theta^2 \cdot \sin^2(\phi) + d\phi^2\right)$$

$$ds^2 = 16 \cdot R^4 \cdot \frac{\left(da^2 + a^2 \cdot d\theta^2 \cdot \sin^2(\phi) + a^2 \cdot d\phi^2\right)}{16 \cdot R^4 + 8 \cdot a^2 \cdot R^2 + a^4} = \frac{da^2 + a^2 \cdot d\theta^2 \cdot \sin^2(\phi) + a^2 \cdot d\phi^2}{\frac{16 \cdot R^4 + 8 \cdot a^2 \cdot R^2 + a^4}{16 \cdot R^4}}$$

$$ds^2 = \frac{da^2 + a^2 \cdot d\theta^2 \cdot \sin^2(\phi) + a^2 \cdot d\phi^2}{1+\frac{1}{2}\left(\frac{a}{R}\right)^2 + \left(\frac{1}{4}\right)^2\left(\frac{a}{R}\right)^4} = \left[1+\frac{1}{4}\left(\frac{a}{R}\right)^2\right]^{-2}\left(da^2 + a^2 \cdot d\theta^2 \cdot \sin^2(\phi) + a^2 \cdot d\phi^2\right)$$

$$ds^2 = R^2\left(1+\frac{\xi^2}{4}\right)^{-2}\left[d\xi^2 + \xi^2\left(d\phi^2 + \sin^2(\phi) \cdot d\theta^2\right)\right]$$

after implementing the replacement

From flat topology, the rod volume ds^3 is equal to $dx \cdot dy \cdot dz$, whereas the rod length is given by $ds^2 = dx^2 + dy^2 + dz^2$. Applying the same rule to the previous flat expression for ds^2 we obtain

$$ds^3 = R^3\left(1+\frac{\xi^2}{4}\right)^{-3} \xi^2 d\xi \cdot \sin(\phi) d\phi$$

within a coordinate triple:

$$0 \le \xi < \infty \;,$$

$$0 \le \theta \le 2 \cdot \pi \quad \text{and}$$

$$0 \le \phi \le \pi \;.$$

$$R^3 \int_0^{2\pi} \int_0^{\pi} \int_0^{d} \left(1+\frac{\xi^2}{4}\right)^{-3} \xi^2 d\xi \cdot \sin(\phi) d\phi$$

The hyper-sphere globe of a diameter d. N.B. The di-ameter d makes sense as a new dimension, by which the space volume is proportional to the flat space at short distances. it should be noted that it is not equivalent to twice the $2 \cdot r$, where r is the original radius of our four-dimensional hyper-sphere.

Taking the integral into account, we can derive the expression for a volume

$$4 \cdot R^3 \cdot \pi \cdot \frac{\left(-8 \cdot d + 16 \cdot \tan^{-1}(\tfrac{1}{2}d) + \tan^{-1}(\tfrac{1}{2}d) \cdot d^4 + 2 \cdot d^3 + 8 \cdot \tan^{-1}(\tfrac{1}{2}d) \cdot d^2\right)}{\left(4 + d^2\right)^2} \qquad (7.2)$$

After accounting for the sub-expression $\tan^{-1}(\tfrac{1}{2}d)$, we obtain

$$4 \cdot R^3 \cdot \pi \cdot \frac{\left(16 + d^4 + 8 \cdot d^2\right)}{\left(4 + d^2\right)^2} \cdot \tan^{-1}(\tfrac{1}{2}d) + 4 \cdot a^3 \cdot \pi \cdot \frac{\left(-8 \cdot d + 2 \cdot d^3\right)}{\left(4 + d^2\right)^2}, \quad \left(16 + d^4 + 8 \cdot d^2\right) = \left(4 + d^2\right)^2$$

It should be noted that $\frac{\left(-8 \cdot d + 2 \cdot d^3\right)}{\left(4 + d^2\right)^2} = 4 \cdot \frac{d}{2} \cdot \frac{d^2 - 4}{\left(d^2 + 4\right)^2} = 4 \cdot \frac{d}{2} \cdot \frac{4 \cdot \left(\tfrac{1}{4}d^2 - 1\right)}{4 \cdot \left[\ \left(\tfrac{1}{4}d^2 + 1\right) \cdot \left(d^2 + 4\right)\ \right]}$.

Finally, we arrive at

$$\frac{d}{2} \cdot \frac{\left(\tfrac{1}{4}d^2 - 1\right)}{\left(\tfrac{1}{4}d^2 + 1\right)\left(\tfrac{1}{4}d^2 + 1\right)} = \frac{d}{2} \cdot \frac{\left(\tfrac{1}{2}d\right)^2 - 1}{\left[\ \left(\tfrac{1}{2}d\right)^2 + 1\ \right] \cdot \left[\ \left(\tfrac{1}{2} \cdot d\right)^2 + 1\ \right]}$$

Let us now make a substitution $\rho = \tfrac{1}{2}d$,

which yields $\rho \cdot \frac{\rho^2 - 1}{\left(\rho^2 + 1\right)^2}$

In conclusion, we obtain the form of the expression for the volume of a radius ρ globe as a three-dimensional globe within four dimensional hyper-surface of radius R, given by Eq. (7.2).

$$4 \cdot \pi \cdot R^3 \left(\tan^{-1}(\rho) + \rho \cdot \frac{\rho^2 - 1}{\left(\rho^2 + 1\right)^2} \right)$$

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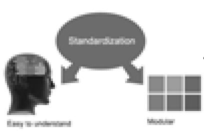

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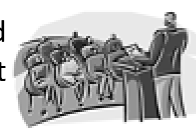

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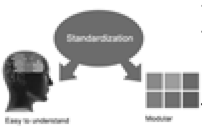

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TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

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2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

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5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

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11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

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15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

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19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

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21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

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Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- 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.

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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.
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- 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

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- 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
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- Submit to generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
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
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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