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Physics and Space Science

Strong Absorption Model

Gravitational Field Deducing

Highlights

Pulsejet Engine Exhaust

Scope of General Theory

Discovering Thoughts, Inventing Future

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Constant Gravitational Mass of Moving Object and Variational Gravitational Field Deducing that Application Scope of General Theory of Relativity is Limited

By Kexin Yao

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Abstract- This paper, based on simple examples, aims to show that the gravitational mass of an object is constant and that the distribution of gravitational field is associated with the motion of object. The formula for distribution of gravitational field during the motion of object has been deduced through variation in geometrical relation between gravitational lines. The paper analyzes the difference between gravitational mass and inertial mass of moving object in terms of size and direction and concludes that equivalency principle is false and application scope of general theory of relativity is limited.

Keywords: *gravitational mass, gravitational field, gravitational flux, axiom of constant force balance, general theory of relativity, black hole.*

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Keywords: gravitational mass, gravitational field, gravitational flux, axiom of constant force balance, general theory of relativity, black hole.

I. Introduction

In Applied Physics Research (Vo1.5, No.1) "Set up Invariable Axiom of Force Equilibrium and Solve Problems about Transformation of Force and Gravitational Mass" indicated that the gravitational mass of object is a constant unrelated to kinematic velocity of object. Since the gravitational field intensity is immediately related to gravitational mass, given the constant gravitational mass, is gravitational field constant too? If it is inconstant, what is the relationship between distribution of gravitation field and kinematic velocity of object? It is necessary for us to understand the relationship so as to accurately determine the force deserved and motion trace of object moving in high speed. Besides, constant gravitational mass and inconstant inertia mass, and whether equivalency principle and general theory of relative is true needs to be re-determined.

II. Distribution of Gravitational Field is Associated with the Motion of Object

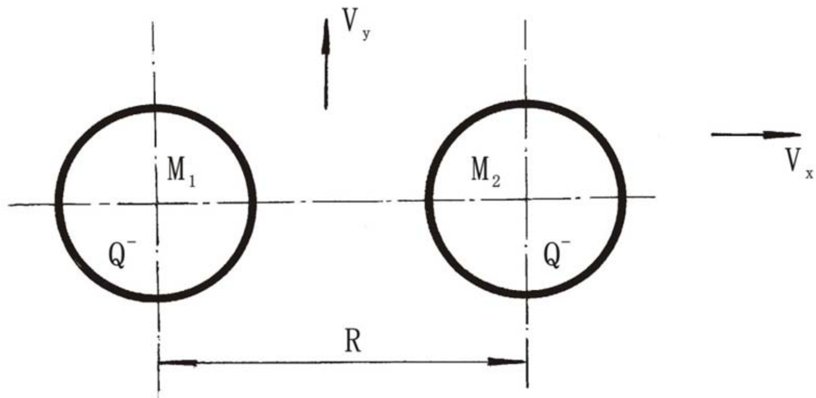

Figure 1 : Universal gravitation is equivalent to electrostatic repulsion

In Figure.1, objects on the left and right sides are identical in size and the center distance between two objects is R. Their gravitational mass is M_1 and M_2, and $M_1=M_2$(M_1 and M_2 are used for the convenience of explanation). These two objects carry negative charge Q^- with equivalent electric quantity. If the universal gravitation and electrostatic repulsion between the two objects are identical to each other to the moment, then the two objects are in balance state, with center distance R unchanged.

According to the special theory of relativity, experiments have proved that inertia mass is on the increase with the increase of kinematic velocity of object. If gravitational mass is equal to inertial mass, then the motion observer considers that the two objects are in motion and that M_1 and M_2 as gravitational mass

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of the two objects are on the increase and that universal gravitation is certain to increase. However, experiments have proved that electric quantity on object Q- is unrelated to the motion of object and is constant. As a result, electrostatic repulsion is not on the increase, in this way, when the two objects are in motion, it is inevitable that universal gravitation is greater than electrostatic repulsion and that the two objects shall strike against each other. It is obvious that there is no such phenomenon, which is indicated in axiom of constant force balance that any motion observers are unable to change the balance state of force.

It can be known from the above mentioned explanation that if the balance state of the two objects does not change with the change of observer, it is inevitable that the gravitational mass of object is in no way to change with the motion of object like inertia mass does in this respect, therefore, gravitational mass shall be identical to electric quantity, being a constant unrelated to motion.

For the convenience of analysis and explanation, A is defined as gravitational field intensity, for M_2 (take M_2 as a point for analysis), on which the gravitational field intensity generated by M_1: $A_1 = GM_1/R^2$ (G-gravitation constant) as well as $A_2 = GM_2/R^2$, universal gravitation of M_1 and M_2: $F = A_1M_2 = A_2M_1$.

Given that the transformation formula for forces of various inertial systems is deduced according to force equilibrium axiom:

$$F' = F\sqrt{\frac{1-V^2\cos^2\theta/C^2}{1-V^2/C^2}} \qquad (1)$$

Where, C indicates the force exerting on the object at rest; F' refers to the force exerting on the moving object at the speed of V; θ refers to included angle between F and V; included angle between F' and V:

$$\theta' = cos^{-1}\cos\theta\sqrt{1-V^2/C^2}\Big/\sqrt{1-V^2\cos^2\theta/C^2}$$

It is known from Figure 1 that when two objects move at the speed of V_x, there is $F' = F$ according to transformation formula (1) of force. According to special theory of relativity, when two objects move at the speed of V_x, R shall be shortened to $R' = R\sqrt{1-V_x^2/C^2}$. For example, the gravitational field of M_1 is in uniform distribution, M_1 is constant, there shall be:

$$A_1' = GM_1/R_1'^2 = GM_1/R^2\left(1-V_x^2/C^2\right)$$

$$F' = A_1'M_2 = GM_1M_2/R^2\left(1-V_x^2/C^2\right) = F/\left(1-V_x^2/C^2\right) \neq F$$

Since formula (1) is from force equilibrium constant axiom, therefore, $F' = F$ is correct and $F' \neq F$ is false. We have determined that M_1 and M_2 are constant, the mistake shall be as a result of $A_1' = GM_1/R_1'^2$, namely the actual $A_1' \neq GM_1/R_1'^2$, indicating that when two objects are in motion, it is impossible for the gravitational field of M_1 (or M_2) to be in uniform distribution.

Similarly, when two objects move at the speed of V_y, $\theta = 90°$ and $\cos\theta = 0$. According to formula (1), there is $F' = F\Big/\sqrt{1-V_x^2/C^2}$; however, the analysis of uniform distribution of gravitational field shows that there is $R \perp V_y$, and that R remains unchanged, namely $R' = R$, then there is $F' = F \neq F\Big/\sqrt{1-V_y^2/C^2}$, thus it is obvious that this is a wrong inference too and indicates that uniform distribution of gravitational field is not in accordance with force equilibrium constant axiom and that distribution of gravitational field shall be subject to change with the motion of object.

III. Distribution of Gravitational Field of Moving Object

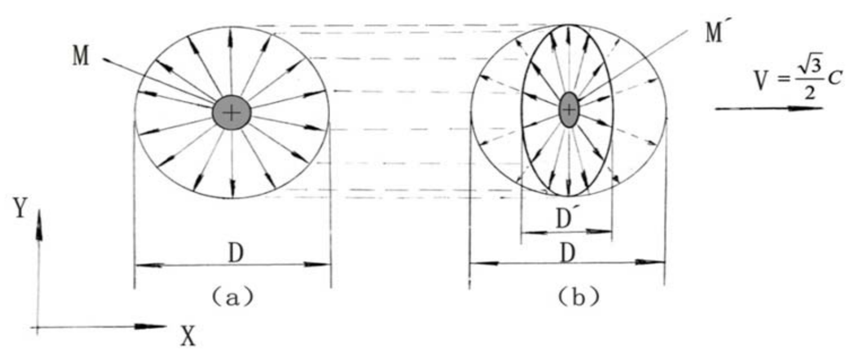

Figure 2 : When pellet M moves at the speed of V , the pellet shall contract along direction of V , and the gravitational line shall disperse along direction of V and concentrate along direction of V

In Figure 2 (a), pellet M generates uniform gravitational line in the surrounding, showing the circular cross section of space with a diameter of D through centre of pellet and the cross section shows that gravitational line is in uniform distribution; Figure 2 (b) shows that M moves at the speed of $V=\sqrt{3}C/2$. According to special theory of relativity, the diameter of M along direction of V shall reduce to $\sqrt{1-V^2/C^2}=1/2$ of original diameter, being M'. The diameter D of cross section of original space of M shall reduce to $D'=D/2$, since direction Y is normal to V, the diameter length of M along direction Y remains unchanged. It is obvious from Figure 2 (b) that the gravitational line of M' along vertical direction V becomes dense and along parallel direction V becomes sparse, and that the circle with a diameter D given in Figure (b) shows the pattern of gravitation line of cross section circle of the space M' in motion, based on which it is more obvious that gravitational line is changed from dense to sparse.

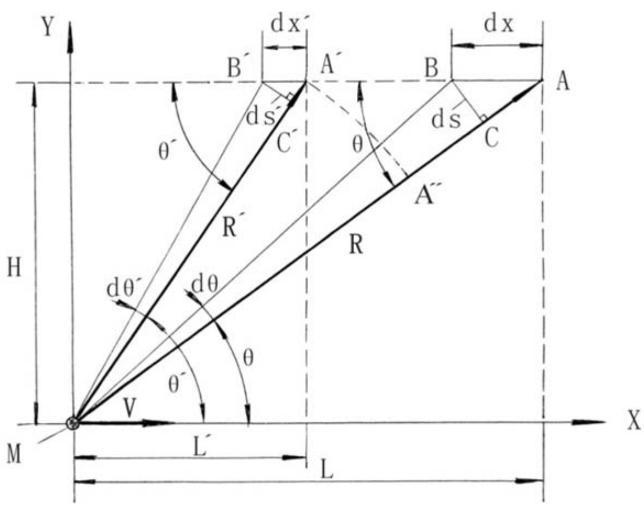

Figure 3 : The change of position of gravitational line when matter of point M moves at the speed of V

We take change of gravitational field in case of matter of point M in motion as an example. In Figure.3, M moves at the speed of V along direction X. According to special theory of relativity, the length along direction X shall contract according to ratio of $\sqrt{1-V^2/C^2}$.

Where L shall contract to $L'=L\sqrt{1-V^2/C^2}$; AB shall contract to $AB'=AB\sqrt{1-V^2/C^2}$. For the convenience of explanation, the AB and $A'B'$ are expressed by dx and dx', BC and $B'C'$ are expressed by ds and ds'. It is known that $BC\perp MA$ and $B'C'\perp MA'$ from triangle BMC and $B'MC'$.

$$ds=MB\sin d\theta;\ ds'=MB'\sin d\theta'$$

Since $d\theta$ and $d\theta'$ are infinitely small quantity, accordingly there is $\sin d\theta=d\theta$; $\sin d\theta'=d\theta'$ and $MB=MA=R$; $MB'=MA'=R'$. Thus, the above mentioned two formulas can be written as $ds=Rd\theta$ and $ds'=R'd\theta'$, herewith

$$\frac{d\theta}{d\theta'}=\frac{dsR'}{ds'R} \qquad (2)$$

It is known from right triangle ΔABC and $\Delta A'B'C'$ that:

$$ds=dx\sin d\theta=\frac{dx'\sin\theta}{\sqrt{1-V^2/C^2}}$$

$$ds'=dx'\sin\theta'$$

Substitute ds and ds' into formula (2) to obtain:

$$\frac{d\theta}{d\theta'}=\frac{dx'\sin\theta' R'}{dx'\sin\theta' R\sqrt{1-V^2/C^2}}=\frac{\sin\theta' R'}{\sin\theta' R\sqrt{1-V^2/C^2}} \qquad (3)$$

It is known from Figure 3 that

$$\sin\theta=\frac{H}{\sqrt{L^2+H^2}}=\frac{H}{\sqrt{H^2+L'^2/\left(1-V^2/C^2\right)}}=H\sqrt{\frac{\left(1-V^2/C^2\right)}{L'^2+H^2-V^2H^2/C^2}}$$

$$\sin\theta'=\frac{H}{\sqrt{L'^2+H^2}}$$

$$R=\sqrt{L^2+H^2}=\sqrt{\frac{L'^2+H^2-V^2H^2/C^2}{1-V^2/C^2}}$$

$$R'=\sqrt{L'^2+H^2}$$

Substitute the above four formulas $\sin\theta$, $\sin\theta'$, R and R' into formula (3), there is

$$\frac{d\theta}{d\theta'}=\frac{\sqrt{1-V^2/C^2}\cdot H\sqrt{L'^2+H^2}\sqrt{L'^2+H^2}\cdot\sqrt{1-V^2/C^2}}{\sqrt{1-V^2/C^2}\sqrt{L'^2+H^2-V^2H^2/C^2}\cdot H\sqrt{L'^2+H^2-V^2H^2/C^2}}=\frac{\left(L'^2+H^2\right)\sqrt{1-V^2/C^2}}{L'^2+H^2-\dfrac{V^2H^2}{C^2}}$$

$$=\frac{\sqrt{1-V^2/C^2}}{1-\dfrac{H^2}{L'^2+H^2}V^2/C^2}=\frac{\sqrt{1-V^2/C^2}}{1-\sin^2\theta' V^2/C^2} \qquad (4)$$

Circumferential angle as a result of MA rotating around MX

$$\beta=\frac{2\pi H}{R}=\frac{2\pi H}{\sqrt{L^2+H^2}}=\frac{2\pi H}{\sqrt{H^2+\dfrac{L'^2}{\left(1-V^2/C^2\right)}}}=\frac{2\pi H\sqrt{1-V^2/C^2}}{L'^2+H^2-V^2H^2/C^2}$$

Circumferential angle as a result of MA' rotating around MX

$$\beta=\frac{2\pi H}{R'}=\frac{2\pi H}{\sqrt{L'^2+H^2}}$$

Solid angle as a result of ΔAMB rotating around MX

$$d\Omega=\beta d\theta=\frac{2\pi H}{R'}=\frac{2\pi H\sqrt{1-V^2/C^2}}{L'^2+H^2-V^2H^2/C^2}d\theta \qquad (5)$$

Solid angle as a result of $\Delta A'MB'$ rotating around MX

$$d\Omega'=\beta' d\theta'=\frac{2\pi H}{\sqrt{L'^2+H^2}}d\theta \qquad (6)$$

By following the concept of electric flux of electric field, we introduce the gravitational flux concept for gravitational field. It is defined that the product of gravitational field intensity and the area (area of vertical gravitational line) through which the gravitational field goes as gravitational flux. It is obvious that gravitational field intensity is proportional to gravitational flux per unit area. If gravitational flux remains unchanged, the gravitational field intensity shall be inversely proportional to area through which gravitational flux goes. When gravitation source is matter of point, as shown in Figure 3, under the condition of same radius and gravitational flux, points A' and A'' in figure (their radius is r'), then gravitational field intensity shall be inversely proportional to solid angle occupied by the area in these two places (corresponding to $d\theta'$ and $d\theta$ respectively). (the gravitational fluxes in two points are same). Supposing that the gravitational field intensity at point A' is A' and that the gravitational field intensity at point A'' is A°, (point A'' refers to a point on MA when M remains still), obviously $A^\circ=GM/(MA'')^2=GM/r'^2$. The solid angle at point A'' is $d\Omega$ (when M remains still), the $d\Omega$ shall reduce to $d\Omega'$ at point A'. Gravitational field intensity shall be inversely proportional to solid angle occupied by unit area, namely:

$$\frac{A}{A'}=\frac{d\Omega}{d\Omega'}$$

Substitute (4),(5) and(6) into the above formula

$$\frac{A}{A^\circ}=\frac{\sqrt{1-V^2/C^2}}{\sqrt{1-\left(H^2/L'^2+H^2\right)V^2/C^2}}\cdot\frac{d\theta}{d\theta'}=\frac{\sqrt{1-V^2/C^2}}{\sqrt{1-\sin^2\theta' V^2/C^2}}\cdot\frac{\sqrt{1-V^2/C^2}}{1-\sin^2\theta' V^2/C^2}$$

$$=\frac{1-V^2/C^2}{\left(1-\sin^2\theta' V^2/C^2\right)^{3/2}}$$

Namely,

$$A'=\frac{1-V^2/C^2}{\left(1-\sin^2\theta' V^2/C^2\right)^{3/2}}A^\circ=G\frac{1-V^2/C^2}{\left(1-\sin^2\theta' V^2/C^2\right)^{3/2}}\cdot\frac{M}{r'^2} \qquad (7)$$

Formula (7) is relational expression between distribution of gravitational field intensity and speed V and θ'. It can be known from the formula that when θ is smaller, there is $A'<GM/r'^2$ and the gravitation field weakens along direction X and that when θ' is greater, there is $A'>GM/r'^2$ and the gravitation field intensifies along direction Y. This is identical to the distribution of gravitational field shown in Figure 2 (b). It is obvious that when V is determined, there shall be a dividing angle θ°, at the angle of θ°, the gravitational field intensity remains unchanged. It is known from calculation that when $V<0.6C$, there is $\theta^\circ=57.4^\circ$, namely when the motion velocity of object is slower than 0.6 light velocity, the dividing angle shall be constant of 57.4°. The gravitational field intensity shall increase in case of more than 57.4°and the gravitational field intensity shall decrease in case of less than 57.4°, but when $V>0.6C$, θ° shall show significant change. For example, when $V=0.8C$, there is $\theta^\circ=61.45^\circ$ and when $V=0.99C$, there is $\theta^\circ=76.47^\circ$.

It is known from comparison that formula (7) and field distribution formula for charged particle in motion are absolutely similar, therefore, with reference to the electric flux of charged body, there shall be, for gravitational field of moving object, in addition, there shall be constant gravitational flux on any closure face enclosing the object

IV. Gravitational Field for Object in Relative Motion

For object (or other object) in motion relative to earth, when gravitational mass is the object of M falling toward earth at the speed of V, (V and R are parallel, supposing it is in the direction X), according to formula (7), there is $\theta' = 0$, $A'_x = G\left(1 - V^2/C^2\right)M/R'^2$. In our view that the object weakens in terms of transearth gravitational field, however, for the object, its length along direction of motion shall be shortened, there shall be $R' = R\sqrt{1 - V^2/C^2}$, after substituting it into formula A'_x, then there is $A'_x = G\,M/R^2$. This indicates that the universal gravitation of earth to the object at any moment shall be constantly equal to the universal gravitation of earth to the object in zero motion regardless of falling speed, just as what defined in transformation formula of force, in case of $\theta' = 0$, there shall be $F' = F$

When object with gravitational mass of M moves in parallel to earth surface at the speed of V, according to formula (7), there shall be $\theta' = 90°$ $A'_y = GM/R'^2\sqrt{1 - V^2/C^2}$ (when $V \perp R$, there is $R' = R$). In our view that that transearth gravitation of the object is increased, namely universal gravitation is on the increase.

V. Conclusion

The above analysis shows that the motion of object and the motion of charged body are absolutely similar when object is moving. Not only the gravitational mass of object similar to quantity of electricity of charged body is a constant, but also the distribution of gravitational field of object is similar to electric field of quantity of electricity and its gravitation is associated with direction. The inertial mass however is on the contrary. Its size is not only related to motion velocity but also has nothing to do with direction. Inertia mass is not a constant, indicating that gravitational mass and inertial mass are two different physical quantities, thus, there is no comparability between the two physical quantities, just like that there is no comparability between inertial mass and electric quantity of object. Therefore, it is concluded that gravitational mass is not possible to be equal to inertia mass, that is equivalency principle is impossible to be true.

It is well known that equivalency is the basis of general theory of relativity. Since equivalency is not tenable, general theory of relativity is accordingly not true.

Some people may question that why general theory of relativity can accurately calculate the precessional motion of mercury's perihelion and be used in GPS. It should be pointed out that verification results cannot prove that the theory is true, for example, geocentric theory that thinks the earth is the center of the universe is not true, but vernal equinox, autumnal equinox, the summer solstice and the winter solstice can be accurately calculated according to this theory. In this case, we cannot accordingly think that geocentric theory is true.

Since general theory of relativity is not true, why does it can be used some practices such as GPS? The author thinks that kinematic velocity of satellite, earth and mercury is very low in comparison with velocity of light and their inertia mass varies little, it is thus considered that their inertia mass is approximatively equal to rest mass, that is to say, inertia mass can be considered the constant like gravitational mass, then equivalency principle is true. Although inertia mass and gravitational mass are two different physical quantities, but if the both are directly proportional, it is assumed that the both are equal and there is no calculative errors on quantity. For example, the pressure of water vessel's bottom unit area is directly proportional to the height from water surface to the bottom. Assuming that pressure equals height, use height to replace pressure, the calculation result has no errors. For satellite and earth moving in low speed, since equivalency principle is true, then general theory of relativity is naturally true too. But for object moving in high speed, its inertia mass is obviously bigger than rest mass, thus inertia mass cannot be considered a constant and equivalency principle is not tenable, accordingly, the analytical result of general theory of relativity is naturally false.

The author thinks that the most obvious analytical error of general theory of relativity is that black hole does not exist at all, because black hole theory points out that the mass of a football court-sized black hole is five times the mass of the sun and 1.3 million times the mass of the earth. The size of the earth is 10^{15} times that of black hole (calculated by a round sphere with its diameter of 120m), that is the density of substances in black hole is more than 10^{21} times that of substances on the earth, which means that the total mass of trillion people on the earth is smaller than that of a grain of rice in black hole. It is known that all substances are composed of several elements among 118 kinds of elements. Up to now, no astronomical substances have been found exceptional, thus black hole should not be exceptional too. According to the calculation of the above black theory, the size of atom of substances in black hole is only one 10^{21th} of the size of atom of substances on the earth, obviously this is an absurd deduction. Because even reduce all atoms of substances in black hole to the size of neutron and put them together, the size of which shall be 1 million times the theoretical size of black hole, so this deduction is obviously untenable.

The black hole theory also thinks that black hole absorbs other celestial bodies to make them a part of black hole. That is to say black hole can reduce the atom of celestial bodies absorbed by more than 10^{21} times in an instant. Obviously, this is a fantastic deduction violating human's common sense. The above statement shows that black hole does not exist in the universe at all.

At present, the researches on general theory of relativity about black hole, white hole and worm hole are leading scientific research to a dead end. The research direction deviating from the truth will block the development of science. Therefore, it must be pointed out that general theory of relativity is not an absolute truth and it is only applicable for analyzing object moving in low speed.

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Elastic Scattering of Heavy ion ^{13}C from Target Nuclei ^{28}Si and ^{32}S at Energy 36MeV by Strong Absorption Model (SAM)

By Fahmida Sharmin & Md. Azizur Rahman

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Abstract- The differential cross-section for the elastic scattering of heavy ion ^{13}C from target nuclei ^{28}Si and ^{32}S at 36 MeV projectile energy has been studied in terms of the Strong Absorption Model of Frahn and Venter[1] using the three parameters version of this model. In this paper we find that a reasonably good description to the angular distribution of the experimental elastic scattering data is possible.

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Fahmida Sharmin [α] & Md. Azizur Rahman [σ]

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I. Introduction

The scattering of p, n, d, τ, ^3He and alpha particles in particular, has been playing a very important and vital role in nuclear physics since the very beginning of the subject. The nuclear scattering experiment ascertains many properties of nuclei such as angular momentum, parity, nuclear size, nuclear density etc. Experimental techniques, so far have achieved greater perfection and theoretical interpretation of data has become correspondingly more accurate and detailed.

Nucleus is a complicated, many body problems and a bound system of nucleons, with very short range interaction. Nucleons or other strongly interacting particles can induce a variety of nuclear reactions, whose diversity is due to the individual properties, relative motions, energies of the colliding particles and the target nuclei. Simple and fundamental laws are required in interpreting data to unravel the known properties of the nuclei and this enables us to predict the unknown properties also.

The scattering involving complex nuclei represents a complicated quantum mechanical many-body problem and it is difficult to correlate the experimental data directly with the properties of fundamental nuclear interactions. It is necessary to devise simpler methods (models) which serve as an intermediary between the data and basic nuclear theory. These methods make use of simplifying assumptions by which certain average features of the many-body problem are connected directly with measurable quantities.

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Numerous analysis of the elastic and scattering data of different projectiles, carried out using the SAM formalism by Frahn and Venter [1] during the past several years as available in refs.[2-6] is quite successful in analyzing the scattering data. This model does not suffer from any ambiguities and the model yields a unique set of parameters to describe the experimental data.

In this present work elastic scattering have been analyzed by means of Strong Absorption Model (SAM). All the elastic scattering data are digitized at near barrier energies close to the Coulomb barrier. The analysis of elastic scattering data will help us to determine the parameters like the cut-off or critical angular momentum T, rounding parameter Δ, and the real nuclear phase shift μ. The elastic scattering data have been digitized from different references [7-11]

II. Strong Absorption Model Formalism

a) Strong Absorption Model

Here we introduce the strong absorption model formalism, which is frequently used. The strong absorption generally takes place at medium and high energy projectiles in nuclear reactions for the cases below:

a. Nucleons, mesons and hyperons of E ≥ 100 MeV.
b. Composite particles (deuterons, tritons, helium-3, alpha particles and heavy ions) above the Coulomb barrier.

The depletion of the elastic channels due to the presence of open reaction channels is termed as strong absorption. It is measured by the deviation from the unitarity of the elastic η_l sub-matrix. The condition of the effectiveness for the strong absorption of these partial waves is

$$\eta_l^j \ll 1 \tag{1.1}$$

This condition holds well for some situations in a certain range of orbital angular momentum below a critical value l_0. From this point of view, the scattering is closely identical to diffraction by an opaque obstacle. The relevant approximations concerning such situations are called diffraction models. The description of the diffraction in nuclear processes is more accurate in momentum space than in configuration space as the relation $\Delta L.\Delta\theta \geq \hbar$ is valid in the former. We shall therefore express SAM formalisms in momentum space.

The transition of η_l from zero to unity is a gradual one, extending over a range of l values of width Δ in the vicinity of T, this follows semi-classically from the diffuseness of the nuclear interaction region. Particles, which are moving along classical orbits penetrating the diffuse region, will be only partially absorbed. If Δ is the range of orbital angular momentum that corresponds to the diffuseness d, we obtain Δ for nuclear particles.

$$\Delta = kd \tag{1.2}$$

and for charged particles

$$\Delta = kd\frac{1-\left(\frac{n}{2kR}\right)}{\left[1-\frac{2n}{kR}\right]^{\frac{1}{2}}} \tag{1.3}$$

It is possible to give a completely analytical formulation of the parameterized S-matrix model of η_l in l space with or without Coulomb interaction. This can be done by splitting η_l into real and imaginary parts;

$$Re[\eta_l exp(-2i\sigma_l)] = g(t) + \rho\frac{dg}{dt} + \varepsilon[1-g(t)] \tag{1.4}$$

$$Im[\eta_l exp(-2i\sigma_l)] = \mu_1\frac{dg(t)}{dt} + \mu_2\frac{d^2g(t)}{dt^2} \tag{1.5}$$

Here, g's are continuously differentiable function of ${(T-t)}/{\Delta}$, whose first derivatives are symmetric and peaked at around T but otherwise arbitrary. Furthermore the function g's are characterized by the cut-off angular momentum $T^{\pm} = \left(L \pm \frac{1}{2}\right)$and rounding parameter $\Delta^{\pm}$ around $T^{\pm}$ in the l space and possessing the property that their derivatives should have simple Fourier transform; the parameter $\mu^{\pm}$ is associated with the real nuclear phase shift and $\varepsilon^{\pm}$ accounts for any possible transparency of partial waves less than $T^{\pm}$.

Equations (1.4) and (1.5) cover a large variety of structures of η_l in strong absorption situations; the real part changes from finite value at small l value to unity at high l value through some rapid transition in the vicinity of T; the form of the imaginary part is such that the real nuclear phase shifts are relevant only for partial waves in some vicinity of T, except for transparency contribution at lower l values. The first derivative of $g(t)$ is the main term in Im η_l. The higher derivatives in the real and imaginary parts of η_l describe possible asymmetries and other complicated variations in the transition region. For charge particles, η_l is replaced by,

$$\eta_l \exp(-2i\sigma_l)$$

where, σ_l are Coulomb phase-shifts.

b) Coulomb Scattering Angle

The Coulomb scattering angle θ_C is related to cut-off parameter T through the relation

$$\theta_C = 2arctg\left(\frac{n}{T}\right) \tag{1.6}$$

The angular distribution is divided into two regions:

(a) Coulomb region for $\theta \leq \theta_C$

and

(b) Diffraction region for $\theta > \theta_C$

c) Total Reaction Cross section

The total reaction cross section can be calculated using the following formulation

$$\sigma_r = \frac{\pi}{k^2}\sum_{l=0}^{\infty}(2l+1)(1-|\eta_l|^2) \tag{1.7}$$

which, for spin zero charged particles becomes,

$$\sigma_r = \frac{\pi T^2}{k^2}\left[1 + 2\frac{\Delta}{T} + \frac{1}{3}\pi^2\left(\frac{\Delta}{T}\right)^2 - \frac{1}{3}\left(\frac{\mu}{\Delta}\right)^2\left(\frac{\Delta}{T}\right)\right] \tag{1.8}$$

This formula has been used by Frahn and Venter[1] for calculating the value of total reaction cross- section.

III. Method of Analysis

Here, we discuss the method of theoretical analysis of the experimental elastic scattering cross-sections of heavy ions at various projectile energies. The elastic scattering analysis yields unambiguous elastic scattering parameter values.

The method of analysis and the effects of parameter variations on the angular distribution have been given by Rahman et al. [12]. The angular distribution of the elastically scattered particles from a target nucleus is obtained from the relation

$$\sigma(\theta) = |f(\theta)|^2 \tag{1.9}$$

where $f(\theta)$ is the scattering amplitude. The amplitude can be calculated using the following parameters:

a. The cut-off angular momentum parameter, T
b. The rounding parameter , Δ
c. The real nuclear phase-shift parameters, μ_1
d. and μ_2
e. The symmetry parameter, ρ and
f. The transparency parameter, ε.

The cut-off angular momentum T is related to the interaction radius R through the semi-classical relation:

$$T = kR\left[1-\left(\frac{2n}{kR}\right)\right]^{1/2} \tag{1.10}$$

The rounding parameter is related to the diffuseness of the nuclear surface through the relation

$$\Delta = kd\left[\left(1-\frac{n}{kR}\right)\left(1-\frac{2n}{kR}\right)^{-1/2}\right] \tag{1.11}$$

where k is the wave number and n is the coulomb parameter respectively.
The total reaction cross-section is given by,

$$\sigma_r = \frac{\pi T^2}{k^2}\left[1 + 2\frac{\Delta}{T} + \frac{1}{3}\pi^2\left(\frac{\Delta}{T}\right)^2 - \frac{1}{3}\left(\frac{\mu}{\Delta}\right)^2\left(\frac{\Delta}{T}\right)\right] \qquad (1.12)$$

The frequency of the oscillation in $\sigma(\theta)$ is determined by the parameter T. By increasing T, the whole oscillation pattern moves towards the smaller angles. The parameter Δ controls the ratio of the backward to forward scattering through which the average slope of the angular distribution is fixed. The higher angle regions are mainly affected by an alteration in Δ value and an increase in Δ mainly lowers the maximum keeping the oscillatory pattern unaltered.

The parameter μ mainly affects the minimum and an increase in μ lowers the minimum keeping the angular position and magnitude of the maxima and the whole angular distribution pattern unaltered.

We use a computer program in analyzing scattering phenomena. The program takes the input from one file and produces output to another file. It is desirable that the output of such a program should be in a graphical presentation. The output file is imported onto a graphical program and then resulting graph is plotted.

First we make the three parameters ρ, ε and μ_2 equal to zero, because these parameters have very insignificant effects on the angular distribution for heavy ion projectiles. To determine the SAM parameters, T should be fixed first. The method followed in determining the parameters are:

1. At first we varied T, say we keep the value of T is 30, keeping Δ and μ fixed to a small value, say .5 and .1 respectively. (For Δ=0, the program will not run, division by zero error will occur).
2. Graphs are plotted simultaneously for various values of T, finally it is varied again with a smaller step size.
3. Since the minima are sharp in general, it is a helpful endeavor to reproduce the positions of minima while fixing T.
4. After having a good fixation of T, then the value of Δ is adjusted, which determines the slope of the angular distribution and whose effect is prominent in the larger angular region.
5. Once the values of T and Δ have been fixed, we vary μ in order to minimize the mean square difference between the experimental and theoretically computed cross-sections.
6. The mean square difference between experimental and computed cross-section, χ^2 is a measure of how good the fit is. The χ^2 is given by,

$$\chi^2 = \frac{1}{n}\sum\left|\frac{\sigma_{\exp}(\theta) - \sigma_{theo}(\theta)}{\delta\sigma_{exp}(\theta)}\right|^2 \qquad (1.13)$$

Here n is the number of data points and other symbols carry the usual meanings.

Finally, all three parameters T, Δ and μ are varied slightly about the obtained values till the best fit parameters are obtained and hence the minimum value of χ^2.

The charge and mass numbers of the projectile and the target, the beam energy, the scattering angles and the corresponding experimental cross-sections and their errors together with the values of the parameters are given in the input of the program. The output gives $\sigma(\theta)$ corresponding to the scattering angle θ with χ^2 for each set of parameters. The interaction radius R, the diffuseness d, standard nuclear radius r_0 and the total reaction cross-section σ_r are computed from the best fit parameters.

IV. Results and Discussions

The differential cross-section for the elastic scattering of ^{13}C from target nuclei ^{28}Si and ^{32}S has been studied on the basis of the Strong Absorption Model formalism (SAM). Data analysis are carried out by a symmetric variation of SAM parameters using the criterion of minimum root square difference between the experimental and theoretical cross-sections.

The result of the SAM analysis rendering the best fit parameter values are summarized in tables 1 and 2. The experimental data along with the theoretically calculated angular distributions are graphically shown in figs.1-2. The quality of fit to the angular distribution throughout the distribution is satisfactory.

Now for further details of the fit quality, the angular distributions data in most of the nuclei are reasonably well reproduced over the angular range covered in the experiment.

a) *The Sam Parameters T, Δ and μ:*

The cut-off angular momentum T and the rounding parameter Δ are respectively given by the expressions (1.10) and (1.11). Their values are shown in the tables 1 and 2.

The rounding parameter Δ controls the ratio of the backward to the forward scattering angle. An increase in Δ mainly affects the cross-sections in the higher angle regions, while the lower angle regions are not affected so much; an increase in Δ value lowers the whole diffractions pattern keeping the oscillatory structure unaltered. The value of real nuclear phase shift μ lies in the domain 0.5.

b) *Interaction Radius R, Surface Diffuseness D And Coulomb Scattering Angle θ_C:*

The interaction radius R and the surface diffuseness d are respectively given by the semi-classical expressions (1.10) and (1.11). They are presented in tables 1 and 2.

We find from the table 2 that the interaction radius R decreases with increase in mass of target while

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the beam energy and mass of the projectile remain the same. As for example, the interaction radii R for ^{28}Si and ^{32}S elastically scattered from ^{13}C for the projectile energies 36 MeV, are 8.97 and 10.6 fm respectively.

Our study further yields the fact that the values of surface diffuseness parameter d roughly spreads in the range 0.14-0.35 fm.

The value of θ_C given by the expression (1.6) and the value is presented in table 1. the value of θ_C decreases as the value of T increases and vice versa. As for example the value of θ_C is 47.30° for the projectile energy 36 MeV at T value 19.5 and the value of θ_C is 44.35° for the projectile energy 36MeV at T value 22.

c) The Total Reaction Cross-Section

The total reaction cross-section σ_r yielded by SAM formalism is given by the equation (1.8). These are shown in table 2. The value of σ_r, in general, decreases for the same projectile and beam energy as the target mass increases. This may be due to the opening of many reaction channels as the target mass is increased. The parameter $\sigma_r/\pi R^2$ is more meaningful than σ_r itself. Its value is of the same order of magnitude (0.41-0.48), which is roughly the same as expected.

Our calculated cross section could not be compared for non availability of any other calculations for cross-sections from any other formalism.

d) Graphs

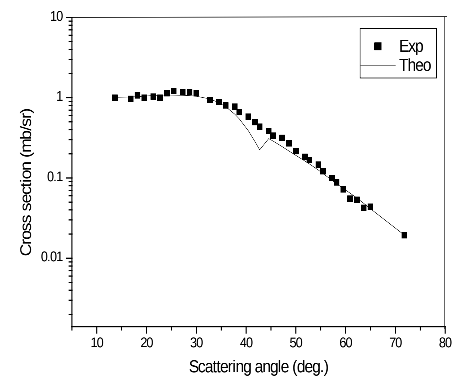

Figure 1 : SAM analysis for elastic scattering of ^{13}C from ^{28}Si at energy 36 MeV

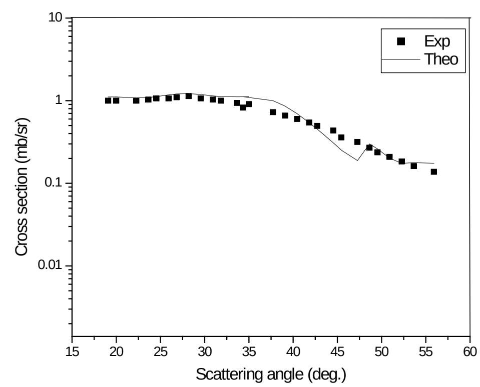

Figure 2 : SAM analysis for elastic scattering of ^{13}C from ^{32}S at energy 36 MeV

e) Tables

Table 1

No	Incident particle + Target nucleus	Beam energy 'E' MeV	T	Δ	μ	$\mu/4\Delta$	θ_C
1	$^{13}C + ^{28}Si$	36	19.5	1.25	0.5	0.10	47.30
2	$^{13}C + ^{32}S$	36	22.0	0.5	0.5	0.250	44.35

Table 2

No	Incident particle + Target nucleus	Beam energy 'E' MeV	r_0	R	d	σ_r	$\sigma_r/\pi R^2$
1	$^{13}C + ^{28}Si$	36	1.66	8.97	0.358	5145	0.480
2	$^{13}C + ^{32}S$	36	1.92	10.6	0.144	4443	0.419

V. Conclusions

The present work was concerned with a study of the elastic scattering of heavy ion ^{13}C at energy 36MeV from target nuclei ^{28}Si and ^{32}S. The motivation was to see to what extent the simple geometrical model can explain the elastic scattering.

The angular distribution have been studied in terms of Strong Absorption Model due to Frahn and Venter[1] and it is evident from these analyses that three parameter SAM formalism provides a reasonable description to elastic scattering of heavy ions. The best fit parameters T, Δ and μ have been obtained. Analysis of the elastic angular distribution have resulted in a consistent set of SAM parameters from which interaction radius R and surface diffuseness d are obtained. The interaction radius increases smoothly as the target mass increases.

It is also observed that R in general increases with the increases in mass of target nucleus. The surface diffuseness d determined from this work over the incident energy and mass region covered agrees with other works [4-6].

Coulomb scattering angle θ_C is directly proportional to Coulomb parameter n and related reciprocally with T.

The reaction cross-section σ_r was also calculated from the SAM parameters. The value of σ_r, in general, decreases for the same projectile and beam energy as the target mass increases.

Finally from this present work we can say that SAM model is a useful, easier, simple method for obtaining various information about nuclear properties. We can also say that an overall good description of the scattering of heavy ions is given by the three parameters of SAM of Frahn and Venter [1].

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Effect of Intercalation of LiAl on Cation Distribution and Properties of Fe_2Tio_5

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Abstract- In order to study the effect of intercalation of LiAl on the cation distribution and properties of Fe_2TiO_5, the samples are prepared by standard ceramic technique. The single-phase formation of the pseudobrookite is confirmed by XRD technique. The retention of amount and proportion of LiAl in the ceramics is confirmed by ICP technique. The ac and dc resistivity of the ceramic increases considerably whereas the interfacial contribution to the dielectric constant decreases by intercalation of LiAl. The experimental data of relaxation spectra, variation of dielectric constant and resistivity with temperature is analyzed and correlated. The magnetic hysteresis and susceptibility measurement shows that LiAl enhances the long range magnetic ordering. The proposed empirical model determines the cation distribution of the samples using lattice parameters.

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Effect of Intercalation of LiAl on Cation Distribution and Properties of Fe_2Tio_5

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Abstract- In order to study the effect of intercalation of LiAl on the cation distribution and properties of Fe_2TiO_5, the samples are prepared by standard ceramic technique. The single-phase formation of the pseudobrookite is confirmed by XRD technique. The retention of amount and proportion of LiAl in the ceramics is confirmed by ICP technique. The ac and dc resistivity of the ceramic increases considerably whereas the interfacial contribution to the dielectric constant decreases by intercalation of LiAl. The experimental data of relaxation spectra, variation of dielectric constant and resistivity with temperature is analyzed and correlated. The magnetic hysteresis and susceptibility measurement shows that LiAl enhances the long range magnetic ordering. The proposed empirical model determines the cation distribution of the samples using lattice parameters.

I. Introduction

A magnetic spinel establishes a long range magnetic ordering by linking its octahedral and tetrahedral sites. Lithium Ferrite and substitutions such as Al, Ti, Mn and Ge have been studied extensively for their magnetic structure [1], crystallographic order-disorder [2, 3], provision of holes for Li^+ ions [4], oxygen loss [5], curie temperature [6], sensitivity towards CO_2 [7], lithium diffusion coefficient [8] etc. A pseudobrookite (AB_2O_5) consists of two octahedral sites M_1 and M_2. One of them is larger and more distorted and connects the other through edge / corner sharing. The cations occupy 1 M1 and 2 M2 sites and large interstitial sites / voids equal to M1 site are vacant [9]. The crystal structure of $Fe_2TiO_5$was first determined by Pauling [10] only minor changes in it have since been reported [11,12,13]. The Ti^{4+}ions prefer fairly regular octahedra [14]. On the other hand four of the six oxygen ions surrounding Fe^{3+}ions are disposed almost tetrahedrally. On the basis of the cation distribution between two sites the compound is said to be ordered / disordered. Both the orthorhombic [15] and monoclinic [16] structures have been reported for Fe_2TiO_5,. Hence it is thought possible to intercalate Fe_2TiO_5 by Li^+ to incorporate the long range magnetic ordering.

II. Experimental

The samples are prepared by the standard ceramic technique and sintered at 1250°C for 24 hours. The single-phase formation of the pseudobrookite is confirmed by XRD technique. The mixture of Fe_2TiO_5 and $LiAlH_4$ powders is thoroughly mixed for 24 hours by magnetic stirring in the dry Benzene to avoid the contact of $LiAlH_4$ with moisture in the air. The samples Fe_2TiO_5, Fe_2TiO_5 + (0.5) LiAl, Fe_2TiO_5 +(1.0) LiAl are abbreviated as [FTR], [FTL$_1$R] and [FTL$_2$R] respectively. That Li^+ do not vaporize during the heat treatment is confirmed by Inductively Coupled Plasma (ICP) technique. The samples are studied by X-ray diffractometry, Infrared spectroscopy, electric, dielectric and magnetic measurements.

III. Results and Discussion

a) Determination of Cation Distribution

The cation distribution in Fe_2TiO_5 and related compounds has been reportedly determined by using Reitveld Refinement technique [17-20]. It is observed that lattice parameters of these compounds depend on the cation distribution as also in other cases [9]. However, the magnitudes of the lattice parameters depend on the heat treatment, fineness and purity of the powder, etc. Therefore it is proposed to have a new model, which is dependent on the relative values of lattice parameters of the reported samples. As larger cation Li^+enters M1 site and excess Li enters interstitial sites there is an expansion along 'c' and a contraction along 'a' and 'b'parameters [20] for the space group Bbmm. Hence a parameter (c/ab) is chosen to obtain the relationship between lattice parameters and cation distribution. Table 1 gives the values of parameter (c/ab) obtained from the reported data and the ratio q1/q2 of cationic charge distributions q1 and q2 on M_1 and M_2 sites respectively. The nonlinear relationship is observed between (c/ab) and (q_1/q2) as shown in Figure 1. Cation distributions of the reported samples are shown in Table 1.

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Table 1 : Cation Distribution of the Reported samples obtained from the reported data.

Sample	Cation distribution	(c/ab)	q_1/q_2
$R_{1[17]}$	$[Fe_{0}\ Ti_{1.0}]_{M1}\ [Fe_{2.0}\ Ti_{0}]_{M2}\ O_5$	0.03683	1.3333
$R_{2[18]}$	$[Fe_{0.67}\ Ti_{0.33}]_{M1}\ [Fe_{1.33}\ Ti_{0.67}]_{M2}\ O_5$	0.03818	0.9985
$R_{3[19]}$	$[Fe_{0.88}\ Ti_{0.12}]_{M1}\ [Fe_{1.12}\ Ti_{0.88}]_{M2}\ O_5$	0.03824	0.9069
$R_{4[20]}$	$\{(Li)_{0.08}\}[Fe_{0.69}\ Li_{0.31}]_{M1}\ [Fe_{0.57}\ Ti_{1.43}]_{M2}\ O_5$	0.03873	0.6406
$R_{5[20]}$	$\{(Li)_{0.11}\}[Fe_{0.49}\ Li_{0.51}]_{M1}\ [Fe_{0.13}\ Ti_{1.87}]_{M2}\ O_5$	0.03909	0.5032
$R_{6[20]}$	$\{(Li)_{0.17}\}[Fe_{0.16}\ Li_{0.64}\ Ti_{0.20}]_{M1}\ [Fe_{0.11}\ Ti_{1.89}]_{M2}\ O_5$	0.03933	0.4866

$$q_1/q_2 = \{(2006.2)\ x^2 - (230.02)\ x + (8.7843)\}10^5\ x - 11172.75 \quad (3.1)$$

Where, x = c/ab

Before giving cation distribution of the samples under study it is felt necessary to locate the position of "$(LiAl)^{4+}$" in Fe_2TiO_5. It is observed from the XRD data that relative intensities of (040) plane passing through interstitials have increased (Table 3). This confirms that the "$(LiAl)^{4+}$" enters the interstitials of Fe_2TiO_5 may also be termed as the intercalation. Also the FTIR spectra indicate that the absorption corresponding to M1 sites of "$(LiAl)^{4+}$"containing samples tends to equal the absorption corresponding to M2 site (Figure 2). Therefore applying empirical formula (3.1) to the XRD data in Table 2, the cation distribution of the samples under study is obtained as given in the Table 3.

Table 2 : Lattice parameters, (c/ab), Charge ratio (q1/q2), Avg. particle size and XRD density.

Sample	a (Å)	B (Å)	c (Å)	c/ab $(Å)^{-1}$	q_1/q_2	Avg. particle size (Å)	XRD density g/cc
[FTR]	9.7780	9.9608	3.7262	0.03826	0.90	540	4.38
$[FTL_1R]$	9.7282	9.9253	3.7055	0.03838	0.83	338	5.02
$[FTL_2R]$	9.7547	9.9222	3.7162	0.03840	0.82	328	5.05

Table 3 : Relative % intensities of (040) plane and Cation Distribution of the samples.

Sample	Cation distribution obtain from the suggested Model	Relative % intensity of (040) plane
[FTR]	$[Fe_{0.78}\ Ti_{0.22}]_{M1}\ [Fe_{1.22}\ Ti_{0.78}]_{M2}\ O_5$	1.6
$[FTL_1R]$	$\{(LiAl)_{0.5}\}\ [Fe_{0.95}\ Ti_{0.05}]_{M1}\ [Fe_{1.05}\ Ti_{0.95}]_{M2}\ O_5$	45.2
$[FTL_2R]$	$\{(LiAl)_{1.0}\}\ [Fe_{1}\ Ti_{0}]_{M1}\ [Fe_{1}\ Ti_{1}]_{M2}\ O_5$	52.9

b) Effect of LiAl on Dielectric Properties

i. *Relaxation Spectra*

In [FTR], the dielectric constant (K') decreases considerably with frequency (Table 4, Figure 3). Which indicates the presence of large quantity of space charge. The nature of this relaxation spectrum is similar to the two media model for the space charge [21]. The presence of a broad tan δ maximum (Figure 4) implies that the dielectric material has conducting ellipsoids (perhaps vacant interstitials) surrounded by an insulating material. In $[[FTL_1R]$ and $[FTL_2R]$ the quantity of space charge is insignificant (Table 4, Figure 3) and the conducting medium is almost absent due to the intercalation of "$(LiAl)^{4+}$".

ii. *Variation of Dielectric Constant with Temperature*

Variation of K' with temperature (300-850 K) at 1kHz is investigated as shown in the Figures5-7. For the samples $[FTL_1R]$ and $[FTL_2R]$ the dielectric constant K' first decreases from 300K to 350Kand after 350K, A loop is observed in the temperature range in which the microcrack healing is reported. The loop areas are larger corresponding to the intercalated samples.

d) Electrical Transport Properties

Table 4 : Restivities, activation energies, band gaps and dielectric constants at room temperature.

Sample	ρac at 1 kHz (KΩm)	ρdc (MΩm)	Activation Energy at high temp. (eV)	Band Gap (eV)	Dielectric constant (K') at			
					1 KHz	10 KHz	100 KHz	1000 KHz
[FTR]	5.5	6.6	0.75	1.50	3407	1484	339	75.8
$[FTL_1R]$	19.3	10.4	0.80	1.60	887	169	69	43.2
$[FTL_2R]$	15.2	10.7	0.83	1.66	897	192	74	46.4

The room temperature resistivities have increased considerably with intercalation of "$(LiAl)^{4+}$" this is due to lowering of space charge. The variation of a.c. resistivity (1kHz) with temperature is measured (300-850K) for all the samples and is shown in the Figures 8-10. From 300K to approximately 350K the curve shows PTCR effect for LiAl containing samples. Above 350K all the curves show two distinct activation energies. The activation energy at high temperature corresponds to the band gap (Table 4). The band gaps are larger corresponding to the intercalated samples.

d) Magnetic Properties

From the shape of hysteresis curves (Figures11, 12) the samples [FTL_1R] and [FTL_2R] may have long range magnetic ordering [22-25] of super paramagnetic (S.P.) type, however the magnetic moment is small. The magnetic susceptibility is not detected in [FTR]. The susceptibility Vs temperature plots corresponding to samples [FTL_1R] and [FTL_2R] are shown in Figures 13,14. The curie temperature (~74°C) is not well defined, which implies the co-existence of multiple curie temperatures. This may be due to the distribution of strength of exchange interaction, which reduces the space charge considerably. At curie temperature the exchange interaction vanishes and the space charge minimizes. The magnetic transition is well depicted as a dip in dielectric constant (Figures 6, 7) and the end of PTCR region (Figures 9, 10) at around 350K.

IV. CONCLUSIONS

The space charge and therefore Dielectric constant is considerably less for LiAl containing samples. The ac and dc resistivities increased with intercalation of LiAl. The energy band gaps increased with intercalation of LiAl. The PTCR effect is observed in LiAl containing samples. The magnetic transition is well depicted as a dip in dielectric constant and the end of PTCR region at around 350K. In LiAl contaning samples long range magnetic ordering of super paramagnetic type is observed, however the magnetic moment is small.

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FIGURE CAPTIONS

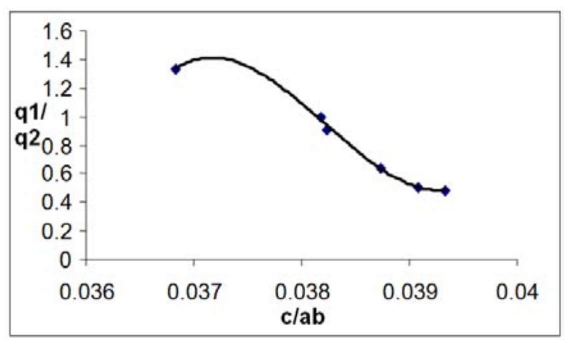

Figure 1 : Cation Distribution Model.

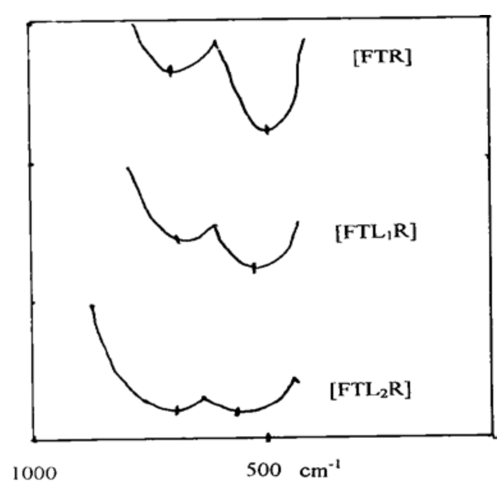

Figure 2 : The IR bands corresponding to M1 and M2 Octahedra.

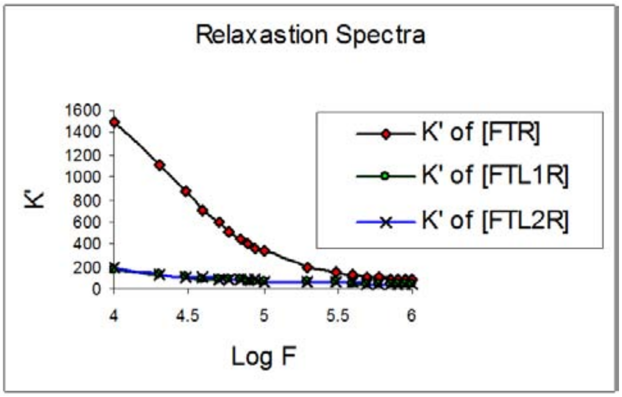

Figure 3 : Relaxation Spectra.

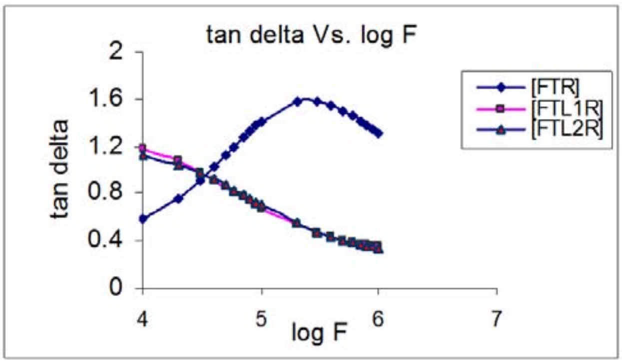

Figure 4 : The plot of tan δ Vs log F.

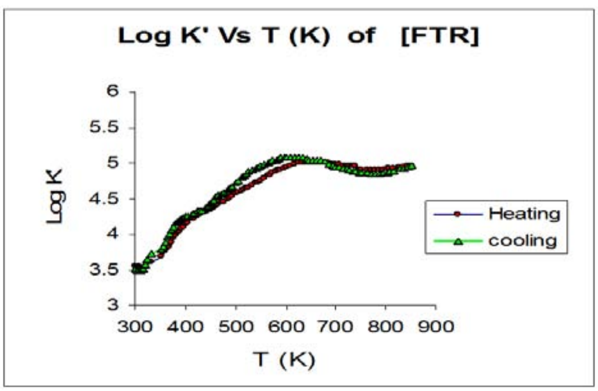

Figure 5 : The variation of Dielectric constant with temperature of sample [FTR].

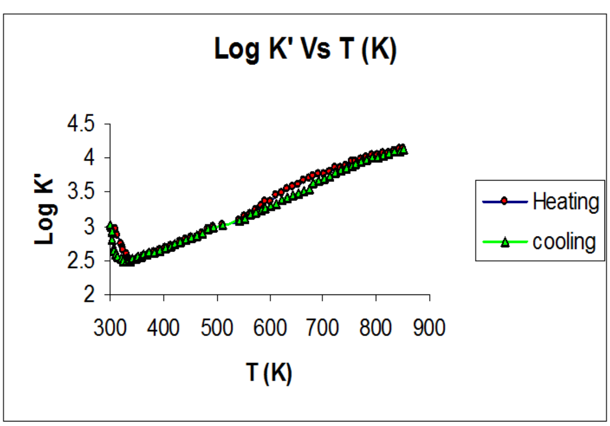

Figure 6 : The variation of Dielectric constant with temperature of sample [FTL_1R].

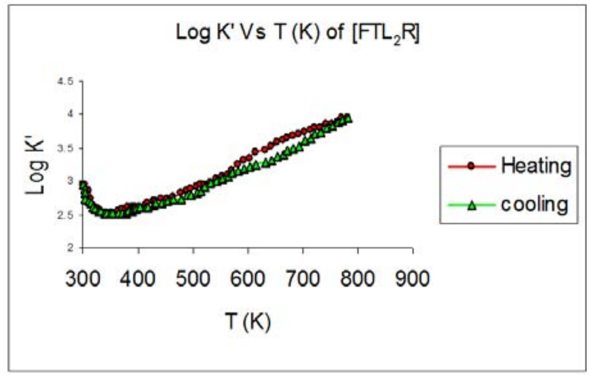

Figure 7 : The variation of Dielectric constant with temperature of sample [FTL_2R].

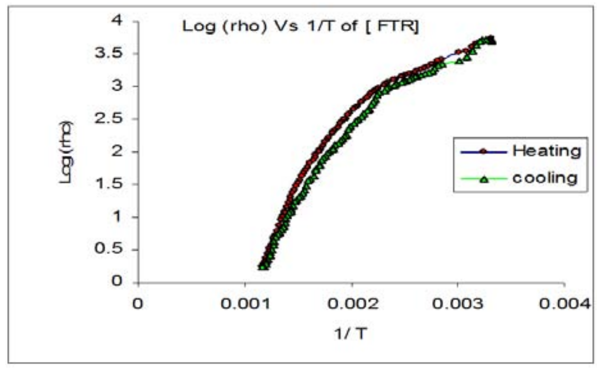

Figure 8 : The variation of a.c. resistivity with temperature of sample [FTR].

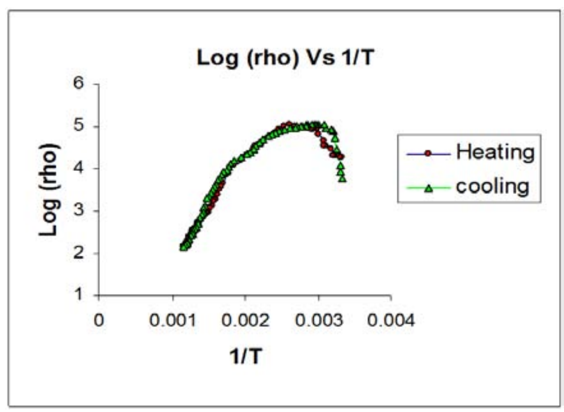

Figure 9 : The variation of a.c. resistivity with temperature of sample [FTL_1R].

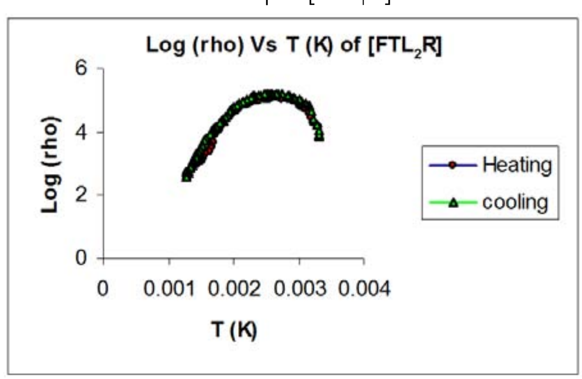

Figure 10 : The variation of a.c. resistivity with temperature of sample [FTL_2R].

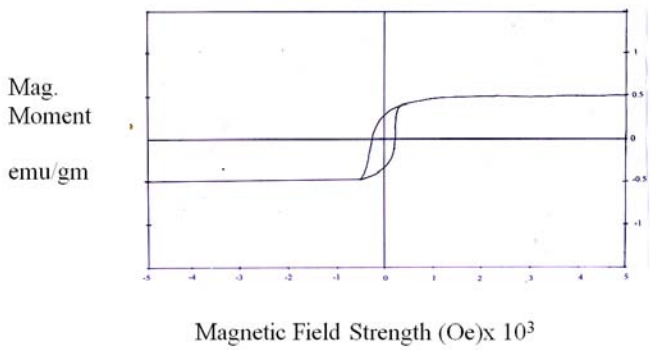

Figure 11 : The magnetic hysteresis of sample [FTL_1R].

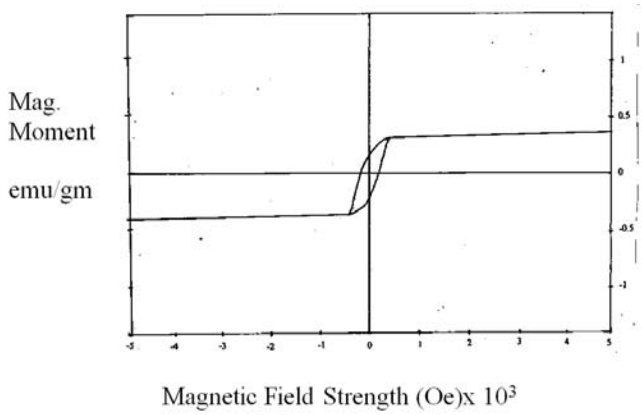

Figure 12 : The magnetic hysteresis of sample [FTL_2R].

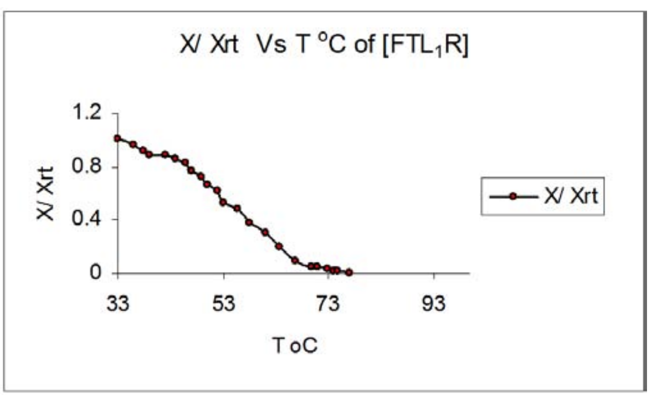

Figure 13 : The variation of magnetic susceptibility with temperature of sample[FTL_1R].

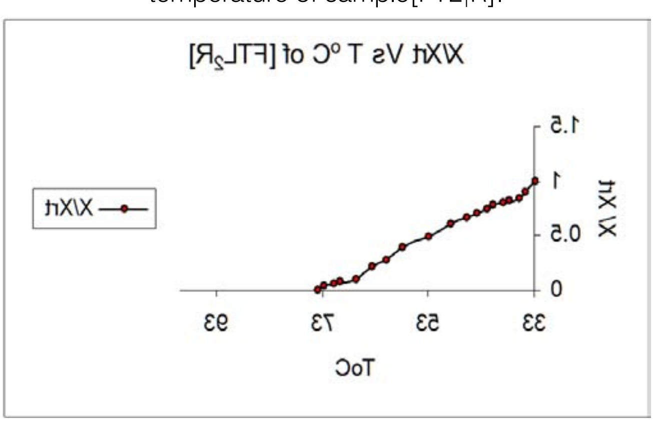

Figure 14 : The variation of magnetic susceptibility with temperature of sample [FTL_2R].

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Possible Signs of Flora on the Planet Venus

By L. V. Ksanfomality, A. S. Selivanov & Y . M. Gektin

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Keywords: planet venus; venera missions; astrobiology; hypothetical flora; space vehicles instruments; planet’s surface.

GJSFR-A Classification : FOR Code: 020199

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Strictly as per the compliance and regulations of :

Possible Signs of Flora on the Planet Venus

L. V. Ksanfomality [α], A. S. Selivanov [σ] & Y. M. Gektin [ρ]

Abstract- Experiments in television photography instrumented by the landers VENERA-13 and VENERA-14 (March, 1 and 5, 1982) yielded 37 panoramas (or their fragments) of the Venus surface at the landing sites. The archival panoramas were re-examined using modern processing techniques and revealed 'stem' objects possessing apparent terramorphic features of Earth-like plants. This paper is devoted to hypothetical venusian flora only. 'Plants' or 'Stems' are thin knotty vertical trunks that have a thickness of 0.3-3 cm and are 0.2 to 0.5 m tall. On close objects, one can see that the 'stem' at the top end is provided with a large bulge, a 'burgeon' or 'flower', with 'petals' surrounding a bright center.

Keywords: planet venus; venera missions; astrobiology; hypothetical flora; space vehicles instruments; planet's surface.

I. Introduction

For thousands of years, humanity has wondered whether there is life outside the Earth. Recently, a series of studies was devoted to strange entities in images that were returned from the surface of the planet Venus by the VENERA landers, 39 (for VENERA-9, 10) and 32 years ago (for VENERA-13, 14). Experiments in television photography [1, 2] instrumented by the landers VENERA yielded many panoramas (or their fragments) of the Venus surface at the landing sites.Thus the method was the same that is used for a contemporary search of hypothetical martian life. The images were re-processed using modern processing techniques. There are entities that one can consider to be signs of hypothetical life on Venus, regardless of how crazy this assumption sounds. Along with unfamiliar forms, some of the found objects are closely reminiscent of the forms of some of Earth's living organisms. The similarity phenomenon is called terramorphism.

II. The Venera TV-Experiments

The VENERA experiments were of extreme technical complexity. Over the past 32 years, no similar missions have been sent to Venus. The thematic issue of "Kosmicheskiye Issledovaniya", V. XXI, No. 2-3, 1983, presented the main results of the VENERA-13 and -14 missions. The methodology of the television experiments on the surface of Venus and the date and list of the experimental data have been published in details [1-4]. The coordinates of the lander VENERA-13 (March 1, 1982) landing site were 7.5°S, 303.5°E, and its height above the level of radius 6051 km was 1.9 km. The temperature was 735 K (462°C) and the pressure was 8.87 MPa, which corresponds to the atmospheric density 59.5 kg/m^3, with the composition CO_2 (96.5%) and N_2 (3.5%). The VENERA-14 lander (March 5, 1982) sank at the equatorial zone at 13°S, 310°E, and the landing site's height was 1.3 km above the radius of 6051 km. The measured physical settings were as follows: The temperature was 738 K, pressure of 9.47 MPa and atmospheric density approximately 65 kg/m^3. Gas analyzers repeated that the atmosphere is composed almost entirely of CO_2 (96,5%) and N_2 (3.5%). At both landing sites local time was about 10 am, with a solar zenith angle of 37 and 36°. Illumination by the diffused sunlight was 3-3.5 kLux. (For more details see [2]).The scene illumination reached 3.5 klx [1,5]. In both cases, the transmission of images began with a one-minute delay after landing to prevent any dust from obscuring the optical view.

The first images of Venus' solid surface were transmitted to Earth by TV-cameras of the VENERA-9 and -10 landers, on 22 and 25 October 1975 [6]. Each of the landers returned one whole and one fragmented panorama. The landing site of the VENERA-9 lander was 32°N, 291°E and of the VENERA-10 lander was 16°N, 291°E, both near the extensive highlands Rhea and Theia Mons. The typical Venusian landscape is a waterless hot stones, or friable flat desert (Fig.1), sometimes with mountains or even volcanoes. An interesting feature of the hypothetical Venusian flora (as well as hypothetical fauna) should be their adaptation to the very long duration of day and night [7]. The annual period of Venus (224.7 terrestrial days), combined with the rotation period (243 days), taking into account the inverse rotation, results in a duration of a sunny day of $T_{sol} = (T^{-1}_{sid} + T^{-1}_{orb})^{-1} = 116.8$ days. Since the rotation axis is almost normal to the orbital plane, day and night are equal to each other and last 58.4 days each. Seasonal effects are absent.

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Figure 1 : Upper panel: a color image of the camera 2 of VENERA-13 constructed after the initial processing (1982). The lower panel presents the same image after the author's contemporary treatment.

On March 1 and 5, 1982, experiments in television photography were repeated by the landers VENERA-13 and 14 [1], yielding in 37 panoramas or their fragments of the Venus surface, with both groups suitable for processing. Their landing sites were 7.5°S, 303.5°E and 13°S, 310°E. Over the past 32 and 39 years, no similar missions have been sent to Venus, primarily because of their extreme engineering complexity. Cameras of VENERA-9 and -10 were less sophisticated than those of VENERA-13 and 14. It should be mentioned that besides VENERA-9, -10, -13, -14 there were VENERA-11 and -12 missions (landed December 21 and 25, 1978); each lander was equipped by two scanning cameras. Unfortunately, on both VENERA-9 and -10 only one camera opened, the lid of the second one was not released. The second camera worked fine, but the window remained closed. The problem worsened when after landing, at VENERA-11 and -12 all lids of the cameras remained closed, although the cameras continued to work.

The VENERA-13 and VENERA-14 scanning cameras were fitted with glass filter disc. Spectral intervals were 410 - 750 nm (no filter), 390 - 510 (blue, images are almost useless), 490 - 610 (green) and 590 - 720 nm (red filter). The transfer of the first black-and-white image was succeeded by transmission of a red, green and blue image, and then again a black-and-white image came. At that time CCD detectors still were at their laboratory stage. The scanning optical-mechanical cameras were equipped by the photomultiplier FEU-114 as the light detector. Its spectral sensitivity was characteristic for a multialkali photocathode (Fig.2).

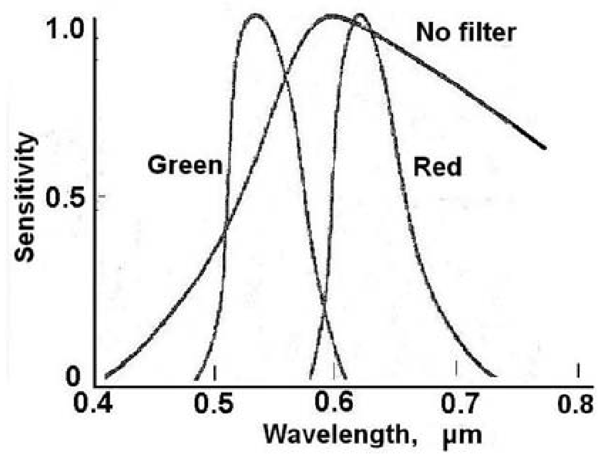

Figure 2 : Spectral sensitivity of the VENERA-13, -14 landers cameras.

The cameras optics entrance was located at a height of 90 cm above the surface, on both opposite sides of the lander. The inclination of the camera's axis (50°) allowed to discern millimeters-sized features of the surface in close proximity to the lander, and about 10 m at the mathematical horizon (at a distance of 3.3 km on a flat surface). The inclination of the camera's axis distorts the image. Pattern of the VENERA-13 panoramic image in initial processing is presented in upper panel of Fig.1. When treated by a contemporary means and corrected for the geometry distortion, the image appear much more detailed (Fig.1, the main panel).

As distinct from traditional television systems, the images produced by each VENERA cameras were panoramic (a horizontal field of about 180°), with lines oriented vertically having a resolution of 211 pixels on the active part and 252 pixels per line, including

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housekeeping. The angular pixel size was 11 arc min. One line took 780 ms (3.1 ms/pixel). The images consisted of 1000 lines and were transmitted by a radio transmitter's omni-directional antenna to the satellite located in the elliptical orbit. The satellite relayed the data from the lander to terrestrial receiving stations in real time.

The VENERA-9 and -10 cameras (1975) were designed for only black-and-white TV-images. The camera design, the images, methods of their processing and interpretation were detailed in a special edition "The first panoramas of Venusian surface" [8]. A special feature of the experiments was the use of powerful lights for the field illumination as there was no certainty that surface will be in good lighting conditions. Two 100-Watt halogen lamps were used, but the precaution was not justified.

Due to high efficiency of thermal protection the rise of the landers' temperature was fairly slow, despite high ambient temperature [2]. On March 1, 1982 the camera 1 of the lander VENERA-13 was operating during record long time, 1 hour 40 minutes, as reported officially. If one considers all the data, including those with an increased noise the signals were being received by the orbiter for more than 2 hours (126 minutes; or may be even for 139 min, according to M.Yu.Gektin, one of authors of the TV-experiment). Anyway, it would have continued, and still worked, but approximately at this time, it is not clear who and why, sent a command from Earth, ordered to stop receiving data on orbiter, while the lander continued to send its signals.

The loss of radio communications between the lander and orbiter would ultimately caused by orbiter's dipping beyond the horizon. Nevertheless disturbance in the operation of the dangerously overheated radio system had been observed sporadically long before the connection was completely lost. Scanning of a single panorama made by VENERA-13 and its simultaneous transfer took 13 minutes. The ADC used 9 bit encoding (TIFF format, with bit #10 used for housekeeping).

After the first full series completed, in the second set, with a good signal level and with low noise, partly shortened versions of the red and green panoramas were transmitted; however, some of their parts still were lost due to the noise. When processed they were replaced by the same parts taken from other images. After completing the second series, the camera and the radio link, of course, did not shut down and continued to work. In the third series, black-and-white, red, green and blue images were transmitted, all with different types and level of noise. The images obtained in the blue spectral region were almost useless, because the blue rays are almost completely blocked by the Venus' atmosphere.

The published colorful panoramas are based on the data of the first and partly of the second series. For the synthesis of color images, that was enough.

III. Hypothetical Mushroom-Like Entity

As a result of the panoramas newly processed the quality of the images was noticeably improved. An interesting findings on the panorama Fig.1 may relate to hypothetic Venusian living form. These entities were investigated first in 2012-2013 [8, 9]. With the improved methods of image processing, contours of previously unclear details became sharper. In Fig.3 "a mushroom" belonging to hypothetical living forms is presented.

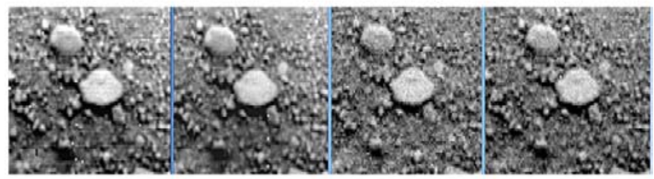

Figure 3 : Fragments of four VENERA-13 panoramas with the "mushroom" object.

Prior to the new image processing, these objects have not attracted any attention, although one of them has been located in the very foreground of the VENERA-13 panorama.

Four fragments of non-processed versions of panoramas of the landing site of the VENERA-13 are shown in Fig. 3, two black-and-white, red and green images were obtained during the first 87 min of the mission.

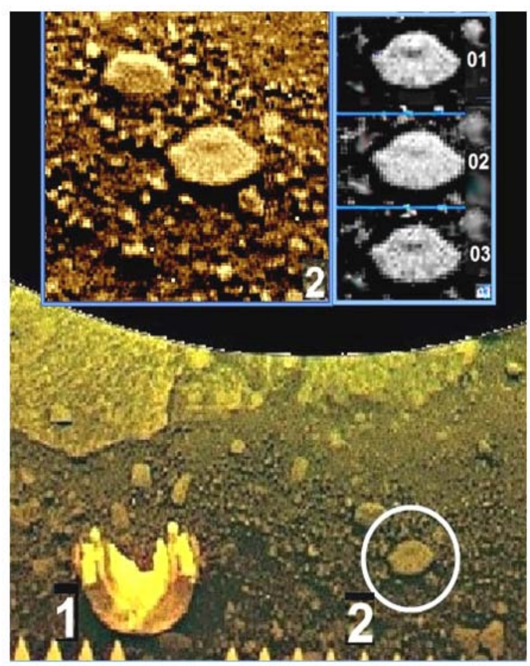

Figure 4 : Position of the tent-shaped object "mushroom" (2) on the VENERA-13 panorama. Three black-and-white figures 01-03 demonstrate a radially folded structure of the object resembling Earth' mushrooms. The white feature 1 is the camera's lid.

The object 2 whose shape resembles a mushroom is located in the foreground at a distance of

15 to 20 cm from the buffer of the lander (Fig. 4). It is elevated above the surface by about 3 cm; however, its support is not visible. The detached camera lid 1 sizes 20 cm. The diameter of the "mushroom" 2 attains, approximately, 8 cm. It is clearly seen on all sequential panoramas of VENERA-13. In Fig. 4, 2, the mushroom is the brightest object in the central part of the panorama. Comparing its brightness with the lighter periphery of the figure, one should keep in mind that the object resides in the shadow region made by the parachute panel of the landing module. The color image Fig. 4 is composed of black-and-white and color-divided red and green primary panoramas. Six sequential images were processed by the method of correlative stacking, including all available panoramas. Three of the resulting versions of black-and-white images are shown by the upper panel of Fig. 4. In each case, the radial tent-shaped folded structure of the object is seen. By virtue of the fortunate close position of the "mushroom", its structural details are clearly distinguishable.

For the 1.5-hour observation of the Venusian surface, no attributes that could testify to motion of the object were found. However the resolution is too poor for a confident conclusion. Apparently, one may relate these objects to Venusian flora (if "mushrooms" relate to flora). This allows associate its properties with the noticeable manifestations of terramorphism, which indicates certain unknown yet biological regularities [9]. By virtue of the small size of the mushroom, it is hard to observe other similar objects remote from the camera at a greater distance.

IV. Hypothetical Plants on Panoramas of Venera-13 and Venera-14

Due to the availability of up to eight duplicates of the images obtained and their low level of masking noise, the VENERA panoramas permit identifying and exploring many types of hypothetical life forms of Venus. Specifically, "plants" or "stems" are the most numerous group of samples of hypothetical flora. The first stem object was detected due to its being close to the entrance of the TV camera, and the remaining were detected by similarities in their shapes and positions to the first stem.

At the time of this writing, three years have elapsed since the submission of the first manuscript for publication that was devoted to hypothetical signs of life on the planet Venus [3]. These objects hypothetically have characteristics of living creatures - flora or fauna.

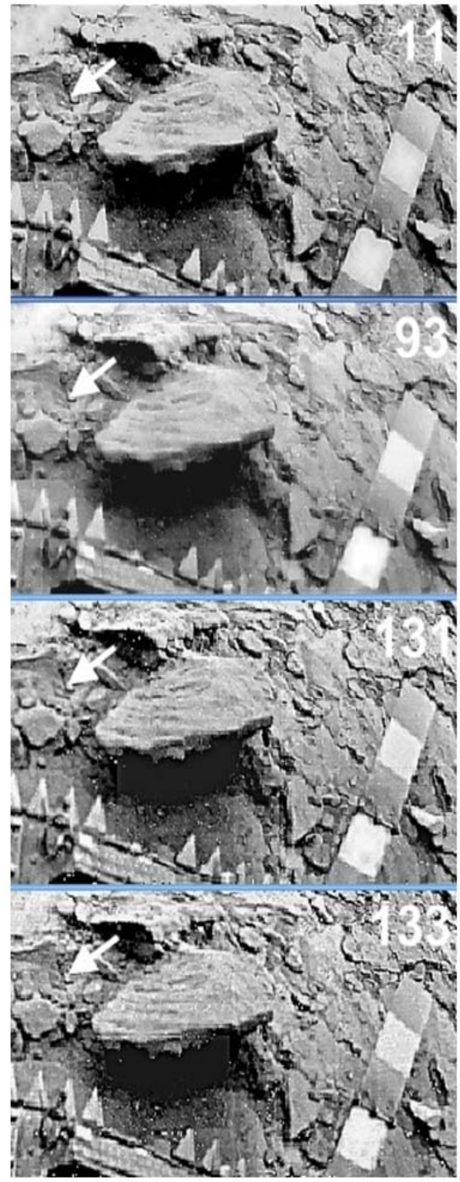

Figure 5 : Fragments of the image of the planet surface at the landing site of VENERA-14. A feature under consideration is shown by the arrow.

When experience using image processing was accumulated, the VENERA-14 panorama allowed an approach to the finer details. An important role was played by additional image processing, image geometric correction and the presence of up to eight duplicates of images that were obtained with good quality and low levels of noise. This arrangement enabled the selection and staking of their fragments. As a result, it managed to find and learn about a few new types of hypothetical living forms at the VENERA-14 landing site [10].

The interest in the searched autotrophic flora of the planet as a source of the existence of its fauna was noted in [4,8-10]. It is natural to assume that, like on the Earth, the Venusian hypothetical fauna is heterotrophic, and the source of its existence is hypothetical autotrophic flora. Although the direct rays of the Sun, as a rule, do not reach the surface of the planet, there is enough light for photosynthesis of the Earth-like type there. A diffuse illumination of 0.5-5 kLux is sufficient for photosynthesis even in the depths of the dense forests of the Earth. The measured illuminance on Venus is of the same order, at the range of 0.4 to 9 kLux. Of course, photosynthesis at high temperatures and in a non-oxidizing environment should be based on a completely different, unknown biophysical mechanism.

The feature shown by the arrow in Fig.5 resembles only a thin scratch, but it is repeated at all panoramas and in the same place. When processed the "scratches" are vertically arranged thin knotty trunks, which are 0.3-2 cm thick and 0.2-0.5 m (and more) tall. On color panoramas, they look black. The first "stem" object that was detected (Fig.6, circled), has a large bulge at the top end, a "burgeon", with a lighter center. The “stem” is located close to the camera. At the “stem’s” base, on the surface, there is a visible group of details that resembles a quatrefoil. Each of its “leaves” has a size of approximately 5-10 cm, and possibly, they have a radial structure. In the vicinity of VENERA-14, the number of stems at the panorama is approximately eight. All of the "stems" are placed vertically, with the exception of one of the largest, which bends to the surface.

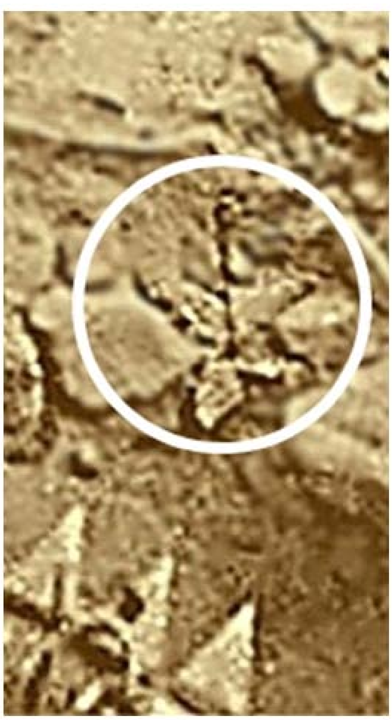

Figure 6 : The first found object of the "stem" type is a thin vertically arranged knotty trunk that has a height of approximately 42 cm and a thickening ("burgeon") on the top. The "stem" is located at a distance of approximately 40 cm from the landing buffer of the VENERA-14 lander and is seen from above.

The clarity of a picture element that has a fixed size depends on the distance. The line resolution was 211 pixels and 11' (arc min); thus, a pixel size of 0.5 cm (thickness of the stem) will correspond to the distance 0.005/(11/3438) = 1.56 m (3438 - the number of minutes in one radian). If the image of a specific object is not single, as in the case of stems, then batch processing and stacking can be used to study the details. Unfortunately, upon heating, the equipment’s adjustment deteriorated, and the actual resolution became worse. In Fig. 6, the knots on the stem have a 2-3 pixel size (1-2 cm), and the "bud" has a 5-6 cm size. Based on the geometry of the resulting angles, we can assume that each point of the image of a stem that is at a distance of 3 m is eroded by four pixels, and its contrast is reduced by about half (due to the one-dimensional structure of the object). For more remote stems, the contrast is reduced; thus, their detection becomes impossible.

To find the height z of the stem in Figure 6, one should use geometric relations and a photoplan (because, on the original panoramas, the distances are significantly distorted). An exact photoplan of the landing site of VENERA-14 is currently being finalized and is not shown here. The input window of the TV camera is located at a height of $h = 90$ cm, the distance a from the projection point of the TV-camera lens onto the surface, to the base of the stem is approximately 40 cm, and the top of the stem is projected onto the surface details, roughly at the distance of $b = 75$ cm. If the stem is placed vertically, from the right triangle, then the angle α at its apex is found to be tg $\alpha = b/h$, and the stem height is $z = (b\text{-}a)/\text{tg}\ \alpha = 42$ cm. A possible error can indicate that the ground surface is uneven.

All of the detected stems are thin and apparently knotted. However, perhaps there is one exception. In the peripheral part of the panorama of VENERA-9, there is an object that could be a thick stem. The image shows its light spotted top.

Its height is approximately half a meter, the thickness of the stem is approximately 5-8 cm, and the nodes are not visible. However, we should be reminded that the low resolution of the VENERA-9 images does not permit making firm conclusions. Other stems on the panorama of the VENERA-9 panorama were not found, perhaps for the same reason.

V. Stems with Flowers

To search for other stems, an additional processing of the VENERA-13 and -14 panoramas has been made to improve the clarity of the details. In some of the cases, the correction has been made of geometrically distorted panoramas. Black-and-white panoramas of VENERA-14 presented in series - groups 1, 6 and 9, 13 (of camera 1) and 3, 5 and 7 and 11 (of camera 2) - and the "red" panoramas of the same series

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(except for defect series 7) were used obtained within 1.5 hours. "Green" panoramas are difficult to use because they are noisier. The synthetic color panorama was used to obtain some information about the colors of the objects.

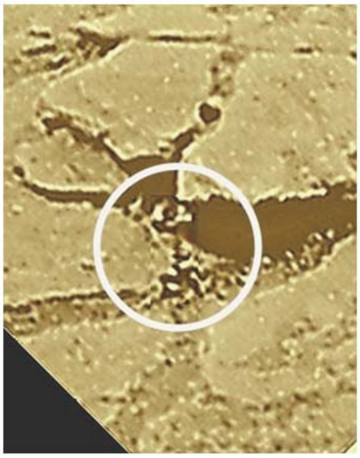

Figure 7 : Processed image: "stem", "quatrefoil" at its base and the opening "burgeon", crowning the top of the "stem" at the landing site of VENERA-13."Stem" is in the foreground.

The clarity of details is different in different panoramas. Large but distant stems, perhaps more than half a meter in height, appear to be found in the left-hand edge of the panorama VENERA-14 and several distant "stems" were found in the right part of the panorama VENERA-13. In all of the cases, the bases of the "stems" were located in crevices between stones. All of the stems that were found are solitary.

Unlike VENERA-14, at the VENERA-13 landing site, only one or two such objects were found, for which the base of the "stems", similar to in Fig.6, were in a crack between the stones. This circumstance can be important because the soil here is mainly fragmented, but the stems there were not found. This interesting object is shown in Figure 3, which presents a stacking of four consecutive images of a knotty stem that was found in the VENERA-13 panoramas. However, the "stem" in Figure 3 is lower than in Fig.6; it is more distant, and the stem itself is not easy to notice, although there are eight distinct images (duplicates), which allows for batch processing. The attention is drawn to the top of the stem, which appears in Fig.7 as a triad of bright dots that are visible on all of the original high-contrast images. The position of the triad is not identical in successive frames. It varies slightly with respect to the adjacent light-colored stone on top of it (Fig.7). This change could arise from the swinging of the triad by the wind.

A clearer picture of the "stem" with a flower is highlighted in Fig.8. It has been suggested that the complex structure of the top of the stem is an opened burgeon. When processing the image with a decreasing contrast, this assumption was confirmed and allowed us to see the whole "flower", of a regular shape (Fig.8), with a white spot (pestle?) in the center and the surrounding petals.The top of the "stem" is more complex than the triad (or bud in Fig.6). The object is visible from above, and its height, which is found by its position on the photoplan, is only approximately 20-30 cm at the base in the crack between the stones. At its base, there is a group of four bright details, similar to the "quatrefoil" leaves shown in Fig.6; that appears to be associated with the stem, also.

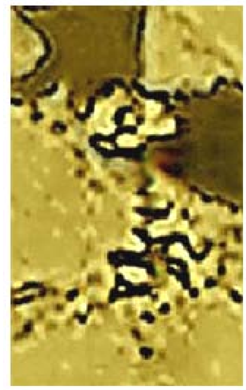

Figure 8 : "Flower" - the same object as in Fig. 6, with lowered contrast and detailed image of the "flower", its light central part and leaves at the base. The diameter of the flower and the "quatrefoil" at the base are 5-8 cm.

The flower is composed of six to eight light petals. Its right-hand bright part forms the triad that is repeated on all of the duplicates, as part of a disclosed flower. The "flower" size is approximately the same as a "quatrefoil" at the base of the stem. The VENERA-13 panorama has been organized in such a way that Fig. 7 represents only a fragment of the black-and-white image; thus, one can talk about only the bright colors of the petals, and their color in Figs.7 and 8 is unknown.

Another interesting but unobtrusive small bright quatrefoil was detected at the center of the VENERA-14 panoramas in a depression that is quite close to the landing buffer (Fig. 9, see frames 1 and 2). In contrast to Fig. 6, its "leaves" are very bright, only slightly darker than the white cap released from the TV camera. One of the quatrefoil elements is in the shadow of a stone. The dimensions of the "leaves" are not more than 2 cm. Despite its smaller size, the object similarity with Fig.6 is obvious. The "stem" itself on the source panoramas (frame 1) is difficult to see; it was isolated by using a gamma-correction and in such a form is shown in column 4 as consecutive original pictures (Fig.9, frame 3).

The height of the plant observed from above is approximately 10 cm. There is a "flower" seen on its top, also. When the image is processed, the "stem" gets viewed as in Fig. 9, frame 4. The dimensions of the "flower" are approximately 2 cm, also. To the right of it, another "flower" is visible, the stem of which apparently is placed behind the stone.

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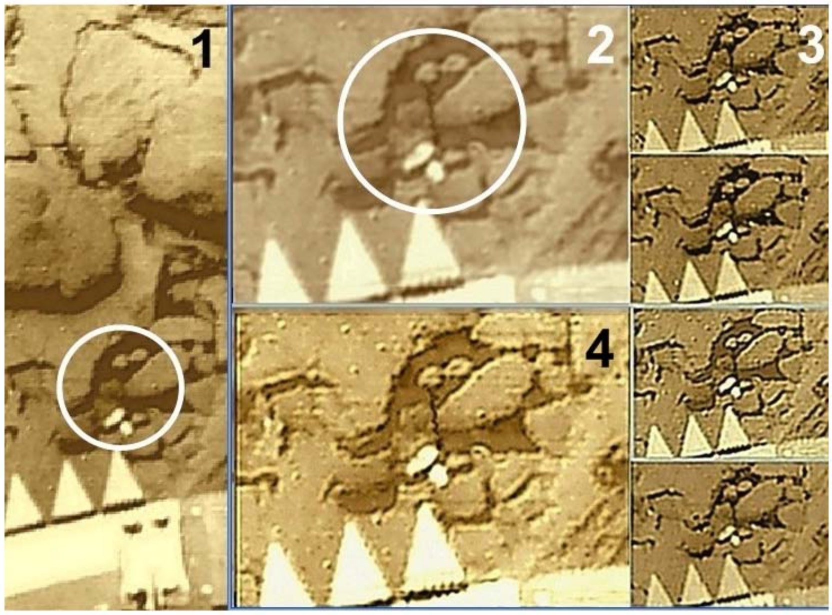

Figure 9 : "Stem" (1, 2) with a bright "quatrefoil" located directly at the landing buffer of VENERA-14; its recurring images are shown on four consecutive panoramas (column 3). The processed image is shown in frame (4). To the right of the feature there is another "flower" visible, the stem of which is apparently situated behind the stone.

In Fig. 9, "stem" and "flower" are seen against the background of high contrasting details and cracks in the stone slab recess. The stem rises from the recess. The object is relatively close to the camera (less than 1 m), but the "flower" is small, and compared with Fig.6, the resolution is low.

There is another fragment of the supposed stem refers to the VENERA-14 panorama, for which there is a full color version. Therefore, it is possible to obtain some information about the color of the object. As mentioned above, the useable VENERA-13, -14 color separation were 490 - 610 nm (green), 590 - 720 nm (red filter) and 410 - 800 nm (no filter). The solar energy distribution at the surface in the range of 410 to 800 nm has a maximum in the nearest infrared region (Fig.10).

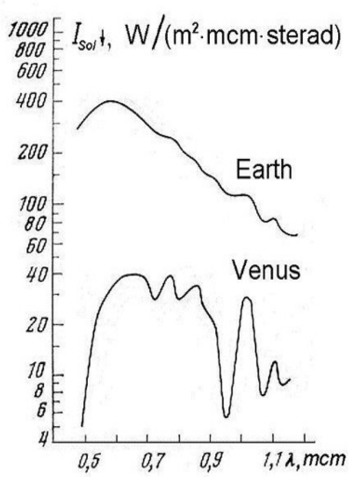

Figure 10 : The solar energy distribution at the surface of Venus close to the equator and midday, in the range of 500 -1200 nm.

Thus, colorful panoramas can be considered conditionally as tricolor. In this sense, the flower shown in it, when compared with the background, has a greenish tint. However, the identification of the object is made with the least confidence among the other figures. The spotty nature of the surface and numerous cracks complicate the identification of the object.

VI. On the Role of Burgeons and Flowers

The landing site around the landers VENERA-13 and VENERA-14 showed a significant number of vertically oriented objects that were similar to the stems of terrestrial plants. The stems are an important complement to the objects of a hypothetical Venusian flora discussed in [10]. If the tops of the stems really are burgeons and flowers, one should reflect their role. The flowers of terrestrial plants are intended for their pollination and reproduction. Pollination is conducted either by insects or by the wind. Wind-pollinated plants do not require blooms in principle, for example, the case of the poplar "fluff." Flowers attract insects. Do the tops of the stems in Fig. 6-9, at least indirectly, hint on the likely participants in the process of pollination?

Terramorphism of hypothetical objects of the flora and fauna of Venus was observed repeatedly in many entities [5, 8-9]. Flowers with their petals in Figures 8 and 9 are new objects that are surprising to find. It is surprising to find the occurrence of the same forms of living objects on different planets that have radically different physical settings. What are the laws of nature that determine the recurrence of terramorphism hidden in such markedly different environments?

The Earth's flora began the evolution of carbon dioxide in an oxygen-free atmosphere, for which the composition was similar to the current atmosphere of Venus. As noted, the illumination on the surface of the planet Venus energetically complies with photosynthesis. Therefore, apart from the very large difference in the physical conditions, the flora of Venus should not be less rich than the Earth's flora.

VII. Conclusion

For thousands of years, humanity has wondered whether there is life outside the Earth. Recently, a series of studies was devoted to strange entities in images that were returned from the hot surface of the planet Venus by the VENERA landers, 32 years ago. Thus the method is the same that is used nowadays for a search of hypothetical martian life. The images were re-processed using modern processing techniques. There are entities that one can consider to be signs of hypothetical life on Venus, regardless of how crazy this assumption sounds, keeping in mind physical setting on the planet. The pictures revealed a dozen previously undetected strange objects that can attest to the fact that Venus does possess life. Materials shown in this paper demonstrate experimental results that involve re-processing of the original panoramas, without any retouching or corrections. For the moment, it is impossible to prove that the objects are alive in fact because they cannot be touched. However, the opposite is true also, that nobody can place errors into the processing of the images. Instead, critical arguments boil down to the famous humorous statement of A.P. Chekhov, in his 'Letter to my neighbor-scientist': "this cannot be, because it never can be." Subconsciously, all positions of critics have been based on variations of the statement: only the Earth's conditions are suitable for life. "We are the best and all our physical conditions are the best too". Based on this idea, limited "habitable zones" are drawn in schemes of extrasolar planet systems and are under the study of theoreticians. One may conclude that other physical settings should be considered either.

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Understanding Cosmic Temperature, Redshift, Growth Rate and Age in Stoney Scale Black Hole Cosmology

By U. V. S. Seshavatharam & S. Lakshminarayana
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Abstract- If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of hydrogen atom, then considering redshift as an index of 'whole galaxy' receding may not be reasonable. Clearly speaking, the observed cosmic redshift can be reinterpreted as an index of 'cosmological' thermodynamic light emission mechanism. During cosmic evolution, at any time in the past, in hydrogen atom- emitted photon energy was always inversely proportional to the CMBR temperature. Thus past light emitted from older galaxy's excited hydrogen atom will show redshift with reference to the current laboratory data. Note that there will be no change in the energy of the emitted photon during its journey from the distant galaxy to the observer. As there is no observational or experimental evidence to Friedmann's second assumption and as 'critical density' itself represents the density of 'growing and light speed rotating black hole', the density classification scheme of Friedmann cosmology must be reviewed at fundamental level and possibly can be relinquished.

Keywords: *mach's principle, stoney mass, black hole cosmology, cosmic growth index, cosmic growth rate, hubble potential, cosmic redshift, cosmic age, halting of cosmic expansion, final unification.*

GJSFR-A Classification : *FOR Code: 020199*

UNDERSTANDINGCOSMICTEMPERATUREREDSHIFTGROWTHRATEANDAGEINSTONEYSCALEBLACKHOLECOSMOLOGY

Strictly as per the compliance and regulations of :

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Abstract- If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of hydrogen atom, then considering redshift as an index of 'whole galaxy' receding may not be reasonable. Clearly speaking, the observed cosmic redshift can be reinterpreted as an index of 'cosmological' thermodynamic light emission mechanism. During cosmic evolution, at any time in the past, in hydrogen atom- emitted photon energy was always inversely proportional to the CMBR temperature. Thus past light emitted from older galaxy's excited hydrogen atom will show redshift with reference to the current laboratory data. Note that there will be no change in the energy of the emitted photon during its journey from the distant galaxy to the observer. As there is no observational or experimental evidence to Friedmann's second assumption and as 'critical density' itself represents the density of 'growing and light speed rotating black hole', the density classification scheme of Friedmann cosmology must be reviewed at fundamental level and possibly can be relinquished. Rate of decrease in current 'Hubble's constant' can be considered as a measure of current cosmic 'rate of expansion'. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion or acceleration. To understand the ground reality, sensitivity and accuracy of current methods of estimating the magnitude of H_0 must be improved and alternative methods must be developed. In this new direction by combining the basics of general theory of relativity, quantum mechanics and particle physics authors proposed 5 new methods for estimating the accurate value of H_0 and can be considered for further study and analysis.

Keywords: mach's principle, stoney mass, black hole cosmology, cosmic growth index, cosmic growth rate, hubble potential, cosmic redshift, cosmic age, halting of cosmic expansion, final unification.

I. Introduction

Using the Hubble space telescope it has been determined that there are about 9×10^{21} stars in the observable universe. Assuming an average stellar mass based on the Sun of mass 2×10^{30} kg, the universe's visible mass can be calculated to be about $1.8\times10^{52\pm1}$ kg. Another similar estimate obtained by [2] was 2.4×10^{52} kg. A recent study has tripled the number of estimated red dwarf stars in elliptical galaxies so this may be an underestimate.

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Michael E. McCulloch says [3]: For an observer in an expanding universe there is a maximum volume that can be observed, since beyond the Hubble distance the velocity of recession is greater than the speed of light and the redshift is infinite: this is the Hubble volume. Its boundary is similar to the event horizon of a black hole because it marks a boundary to what can be observed. This means that it is reasonable to assume that Hawking radiation is emitted at this boundary both outwards and inwards to conserve energy, and any wavelength that does not fit exactly within this size cannot be allowed for the inwards radiation, and therefore also for the outwards radiation. According to Hawking, the mass of a black hole is linearly related to its temperature or inversely-linearly related to the wavelength of the Hawking radiation it emits. Therefore, for a given size of the universe there is a maximum Hawking wavelength it can have and a minimum allowed gravitational mass it can have. If its mass was less than this then the Hawking radiation would have a wavelength that is bigger than the size of the observed universe and would be disallowed. The minimum mass it predicts is $(4.6 \pm 0.4)\times10^{52}$ kg and is encouragingly close to the observed mass of the Hubble volume. It can be called as the 'current hubble mass'. Note that by considering 'hubble volume' and 'hubble mass', distance cosmic back ground can be quantified and by finding the applications of hubble mass, Mach's principle can be implemented successfully in cosmology.

Authors published their concepts on black hole cosmology in many online journals [4-13]. In this paper by highlighting the basic short comings of modern cosmology [14] an attempt is made to review the model of black hole cosmology [15-28] in terms of cosmic redshift, CMBR redshift, cosmic growth index, cosmic growth rate and cosmic age. According to standard cosmology, since decoupling, the temperature of the cosmic background radiation has dropped by a factor of roughly 1100 due to the expansion of the universe. As the universe expands, the CMB photons are redshifted, making the radiation's temperature inversely proportional to a parameter called the universe's scale factor. If T_t is the temperature of the CMB and z is the observed redshift, then $T_t \cong (1+z)2.725\text{ K}$ where $(1+z)$ is known as the universal scale factor. Extending this concept, in this paper an attempt is made to re-interpret and re-understand the observed cosmic redshift in the following way. 1) If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of hydrogen atom, then considering redshift as an index of 'whole galaxy' receding [29,30] may not be reasonable. 2) If light is coming from the atoms of the gigantic galaxy, then instead of wavelength difference, in terms of 'quantum of energy' redshift can also be interpreted as an index of the galactic cosmological atomic 'light emission mechanism' and emitted quantum of energy is inversely proportional to the CMB temperature. 3) According to the modern cosmological approach, bound systems like 'atoms' which are found to be the major constituents of galactic matter - will not change with cosmic expansion/ acceleration. As per the present observational data this may be true. But it might be the result of ending stage of cosmic expansion. As the issue is directly related with unification it requires lot of research in basic physics to confirm. In this regard, without considering and without analysing the past data, one can not come to a conclusion. If one is willing to think in this direction observed galactic redshift data can be considered for this type of new analysis.

In 1947 Hubble himself stated [30] that: "We may predict with confidence that the 200 inch will tell us whether the red shifts must be accepted as evidence of a rapidly expanding universe, or attributed to some new principle in nature. Whatever may be the answer, the result may be welcomed as another major contribution to the exploration of the universe."

Friedmann made two simple assumptions about the universe. They can be stated in the following way.

1. When viewed at large enough scales, universe appears the same in every direction.
2. When viewed at large enough scales, universe appears the same from every location.

In this regard Hawking says : "There is no scientific evidence for the Friedmann's second assumption. We believe it only on grounds of modesty: it would be most remarkable if the universe looked the same in every direction around us, but not around other points in the universe". This is one key point to be noted here. The term 'critical density' is the back bone of modern cosmology. At any time in the past, it is generally expressed in the following way.

$$(\rho_c)_t \cong \frac{3H_t^2}{8\pi G} \tag{1}$$

Its current expression is as follows.

$$(\rho_c)_0 \cong \frac{3H_0^2}{8\pi G} \tag{2}$$

According to standard Friedmann cosmology,

1. If matter density is greater than the critical density, universe will have a positive curvature.
2. If matter density equals the critical density, universe will be flat.
3. If matter density is less than the critical density, universe will have a negative curvature.

But by considering 'black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'volume density'. If mass of the black hole universe is M_t, (c/H_t) is the radius of the black hole universe that rotates at light speed with angular velocity H_t, at any time in the past,

$$\frac{2GM_t}{c^2} \cong \frac{c}{H_t} \text{ and } M_t \cong \frac{c^3}{2GH_t}.$$

$$(\rho_v)_t \cong (M_t)\left[\frac{4\pi}{3}\left(\frac{c}{H_t}\right)^3\right]^{-1} \tag{3}$$

$$\cong \left(\frac{c^3}{2GH_t}\right)\left[\frac{3}{4\pi}\left(\frac{H_t}{c}\right)^3\right] \cong \frac{3H_t^2}{8\pi G} \tag{4}$$

At present,

$$(\rho_v)_0 \cong (M_0)\left[\frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3\right]^{-1}$$

$$\cong \left(\frac{c^3}{2GH_0}\right)\left[\frac{3}{4\pi}\left(\frac{H_0}{c}\right)^3\right] \cong \frac{3H_0^2}{8\pi G} \tag{5}$$

Clearly speaking, when the currently believed 'critical density' itself represents the mass density of a light speed rotating black hole universe and as there is no observational or experimental evidence to Friedmann's second assumption, the density classification scheme of Friedmann cosmology must be reviewed at fundamental level. Proceeding further, the basic shortcomings of modern cosmology can be expressed as follows. For more information see the authors published self references [4-13].

1. No direct observational evidence to Friedmann's second assumption [31]. We believe it only on the grounds of modesty. Really if there was a 'big bang'

in the past, with reference to formation of the big bang as predicted by general theory of relativity and with reference to the cosmic expansion that takes place simultaneously in all directions at a uniform rate at that time about the point of big bang - 'point' of big bang can be considered as the centre or characteristic reference point of cosmic expansion in all directions. In this case, saying that there is no preferred direction in the expanding universe - may not be correct.

2. No theoretical base in considering the Hubble's constant merely as the cosmic expansion parameter. With coefficient of unity, if one is willing to consider (c/H_0) as a characteristic length, then based on elementary dimensional analysis it is very simple to show that, dimensions of H_t are rad/sec and thus with a coefficient of unity and with reference to the characteristic light speed, H_t can be considered as cosmic angular velocity. Note that, in any case if length coefficient is less than unity or greater than unity, 'Hubble length' may loose its physical identity.
3. 'Rate of decrease in current 'Hubble's constant' can be considered as a measure of current cosmic 'rate of expansion'. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion or acceleration. To understand the ground reality, sensitivity and accuracy of current methods of estimating the magnitude of H_0 must be improved.
4. When Friedmann's cosmology was taking its final shape, black hole physics was in its beginning stage. Recent observations confirm the light speed rotation of black holes. So far no theoretical proof is available for cosmic non-rotation. So far no experimental or observational evidence is available for super luminal rotation speed of any celestial object. By considering 'black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' with Hubble constant as angular velocity, throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'mass density'. If so it is possible to suggest that, there is no theoretical base in Friedmann's 'critical density' concept and the 'matter density' classification scheme.
5. If it is true that galaxy constitutes so many stars, each star constitutes so many hydrogen atoms and light is coming from the excited electron of hydrogen atom, then considering redshift as an index of 'whole galaxy' receding [29,30] may not be reasonable. Merely by estimating galaxy distance and without measuring galaxy receding speed, one cannot verify its receding speed or acceleration. (Clearly speaking: two mistakes are being possible here. i) Assumed galaxy receding speed is not being measured and not being confirmed. ii) Without measuring and confirming the galaxy receding speed, how can one say and confirm that it (galaxy) is accelerating). More over no direct observational evidence for the current cosmic acceleration and the dark energy [32,33].
6. If one is willing to accept 'Planck mass' as the characteristic beginning 'mass scale' of the expanding universe, by substituting the geometric mean mass of current hubble mass and Planck mass in the famous Hawking's black hole temperature formula automatically the observed 2.725 K can be fitted very accurately [9,10,11]. One should not ignore this coincidence. Note that, drop in current 'cosmic temperature' can be considered as a measure of the current cosmic expansion and 'rate of decrease in current cosmic temperature' can be considered as a measure of the current cosmic 'rate of expansion'. But if rate of decrease in temperature is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current cosmic temperature is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' thermal expansion and there is no 'observable' cosmic expansion. If observed CMBR temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable.
7. So far no ground based experiment confirmed the existence of dark energy. There is no single clue or evidence to any of the natural physical properties of (the assumed) dark energy. If 'Dark energy' is the major outcome of the 'accelerating universe', it is very important to note that - in understanding the basic concepts of unification or other fundamental areas of physics, role of dark energy is very insignificant. If existence of dark energy is true and dark energy is supposed to have a key role in the past and current cosmic expansion, then it must have also played a key role in the beginning of cosmic evolution. In this regard no information is available in standard cosmology. It casts doubt on the existence of 'dark energy'.
8. Mach's principle is not being implemented in standard cosmology. To understand the beauty of Mach's principle, distance cosmic back ground must be quantified.

9. No comparative and relational study in between Friedmann cosmology, Mach's principle and microscopic physical phenomena.

II. Possible Assumptions and Possible Explanation

Possible assumptions in unified cosmic physics can be expressed in the following way.

Assumption-1: With reference to the elementary charge and with mass similar to the Planck mass, a new mass unit can be constructed in the following way. It can be called as the Stoney mass.

$$(M_S)^{\pm} \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \cong 1.859272\times10^{-9}\ \text{Kg} \quad (6)$$
$$\cong 1.042975\times10^{18}\ \text{GeV/c}^2$$

Assumption-2: At any time Hubble length (c/H_t) can be considered as the gravitational or electromagnetic interaction range.

Assumption-3: At any time, H_t being the angular velocity, universe can be considered as a growing and light speed rotating primordial black hole. Thus at any given cosmic time,

$$R_t \cong \frac{2GM_t}{c^2} \cong \frac{c}{H_t} \text{ and } M_t \cong \frac{c^3}{2GH_t} \quad (7)$$

If $H_0 \cong 70$ km/sec/Mpc,

$M_0 \cong 8.8984\times10^{52}$ kg and $R_0 \cong 1.32153\times10^{26}$ m.

when $M_t \to M_S$,

$$R_S \cong \frac{2GM_S}{c^2} \text{ and } H_S \cong \frac{c}{R_S} \cong \frac{c^3}{2GM_S} \quad (8)$$

can be considered as the characteristic initial physical measurements of the universe. Here the subscript S refers to the initial conditions of the universe and can be called as the Stoney scale. Similarly

$$R_0 \cong \frac{2GM_0}{c^2} \cong \frac{c}{H_0},\ M_0 \cong \frac{c^3}{2GH_0} \text{ and } H_0 \cong \frac{c^3}{2GM_0} \quad (9)$$

can be considered as the characteristic current physical measurements of the universe.

Assumption-4: During cosmic evolution, at any time the past , in hydrogen atom emitted photon energy was always inversely proportional to the cosmic temperature. Thus past light emitted from older galaxy's hydrogen atom will show redshift with reference to the current laboratory data. There will be no change in the energy of the emitted photon during its journey from the distant galaxy to the observer.

$$\frac{E_t}{E_0} \cong \frac{\lambda_0}{\lambda_t} \cong \frac{T_0}{T_t} \quad (10)$$

Here, E_t is the energy of emitted photon from the galactic hydrogen atom and E_0 is the corresponding energy in the laboratory. λ_t is the wave length of emitted and received photon from the galactic hydrogen atom and λ_0 is the corresponding wave length in the laboratory. T_t is the cosmic temperature at the time when the photon was emitted and is T_0 the current cosmic temperature.

Assumption-5: At any given time, ratio of volume energy density and thermal energy density can be called as the cosmic growth index and can be expressed as follows.

$$\frac{3H_t^2c^2}{8\pi GaT_t^4} \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^2 \quad (11)$$
$$\cong \text{Cosmic Growth index}$$

Thus at the Stoney scale,

$$\frac{3H_S^2c^2}{8\pi GaT_S^4} \cong \left[1+\ln\left(\frac{M_S}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_S}\right)\right]^2 \cong 1 \quad (12)$$

Assumption-6: At any given time, cosmic black hole's growth rate can be expressed as $g_t \cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1}c$. With this idea and by considering the average growth rate cosmic age can be estimated.

$$g_t \cong \text{Cosmic growth rate} \cong \frac{c}{\text{cosmic growth index}}$$
$$\cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1}c \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}c \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2}c \quad (13)$$

At the Stoney scale,

$$g_S \cong \left(\frac{3H_S^2c^2}{8\pi GaT_S^4}\right)^{-1}c \cong \left[1+\ln\left(\frac{M_S}{M_S}\right)\right]^{-2}c$$
$$\cong \left[1+\ln\left(\frac{H_S}{H_S}\right)\right]^{-2}c \cong c \quad (14)$$

a) *Possible Explanation for the proposed Assumptions*

To have some clarity and to have some quantitative measurements and fittings of initial and current states of the black hole universe - instead of considering 'star - black hole explosions' and 'higher dimensions', the authors of this paper focused their attention only on the old and famous Mach's principle [34], 'Hubble volume' and 'primordial evolving black holes'. Some cosmologists use the term 'Hubble volume' to refer to the volume of the observable universe. There is no perfect theory that defines the lower and upper limits of a massive black hole. Most of the theoretical models assume a lower mass limit close to the 'Planck mass'. Astronomers believe that black holes that are as large as a billion solar masses can be found at the centre of most of the galaxies. Here the fundamental questions to be answered are: If the galactic central black hole mass is 10 billion solar masses and density is less than 1 kg/m^3 - with such a small density and large mass, without collapsing - how it is able to hold a gigantic galaxy? What force makes the black hole stable? Recent observations confirm that, instead of collapsing, galactic central black holes are growing faster and spinning with light speed. Even though mass is too high and density is too low, light speed rotation certainly helps in maintaining black hole's stability from collapsing with maximum possible outward radial force of the magnitude close to $\left(c^4/G\right)$. Based on these points the authors propose the following picture of Black hole cosmology. Forever rotating at light speed, high temperature and high angular velocity small sized primordial cosmic black hole of mass $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ gradually transforms into a low temperature and low angular velocity large sized massive primordial cosmic black hole. At any given cosmic time, for the primordial growing black hole universe, its 'Schwarzschild radius' can be considered as its characteristic possible minimum radius and 'constant light speed rotation' will give the maximum possible stability from collapsing. Here $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ can be called as the mass of the primordial baby black hole universe. Here 4 important points can be stated as follows.

1. It is well known that e, c, G play a vital role in fundamental physics. With these 3 constants space-time curvature concepts at a charged particle surface can be studied. Note that the basic concept of unification is to understand the origin of 'mass' of any particle. Mass is the basic property in 'gravitation' and charge is the basic property in 'atomicity'. So far no model established a cohesive relation in between 'electric charge' and 'mass' of any 'elementary particle' or 'cosmic dust'. From physics point of view, the fundamental questions to be answered are: 1) Without charge, is there any independent existence to "mass"? 2) Without mass, is there any independent existence to "charge"? From cosmology point of view the fundamental questions to be answered are: 1) What is 'cosmic dust'? 2) Without charge, is there any independent existence to "cosmic dust"? From astrophysics point of view the fundamental questions to be answered are: 1) Without charge, is there any independent existence to 'mass' of any star? 2) Is black hole – a neutral body or electrically a neutralized body? To understand these questions the authors made an attempt to construct the above unified mass unit. It is having a long history. It was first introduced by the physicist George Johnstone Stoney [35]. He is most famous for introducing the term 'electron' as the 'fundamental unit quantity of electricity'. With this mass unit in unification program with a suitable proportionality it may be possible to represent the characteristic mass of elementary charge. It can be considered as the seed of galactic matter or galactic central black hole. It can also be considered as the seed of any cosmic structure. If 2 such oppositely charged particles annihilates, a large amount of energy can be released. If so under certain extreme conditions at the vicinity of massive stars or black holes, a very high energy radiation can be seen to be emitted by the pair annihilation of M_S. With this mass unit, proton-electron mass ratio and proton and electron rest masses can be fitted. Thus with reference to the elementary charge and electron & proton rest masses, magnitude of the gravitational constant can be fitted [4,5].
2. In theoretical physics, particularly in discussions of gravitation theories, Mach's principle is the name given by Einstein to an interesting hypothesis often credited to the physicist and philosopher Ernst Mach. The idea is that the local motion of a rotating reference frame is determined by the large scale distribution of matter. With reference to the Mach's principle and the Hubble volume, at any cosmic time, if 'Hubble mass' is the product of cosmic 'critical density' and the 'Hubble volume', then it can be suggested that, i) Each and every point in the free space is influenced by the Hubble mass, ii) Hubble volume and Hubble mass play a vital role in understanding the properties of electromagnetic and nuclear interactions and iii) Hubble volume and Hubble mass play a key role in understanding the geometry of the universe. With reference to the famous Mach's principle, 'Hubble volume' and 'Hubble mass' both can be considered as quantitative measurements of the 'distance cosmic back ground'. As a first attempt, in this paper authors proposed a semi empirical relation that connects the CMBR energy density, Hubble's constant and $\sqrt{e^2/4\pi\varepsilon_0 G}$.
3. Starting from an electron to any gigantic galaxy, rotation is a common phenomenon in atomic experiments and astronomical observations. From Newton's laws of motion and based on the Mach's principle, sitting inside a closed universe, one cannot comment whether the universe is rotating or not. We have to search for alternative means for confirming the cosmic rotation. Recent findings from the University of Michigan [36] suggest that the

shape of the Big Bang might be more complicated than previously thought, and that the early universe spun on an axis. A left-handed and right-handed imprint on the sky as reportedly revealed by galaxy rotation would imply the universe was rotating from the very beginning and retained an overwhelmingly strong angular momentum. An anonymous referee who reviewed the paper for Physics Letters said, "In the paper the author claims that there is a preferred handedness of spiral galaxies indicating a preferred direction in the universe. Such a claim, if proven true, would have a profound impact on cosmology and would very likely result in a "Nobel prize". The consequences of a spinning universe [36-49] seem to be profound and natural. Not only that, with 'constant rotation speed' 'cosmic collapse' can be prevented and can be considered as an alternative to the famous 'repulsive gravity' concept. If so, at any time to have maximum possible stability from collapsing 'constant light speed rotation' can be considered as a constructive and workable concept.

4. Recent observations confirm black hole's light speed rotation. In 2013 February, using NASA's newly launched NuStar telescope and the European Space Agency's workhorse XMM-Newton, an international team observed high-energy X-rays released by a super massive black hole in the middle of a nearby galaxy. They calculated its spin at close to the speed of light: 670 million mph [50,51].Please note that, for any black hole even though its mass is too high and density is too low, light speed rotation certainly helps in maintaining its stability from collapsing with maximum possible outward radial force of magnitude $\left(c^4/G\right)$. At the beginning of comic evolution if rotation speed was zero and there was no big bang - definitely it will cast a doubt on the stability, existence and angular velocity of the assumed initial primordial cosmic baby black hole. Hence at the beginning also, to guess or define the angular velocity and to have maximum possible stability it is better to assume light speed rotation for the cosmic baby black hole. At present if rate of cosmic expansion is very slow, then rate of decrease in angular velocity will be very small and practically can be considered as zero. Along with (practically) constant angular velocity, at present if constant light speed rotation is assumed to be maintained then cosmic stability will be maximum and rate of change in cosmic size will be practically zero and hence this idea helps us to believe in present Hubble length along with the observed ordered galactic structures and uniform thermal energy density.

b) To Reinterpret the Hubble's constant

With a simple derivation it is possible to show that, Hubble's constant H_t represents the cosmological angular velocity. Authors presented this derivation in their published papers. Basic idea of this derivation is to express the angular velocity of any rotating celestial body in terms of its mass, radius, mass density and surface escape velocity. Assume that, a planet of mass M and radius R rotates with angular velocity ω_e and linear velocity v_e in such a way that, free or loosely bound particle of mass m lying on its equator gains a kinetic energy equal to potential energy as,

$$\frac{1}{2}mv_e^2 = \frac{GMm}{R} \tag{15}$$

$$R\omega_e = v_e = \sqrt{\frac{2GM}{R}} \text{ and } \omega_e = \frac{v_e}{R} = \sqrt{\frac{2GM}{R^3}} \tag{16}$$

i.e Linear velocity of planet's rotation is equal to free particle's escape velocity. Without any external power or energy, test particle gains escape velocity by virtue of planet's rotation. Note that if Earth completes one rotation in one hour then free particles lying on the equator will get escape velocity. Now writing $M = \frac{4\pi}{3}R^3\rho_e$,

$$\omega_e = \frac{v_e}{R} = \sqrt{\frac{8\pi G\rho_e}{3}} \text{ Or } \omega_e^2 = \frac{8\pi G\rho_e}{3} \tag{17}$$

$$\text{Density, } \rho_e = \frac{3\omega_e^2}{8\pi G} \tag{18}$$

In real time, this obtained density may or may not be equal to the actual density. But the ratio $\frac{8\pi G\rho_{real}}{3\omega_{real}^2}$ may have some physical significance. The most important point to be noted here, is that, as far as dimensions and units are considered, from equation (18), it is very clear that, proportionality constant being $\frac{3}{8\pi G}$,

$$\text{density} \propto (\text{angular velocity})^2 \tag{19}$$

Equation (18) is similar to "flat model concept" of cosmic "critical density"

$$\rho_c = \frac{3H_t^2}{8\pi G} \tag{20}$$

Comparing equations (18) and (20) dimensionally and conceptually, i.e.

$$\rho_e = \frac{3\omega_e^2}{8\pi G} \text{ with } \rho_c = \frac{3H_t^2}{8\pi G} \tag{21}$$

$$H_t^2 \to \omega_e^2 \text{ and } H_t \to \omega_e \tag{22}$$

It is very clear that, dimensions of 'Hubble's constant' must be 'radian/second'. In any physical system under study, for any one 'simple physical parameter' there will not be two different units and there will not be two different physical meanings. This is a simple clue and brings 'cosmic rotation' into picture. This is possible in a closed universe only. Cosmic models that depend on this "critical density" may consider 'angular velocity of the universe' in the place of 'Hubble's constant'. In the sense, with a great confidence 'cosmic rotation' can be included in the existing models of cosmology. Then the term 'critical density' appears to be the 'volume density' of the closed and expanding universe. Thinking in this way, considering 'black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'volume density'. Thus based on the Mach's principle, 'distance cosmic back ground' can be quantified in terms of 'Hubble volume' and 'Hubble mass'.

c) To Reinterpret the Cosmic redshift

If one is willing to consider the proposed assumptions, in hydrogen atom emitted photon energy can be understood as follows.

1. As the cosmic time increases cosmic angular velocity and hence cosmic temperature both decrease. As a result, during cosmic evolution, in hydrogen atom, binding energy increases in between proton and electron.
2. As cosmic temperature decreases, it requires more excitation energy to break the bond between electron and the proton. In this way, during cosmic evolution, whenever it is excited, hydrogen atom emits photons with increased quantum of energy.
3. Thus past light quanta emitted from old galaxy's excited hydrogen atom will have less energy and show a red shift with reference to the current laboratory magnitude.
4. During journey light quanta will not lose energy and there will be no change in light wavelength.
5. Galactic photon energy in hydrogen atom when it was emitted can be estimated as follows.

$$E_t \cong \frac{hc}{\lambda_t} \cong \left(\frac{T_0}{T_t}\right)\left(\frac{hc}{\lambda_0}\right) \cong \left(\frac{T_0}{T_t}\right)E_0 \qquad (23)$$

Here, λ_0 is the wavelength of photon in the laboratory.

E_t is the energy of received photon when it was emitted in the distant galaxy.

E_0 is the corresponding energy of photon in the current laboratory methods.

λ_t is the wavelength of emitted and received photon when it was emitted in the distant galaxy.

T_t is the cosmic temperature at the time when the photon was emitted and is T_0 the current cosmic temperature.

In subsection 2.5 an attempt is made to understand the cosmological thermodynamic light emission mechanism in hydrogen atom in a unified approach.

d) To Reinterpret the Hubble's Law

Based on the assumptions it is possible to say that, during cosmic evolution, as the universe is growing and rotating, at any time, any galaxy will have revolution speed as well as receding speed simultaneously and both can be expressed in the following way.

$$(V_G)_{revolution} \cong \left(\frac{r}{R_t}\right)c \cong rH_t \text{ where } r \le \left(R_t \cong \frac{c}{H_t}\right) \qquad (24)$$

r is the distance between galaxy and the cosmic center and R_t is the cosmic radius at time t.

$$(V_G)_{receding} \cong \left(\frac{r}{R_t}\right)g_t \cong \left(\frac{r}{R_t}\right)\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} c \qquad (25)$$

$$\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} rH_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} (V_G)_{revolution}$$

$$\frac{(V_G)_{revolution}}{(V_G)_{receding}} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{2} \qquad (26)$$

Please note that both the relations are independent of the observed redshift. This is for further study.

e) To Understand the Cosmological Thermodynamic light Emission Mechanism

Physicists of the particle data group say [53]: "It is very tempting to make an analogy between the status of the cosmological 'Standard Model' and that of particle physics. In cosmology there are about 10 free parameters, each of which is becoming well determined, and with a great deal of consistency between different measurements. However, none of these parameters can be calculated from a fundamental theory, and so hints of the bigger picture, 'physics beyond the Standard Model,' are being searched for with ever more ambitious experiments. Despite this analogy, there are some basic differences. For one thing, many of the cosmological parameters change with cosmic epoch, and so the measured values are simply the ones determined today, and hence they are not 'constants,' like particle masses for example (although they are deterministic, so that if one knows their values at one epoch, they can be calculated at another). Moreover, the parameter set is not as well defined as it is in the particle physics Standard Model; different researchers will not necessarily agree on which parameters should be considered as free, and the set can be extended as the

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quality of the data improves. In a more general sense, the cosmological 'Standard Model' is much further from the underlying 'fundamental theory,' which will ultimately provide the values of the parameters from first principles. Nevertheless, any genuinely complete 'theory of everything' must include an explanation for the values of these cosmological parameters as well as the parameters of the Standard Model of particle physics".

Current magnitude of Hubble constant [53-57] is (67.80 ± 0.77) km/sec/Mpc, (68.1 ± 1.2) km/sec/Mpc, (67.3 ± 1.2) km/sec/Mpc, (69.7 ± 2.0) km/sec/Mpc, (70.0 ± 2.2) km/sec/Mpc, (70.6 ± 3.3) km/sec/Mpc, (73.8 ± 2.4) km/sec/Mpc, and (72.5 ± 2.5) km/sec/Mpc.

In a cosmological approach with various trial-error methods, at present in hydrogen atom, if $H_0 \cong 71$ km/sec/Mpc, Bohr radius [58] can be fitted as follows.

$$\begin{aligned}(a_B)_0 &\cong \left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{GM_0}{c^2}\right) \cong \left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{c}{2H_0}\right) \\ &\cong \left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{c}{2H_0}\right) \cong \frac{1}{2}\left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right)\left(\frac{c}{H_0}\right) \\ &\cong 5.27225 \times 10^{-11} \text{ m.}\end{aligned} \tag{27}$$

$\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)$ is the electromagnetic and gravitational force ratio of proton. This relation seems to be very simple and needs no further derivation. But reasons must be explored for the factor 2. For any physicist or cosmologist it will be a very big surprise. Note that, this relation is free from the famous reduced Planck's constant,electron rest mass and other arbitrary numbers or coefficients. After simplification and considering the ground state, it is possible to express the ground state potential energy of electron in the following way.

$$\begin{aligned}(E_{\text{pot}})_0 &\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 c^2}{4\pi\varepsilon_0 G M_0}\right) \\ &\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0}\right)\left(\frac{1}{2}\frac{c}{H_0}\right)^{-1} \\ &\cong -2\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)\end{aligned} \tag{28}$$

Here $\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)$ can be called as the current Hubble potential. Characteristic ground state kinetic energy of electron can be expressed in the following way.

$$\begin{aligned}(E_{\text{kin}})_0 &\cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 c^2}{8\pi\varepsilon_0 G M_0}\right) \\ &\cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0}\right)\left(\frac{c^2}{2GM_0}\right) \\ &\cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)\end{aligned} \tag{29}$$

Characteristic ground state total energy of electron can be expressed in the following way.

$$\begin{aligned}(E_{\text{tot}})_0 &\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 c^2}{8\pi\varepsilon_0 G M_0}\right) \\ &\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0}\right)\left(\frac{c^2}{2GM_0}\right) \\ &\cong -\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)\end{aligned} \tag{30}$$

If $H_0 \cong 71$ km/sec/Mpc, $(E_{\text{tot}})_0 \cong -13.66$ eV. Based on this coincidence, this proposed new concept can be given some consideration and it can be suggested that the best value of H_0 lies in between 70 and 71 km/sec/Mpc. Unfortunately these relations seem to be independent of the reduced Planck's constant [59,60]. If one is willing to linkup these relations with the observed 'discrete' energy spectrum of the hydrogen atom, then the desired cosmological light emission mechanism can be developed in a unified picture. Considering the concept of stationary orbits and jumping nature of electron, emitted photon energy can be expressed in the following way.

$$(E_{photon})_0 \cong \left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \tag{31}$$

where $n_1 = n_2 \cong 1, 2, 3, ..$ and $n_2 > n_1$. The best fit of H_0 can be obtained in the following way.

$$\left.\begin{aligned}\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right) &\cong \frac{e^4 m_e}{32\pi^2 \varepsilon_0^2 \hbar^2} \\ \text{and } H_0 \cong \frac{G m_p^2 m_e c}{2\hbar^2} &\cong 70.738 \text{ km/sec/Mpc}\end{aligned}\right\} \tag{32}$$

At any time in the past - in support of the proposed cosmological red shift interpretation, above relations can be re-expressed as follows.

$$\left(E_{\text{pot}}\right)_t \cong -\left(\frac{T_0}{T_t}\right)\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 c^2}{4\pi\varepsilon_0 G M_0}\right)$$
$$\cong -2\left(\frac{T_0}{T_t}\right)\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right) \quad (33)$$

$$\left(E_{\text{kin}}\right)_t \cong \left(\frac{T_0}{T_t}\right)\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right) \quad (34)$$

$$\left(E_{\text{tot}}\right)_t \cong -\left(\frac{T_0}{T_t}\right)\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right) \quad (35)$$

This can be considered as the base for the 'cosmological thermodynamic light emission mechanism'. At any time in the past, at any galaxy, emitted photon energy can be expressed as follows.

$$\left(E_{photon}\right)_t \cong \left(\frac{T_0}{T_t}\right)\left(\frac{e^2}{4\pi\varepsilon_0 G m_p^2}\right)\left(\frac{e^2 H_0}{4\pi\varepsilon_0 c}\right)\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right] \quad (36)$$

This issue is for further study. Considering laboratory experiments on hydrogen atom or observations on distant galactic hydrogen atom, by studying the rate of increase in 'future redshift', the absolute rate of cosmic expansion can be verified. It can be understood as follows. From now onwards, as cosmic time passes, within a selected or predefined time span and within the scope of observational accuracy of galactic hydrogen atom's redshift or within the scope of experimental accuracy of laboratory hydrogen atom's redshift, if magnitude of 'rate of increase in future redshift' is gradually increasing, it is an indication of cosmic acceleration. If magnitude of 'rate of increase in future redshift' is practically constant, it is an indication of uniform rate of cosmic expansion. If magnitude of 'rate of increase in future redshift' is gradually decreasing, it is an indication of cosmic deceleration. If magnitude of 'rate of increase in future redshift' is zero, it is an indication of cosmic halt.

In a unified picture, electron's current quantum of angular momentum can be expressed as follows.

$$\hbar \cong \sqrt{\frac{M_0}{m_e}}\left(\frac{G m_p m_e}{c}\right) \cong \frac{G m_p \sqrt{m_e M_0}}{c} \cong \hbar_0$$
$$\cong \sqrt{\frac{c^3}{2GH_0 m_e}}\left(\frac{G m_p m_e}{c}\right) \cong \sqrt{\left(\frac{c}{H_0} \div \frac{2Gm_e}{c^2}\right)}\left(\frac{G m_p m_e}{c}\right) \quad (37)$$

If atomic nuclear mass increases in integral multiples of the proton mass, then the observed discreteness of the reduced Planck's constant can be expressed as follows.

$$n\hbar \cong \frac{G\left(n.m_p\right)\sqrt{m_e M_0}}{c} \cong n\hbar_0 \quad (38)$$

Where $n = 1, 2, 3, ..$ This issue is also for further study. At any time in the past, hypothetically, in terms of the current and past 'primordial' cosmic temperatures, it is possible to express the cosmological 'variable quantum of angular momentum' of electron in the following way. Whether it is virtual or real or speculative - to be confirmed from further study.

$$\hbar_t \cong \sqrt{\frac{T_t}{T_0}}.\hbar_0 \cong \sqrt{\frac{\lambda_t}{\lambda_0}}.\hbar_0 \quad (39)$$

It may be noted that, throughout the cosmic evolution, Planck's constant and the Uncertainty constant both can be conside-red as 'constants'. Now the fundamental questions to be answered are –

1. Is reduced Planck's constant – an output of the atomic system?
2. Is the reduced Planck's constant – a cosmological variable?
3. Is the Planck's constant – a cosmological constant?
4. How to understand and how to consider the constancy of the Planck's constant along with the variable reduced Planck's constant?
5. Is the condition, $\hbar \to (h/2\pi)$ an indication of saturation or halt of cosmological expansion?

III. Connecting Cosmic Thermal and Physical Parameters

a) *Cosmic Thermal Energy Density and Matter Energy Density*

It may be noted that connecting CMBR energy density with Hubble's constant is really a very big task and mostly preferred in cosmology. At any given cosmic time, thermal energy density can be expressed with the following semi empirical relation.

$$aT_t^4 \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\left(\frac{3H_t^2c^2}{8\pi G}\right)$$
$$\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2}\left(\frac{3H_t^2c^2}{8\pi G}\right) \quad (40)$$

$$T_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-\frac{1}{2}}\left(\frac{3H_t^2c^2}{8\pi Ga}\right)^{\frac{1}{4}} \quad (41)$$

With a suitable derivation if above expression is obtained, then certainly the subject of black hole cosmology is put into main stream physics. Thus at present, if H_0 is close to 71 km/sec/Mpc, obtained CMBR temperature is 2.723 K [53-57]. For the time being this can be considered as a remarkable discovery and an accurate fit.

$$aT_0^4 \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\left(\frac{3H_0^2c^2}{8\pi G}\right) \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2}\left(\frac{3H_0^2c^2}{8\pi G}\right) \quad (42)$$

$$T_0 \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-\frac{1}{2}}\left(\frac{3H_0^2c^2}{8\pi Ga}\right)^{\frac{1}{4}} \quad (43)$$

With reference to the current cosmic temperature, at any time in the past,

$$\frac{T_t}{T_0} \cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}} \quad (44)$$

Using this relation, cosmic redshift data can be fitted. When the assumed CMBR temperature is 2999 K, esti-mated redshift is 1099 and is in very good agreement with the standard model of cosmology.

Mostly at the ending stage of expansion, rate of change in H_t will be practically zero and can be considered as practically constant. Thus at its ending stage of expansion, for the whole cosmic black hole as H_t practically remains constant, its corresponding thermal energy density will be 'the same' throughout its volume. This 'sameness' may be the reason for the observed 'isotropic' nature of the current CMB radiation. With this coincidence it can be suggested that, at the beginning of cosmic evolution,

$$aT_S^4 \cong \left(\frac{3H_S^2c^2}{8\pi G}\right) \quad (45)$$

Matter-energy density can be considered as the geometric mean density of volume energy density and the thermal energy density and it can be expressed with the following semi empirical relation.

$$(\rho_m)_t c^2 \cong \sqrt{\left(\frac{3H_t^2c^2}{8\pi G}\right)\left(aT_t^4\right)} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1}\left(\frac{3H_t^2c^2}{8\pi G}\right) \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-1}\left(\frac{3H_0^2c^2}{8\pi G}\right) \quad (46)$$

Here one important observation to be noted is that, at any time

$$\frac{8\pi G(\rho_m)_t}{3H_t^2} \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-1} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1} \cong (\Omega_m)_t \quad (47)$$

Thus at present,

$$(\rho_m)_0 \cong \frac{1}{c^2}\sqrt{\left(\frac{3H_0^2c^2}{8\pi G}\right)\left(aT_0^4\right)} \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-1}\left(\frac{3H_0^2}{8\pi G}\right) \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-1}\left(\frac{3H_0^2}{8\pi G}\right) \cong 6.6\times10^{-32}\ \text{gram/cm}^3 \quad (48)$$

Based on the average mass-to-light ratio for any galaxy present matter density can be expressed with the following relation [61].

$$(\rho_m)_0 \cong 1.5\times10^{-32}\,\eta h_0 \ \ \text{gram/cm}^3 \quad (49)$$

Here

$$\eta \cong \left\langle\frac{M}{L}\right\rangle_{\text{galaxy}} \Big/ \left\langle\frac{M}{L}\right\rangle_{\text{sun}}, \; h_0 \cong H_0/100\ \text{Km/sec/Mpc} \cong 0.71$$

Note that elliptical galaxies probably comprise about 60% of the galaxies in the universe and spiral galaxies thought to make up about 20% percent of the galaxies in the universe. Almost 80% of the galaxies are in the form of elliptical and spiral galaxies. For spiral galaxies, $\eta h_0^{-1} \cong 9 \pm 1$ and for elliptical galaxies, $\eta h_0^{-1} \cong 10 \pm 2$ For our galaxy inner part, $\eta h_0^{-1} \cong 6 \pm 2$. Thus the average ηh_0^{-1} is very close to 8 to 9 and its corresponding matter density is close to (6.0 to 6.7) × 10^{-32} gram/cm^3 and can be compared with the above proposed magnitude of 6.6 × 10^{-32} gram/cm^3.

b) Age of the Growing Cosmic black hole

Age of the growing cosmic black hole can be assumed as the time taken to grow from the assumed Stoney scale to the current scale. At present,

$$g_0 \cong \left(\frac{8\pi GaT_0^4}{3H_0^2c^2}\right)c \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2}c \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}c \approx 14.66\ \text{km/sec} \quad (50)$$

Clearly speaking, at present, Hubble volume is growing at 14.66 km/sec in a decelerating trend. Starting from the Stoney scale, if the assumed growth rate is gradually decreasing, at any time average growth rate can be expressed as follows.

$$\frac{g_S+g_t}{2} \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\right\}c \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2}\right\}c \quad (51)$$

For the current scale, average growth rate can be expressed as follows.

$$\frac{g_S + g_0}{2} \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2}\right\}c$$
$$\cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}c \qquad (52)$$

Time taken to reach from the Stoney scale to any assumed scale can be expressed as follows.

$$\left(\frac{g_S + g_t}{2}\right)t \cong \left(R_t - R_S\right) \cong R_t \qquad (53)$$

where, $R_t \gg R_S$ and $R_S \approx 0$. Hence for the current scale,

$$\left(\frac{g_S + g_0}{2}\right)t_0 \cong \left(R_0 - R_S\right) \cong R_0 \cong \frac{c}{H_0} \qquad (54)$$

$$t_0 \cong \left(\frac{g_S + g_0}{2}\right)^{-1}\frac{c}{H_0} \cong \left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}^{-1}\frac{2}{H_0} \qquad (55)$$

$\cong$ 27.496 Gyr.

where $\left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}^{-1} \cong 0.99995.$

This proposal is for further study. Based on this proposal, after one second from the Stoney scale, cosmic angular velocity is 2 rad/sec, growth rate is 29 km/sec and cosmic temperature is 3×10^9 K. With reference to the current and past cosmic temperatures, at any time in the past, at any galaxy, for any hydrogen atom,

$$\frac{E_0}{E_t} \cong \frac{\lambda_t}{\lambda_0} \cong \frac{T_t}{T_0} \cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}}$$
$$\cong \left\{\frac{\left[1+\ln\left(\frac{R_0}{R_S}\right)\right]R_0}{\left[1+\ln\left(\frac{R_t}{R_S}\right)\right]R_t}\right\}^{\frac{1}{2}} \cong \left\{\frac{\left(\Omega_m\right)_t H_t}{\left(\Omega_m\right)_0 H_0}\right\}^{\frac{1}{2}} \qquad (56)$$

By guessing H_t, $\left(z_0+1\right)$ can be estimated. It seems to be a full and absolute definition for the cosmic redshift. Thus at any time in the past,

$$\left(\frac{E_0}{E_t}-1\right) \cong \left(\frac{\lambda_t}{\lambda_0}-1\right) \cong \left(\frac{T_t}{T_0}-1\right)$$
$$\cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}} -1 \cong \left\{\frac{\left(\Omega_m\right)_t H_t}{\left(\Omega_m\right)_0 H_0}\right\}^{\frac{1}{2}} -1 \cong z_0 \qquad (57)$$

Please see the following table-1 for the cosmic physical and thermal parameters. This table prepared with C++ program with reference to the observed 2.725 K. In this table:

Column-1 = Assumed cosmic angular velocity.
Column-2 = Estimated cosmic radius, from relation (7).
Column-3 = Estimated cosmic mass, from relation (7).
Column-4 = Estimated cosmic growth index, from relation(11).
Column-5 = Estimated cosmic growth rate, from relation (13).
Column-6 = Estimated cosmic time, from relation (53).
Column-7 = Estimated cosmic temperature, from relation (41)
Column-8 = Estimated cosmic redshift, from relation (57)

Table 1 : Assumed Cosmic angular velocity and estimated other cosmic physical and thermal parameters

Assumed Cosmic Angular velocity	Estimated Cosmic radius	Estimated Cosmic mass	Cosmic Growth index $\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^2$	Estimated Cosmic Growth rate	Estimated Cosmic time	Estimated Cosmic temperature	Estimated Cosmic Redshift z_0
(rad/sec)	(meter)	(kg)	(number)	(km/sec)	(sec)	(K)	(number)
1.086E+44	2.761E-36	1.859E-09	1	299792	0.000E+00	2.237E+32	8.207E+31
2.305E+43	1.301E-35	8.759E-09	6.50173	46109.6	5.924E-44	6.455E+31	2.368E+31
2.305E+42	1.301E-34	8.759E-08	23.5461	12732.1	8.148E-43	1.480E+31	5.428E+30
2.305E+41	1.301E-33	8.759E-07	51.1943	5855.97	8.493E-42	3.853E+30	1.414E+30
2.305E+40	1.301E-32	8.759E-06	89.4463	3351.65	8.580E-41	1.060E+30	3.888E+29
2.305E+39	1.301E-31	8.759E-05	138.302	2167.66	8.615E-40	3.006E+29	1.103E+29
2.305E+38	1.301E-30	8.759E-04	197.762	1515.93	8.634E-39	8.692E+28	3.189E+28
2.305E+37	1.301E-29	8.759E-03	267.825	1119.36	8.645E-38	2.548E+28	9.347E+27
2.305E+36	1.301E-28	8.759E-02	348.492	860.256	8.653E-37	7.544E+27	2.768E+27
2.305E+35	1.301E-27	8.759E-01	439.763	681.714	8.658E-36	2.251E+27	8.258E+26
2.305E+34	1.301E-26	8.759E+00	541.638	553.492	8.662E-35	6.756E+26	2.479E+26
2.305E+33	1.301E-25	8.759E+01	654.116	458.317	8.665E-34	2.038E+26	7.477E+25
2.305E+32	1.301E-24	8.759E+02	777.199	385.735	8.667E-33	6.173E+25	2.265E+25
2.305E+31	1.301E-23	8.759E+03	910.885	329.122	8.668E-32	1.876E+25	6.883E+24

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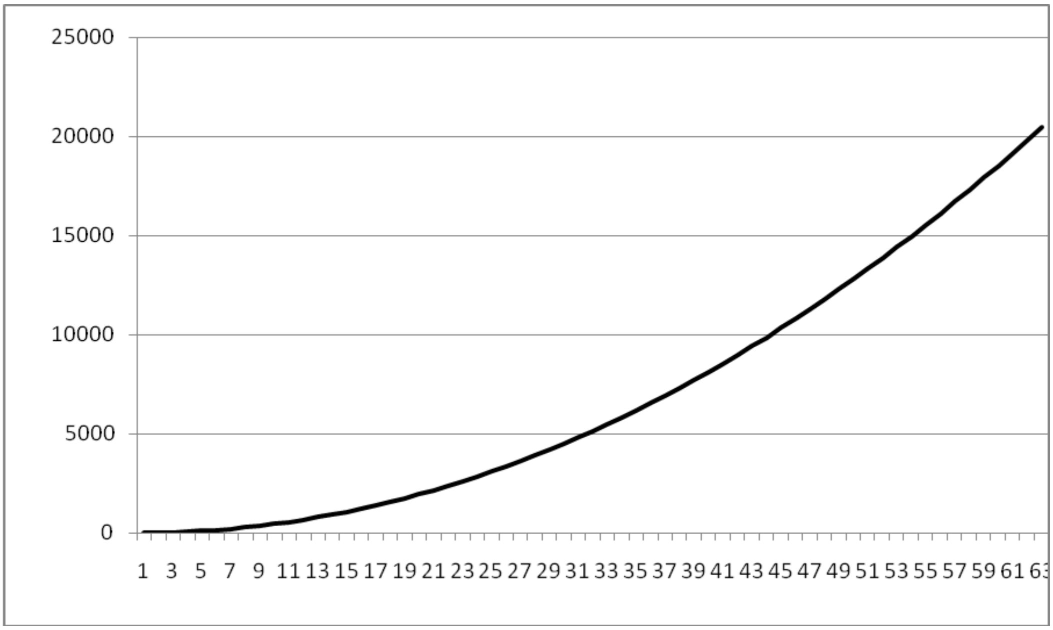
2.305E+30	1.301E-22	8.759E+04	1055.17	284.116	8.670E-31	5.719E+24	2.098E+24
2.305E+29	1.301E-21	8.759E+05	1210.07	247.748	8.671E-30	1.748E+24	6.411E+23
2.305E+28	1.301E-20	8.759E+06	1375.57	217.941	8.671E-29	5.352E+23	1.964E+23
2.305E+27	1.301E-19	8.759E+07	1551.67	193.207	8.672E-28	1.642E+23	6.025E+22
2.305E+26	1.301E-18	8.759E+08	1738.37	172.456	8.673E-27	5.048E+22	1.852E+22
2.305E+25	1.301E-17	8.759E+09	1935.68	154.877	8.673E-26	1.554E+22	5.701E+21
2.305E+24	1.301E-16	8.759E+10	2143.59	139.855	8.674E-25	4.790E+21	1.757E+21
2.305E+23	1.301E-15	8.759E+11	2362.11	126.917	8.674E-24	1.478E+21	5.424E+20
2.305E+22	1.301E-14	8.759E+12	2591.23	115.695	8.674E-23	4.568E+20	1.676E+20
2.305E+21	1.301E-13	8.759E+13	2830.96	105.898	8.675E-22	1.413E+20	5.184E+19
2.305E+20	1.301E-12	8.759E+14	3081.28	97.2947	8.675E-21	4.375E+19	1.605E+19
2.305E+19	1.301E-11	8.759E+15	3342.21	89.6987	8.675E-20	1.356E+19	4.973E+18
2.305E+18	1.301E-10	8.759E+16	3613.75	82.9588	8.675E-19	4.204E+18	1.542E+18
2.305E+17	1.301E-09	8.759E+17	3895.89	76.951	8.676E-18	1.305E+18	4.786E+17
2.305E+16	1.301E-08	8.759E+18	4188.63	71.5729	8.676E-17	4.052E+17	1.486E+17
2.305E+15	1.301E-07	8.759E+19	4491.98	66.7395	8.676E-16	1.259E+17	4.619E+16
2.305E+14	1.301E-06	8.759E+20	4805.93	62.3797	8.676E-15	3.915E+16	1.436E+16
2.305E+13	1.301E-05	8.759E+21	5130.48	58.4336	8.676E-14	1.218E+16	4.468E+15
2.305E+12	1.301E-04	8.759E+22	5465.64	54.8504	8.676E-13	3.791E+15	1.391E+15
2.305E+11	1.301E-03	8.759E+23	5811.41	51.5869	8.676E-12	1.180E+15	4.331E+14
2.305E+10	1.301E-02	8.759E+24	6167.77	48.6063	8.676E-11	3.678E+14	1.349E+14
2.305E+09	1.301E-01	8.759E+25	6534.74	45.8767	8.676E-10	1.146E+14	4.206E+13
2.305E+08	1.301E+00	8.759E+26	6912.31	43.3708	8.677E-09	3.575E+13	1.311E+13
2.305E+07	1.301E+01	8.759E+27	7300.49	41.0647	8.677E-08	1.115E+13	4.091E+12
2.305E+06	1.301E+02	8.759E+28	7699.27	38.9378	8.677E-07	3.480E+12	1.277E+12
2.305E+05	1.301E+03	8.759E+29	8108.66	36.9719	8.677E-06	1.086E+12	3.985E+11
2.305E+04	1.301E+04	8.759E+30	8528.65	35.1512	8.677E-05	3.392E+11	1.244E+11
2.305E+03	1.301E+05	8.759E+31	8959.24	33.4618	8.677E-04	1.059E+11	3.887E+10
2.305E+02	1.301E+06	8.759E+32	9400.43	31.8913	8.677E-03	3.310E+10	1.214E+10
2.305E+01	1.301E+07	8.759E+33	9852.23	30.4289	8.677E-02	1.035E+10	3.796E+09
2.305E+00	**1.301E+08**	**8.759E+34**	**10314.6**	**29.0648**	**8.677E-01**	**3.234E+09**	**1.187E+09**
2.305E-01	1.301E+09	8.759E+35	10787.6	27.7904	8.677E+00	1.011E+09	3.710E+08
2.305E-02	1.301E+10	8.759E+36	11271.3	26.598	8.677E+01	3.163E+08	1.161E+08
2.305E-03	1.301E+11	8.759E+37	11765.5	25.4807	8.677E+02	9.897E+07	3.631E+07
2.305E-04	1.301E+12	8.759E+38	12270.3	24.4324	8.677E+03	3.097E+07	1.136E+07
2.305E-05	1.301E+13	8.759E+39	12785.7	23.4475	8.677E+04	9.693E+06	3.556E+06
2.305E-06	1.301E+14	8.759E+40	13311.7	22.5209	8.677E+05	3.034E+06	1.113E+06
2.305E-07	1.301E+15	8.759E+41	13848.4	21.6482	8.677E+06	9.501E+05	3.486E+05
2.305E-08	1.301E+16	8.759E+42	14395.6	20.8253	8.677E+07	2.976E+05	1.092E+05
2.305E-09	1.301E+17	8.759E+43	14953.4	20.0484	8.677E+08	9.321E+04	3.419E+04
2.305E-10	1.301E+18	8.759E+44	15521.9	19.3142	8.677E+09	2.920E+04	1.071E+04
2.305E-11	1.301E+19	8.759E+45	16100.9	18.6196	8.677E+10	9.150E+03	3.356E+03
2.52E-12	**1.19E+20**	**8.01E+46**	**16667.6**	**17.9865**	**7.94E+11**	**2998.85**	**1099.21**
2.305E-12	**1.301E+20**	**8.759E+46**	**16690.6**	**17.9618**	**8.677E+11**	**2.868E+03**	**1.051E+03**
2.305E-13	1.301E+21	8.759E+47	17290.8	17.3382	8.677E+12	8.988E+02	3.288E+02
2.305E-14	1.301E+22	8.759E+48	17901.7	16.7466	8.677E+13	2.818E+02	1.024E+02
2.305E-15	1.301E+23	8.759E+49	18523.2	16.1847	8.677E+14	8.835E+01	3.141E+01
2.305E-16	1.301E+24	8.759E+50	19155.2	15.6507	8.677E+15	2.771E+01	9.164E+00
2.305E-17	1.301E+25	8.759E+51	19797.9	15.1427	8.677E+16	8.689E+00	2.188E+00
2.305E-18	**1.301E+26**	**8.759E+52**	**20451.2**	**14.6589**	**8.677E+17**	**2.726E+00**	**0.000E+00**

See the below figure-1 for the cosmic growth index for ~ 61 values starting from 1 to 20451.2 of Column-4 in table-1.

Figure 1 : Cosmic Growth Index



c) *Direct fitting of the two current CMBR wavelengths*

Note that the spectrum from Planck's law of black body radiation takes a different shape in the frequency domain from that of the wavelength domain, the frequency location of the peak emission does not correspond to the peak wavelength using the simple relationship between frequency, wavelength, and the speed of light. In other words, the peak wavelength and the peak frequency do not correspond. The frequency form of Wien's displacement law is derived using similar methods, but starting with Planck's law in terms of frequency instead of wavelength. The effective result is to substitute 3 for 5 in the equation for the peak wavelength. Thus it is possible to say that [62],

$$\sqrt{\frac{c}{\lambda_m f_m}} \cong \sqrt{1.75978} \cong 1.326567 \cong \frac{4}{3} \quad (58)$$

Where λ_m and f_m are the peak wavelength in wavelength domain and peak frequency in frequency domain respectively.

Let λ_f is the wavelength corresponding to $\frac{dE_v}{dv}$ and E_v is the total energy at all frequencies up to and including v, at any given cosmic time. λ_m is the wavelength corresponding to $\frac{dE_\lambda}{d\lambda}$ and E_λ is the total energy at all wavelengths up to and including λ. Considering the observed CMBR wavelengths, it is possible to express both the wavelengths in the following way.

$$\left[\left(\lambda_m\right)_t \text{ and } \left(\lambda_f\right)_t\right] \propto \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \quad (59)$$

$$\left[\left(\lambda_m\right)_t \text{ and } \left(\lambda_f\right)_t\right] \propto \sqrt{\left(\frac{4\pi GM_t}{c^2}\right)\cdot\left(\frac{4\pi GM_S}{c^2}\right)} \quad (60)$$

Guessing in this way it is noticed that,

$$\left(\lambda_f\right)_t \cong \left(\frac{4}{3}\right)\cdot\sqrt{1+\ln\left(\frac{M_t}{M_S}\right)}\cdot\frac{4\pi G\sqrt{M_t M_S}}{c^2} \cong \left(\frac{4}{3}\right)\cdot\sqrt{\frac{3H_t^2}{8\pi G\left(\rho_m\right)_t}}\cdot\frac{4\pi G\sqrt{M_t M_S}}{c^2} \quad (61)$$

$$\left(\lambda_m\right)_t \cong \left(\frac{3}{4}\right)\cdot\sqrt{1+\ln\left(\frac{M_t}{M_S}\right)}\cdot\frac{4\pi G\sqrt{M_t M_S}}{c^2} \cong \left(\frac{3}{4}\right)\cdot\sqrt{\frac{3H_t^2}{8\pi G\left(\rho_m\right)_t}}\cdot\frac{4\pi G\sqrt{M_t M_S}}{c^2} \quad (62)$$

Thus it is possible to express both the wavelength relations in the following way.

$$\left(\lambda_f,\lambda_m\right)_t \cong \left(\frac{4}{3}\right)^{\pm 1}\cdot\sqrt{1+\ln\left(\frac{M_t}{M_S}\right)}\cdot\frac{4\pi G\sqrt{M_t M_S}}{c^2} \cong \left(\frac{4}{3}\right)^{\pm 1}\cdot\sqrt{1+\ln\left(\frac{H_S}{H_t}\right)}\cdot\frac{2\pi c}{\sqrt{H_S H_t}} \cong \left(\frac{4}{3}\right)^{\pm 1}\cdot\sqrt{\frac{3H_t^2}{8\pi G\left(\rho_m\right)_t}}\cdot\frac{2\pi c}{\sqrt{H_S H_t}} \quad (63)$$

Alternatively geometric mean of $(\lambda_f, \lambda_m)_t$ can be expressed as follows.

$$\sqrt{(\lambda_m)_t (\lambda_f)_t} \cong \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2}$$
$$\cong \sqrt{1+\ln\left(\frac{H_S}{H_t}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_t}} \cong \sqrt{\frac{3H_t^2}{8\pi G(\rho_m)_t}} \cdot \frac{2\pi c}{\sqrt{H_S H_t}} \quad (64)$$

At present, if H_0 is close to 71 km/sec/Mpc,

$$(\lambda_f, \lambda_m)_0 \cong \left(\frac{4}{3}\right)^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{M_0}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_0 M_S}}{c^2}$$
$$\cong \left(\frac{4}{3}\right)^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{H_S}{H_0}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_0}} \quad (65)$$
$$\cong (1.90\text{ mm},\ 1.069\text{ mm})$$

With reference to $(\lambda_m)_t$ and Wien's displacement constant, from above relations $k_B T_t$ can be expressed as follows.

$$T_t \cong \frac{2.898\times 10^{-3}}{(\lambda_m)_t} \cong \left(\frac{hc}{4.965114 k_B}\right)\left(\frac{1}{(\lambda_m)_t}\right) \text{ and}$$
$$k_B T_t \cong \left(\frac{4}{3x}\right)\sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\left(\frac{M_t}{M_S}\right)} \cdot \left(\frac{hc^3}{4\pi G M_t}\right) \quad (66)$$

where $x \cong 4.965114$.

$$k_B T_t \propto \left(\frac{hc^3}{4\pi G M_t}\right) \cong \frac{hH_t}{2\pi} \cong h\left(\frac{H_t}{2\pi}\right) \quad (67)$$

This relation may not be identical but similar to the famous Hawking's black hole temperature formula [63].

$$k_B T_t \propto \sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\left(\frac{M_t}{M_S}\right)} \quad (68)$$

In this way in a very simple approach observed CMBR and the proposed Black hole universe concepts can be put into single frame of reference. Here the very interesting and strange observation is that, at present

$$\left(1+\ln\left(\frac{M_0}{M_S}\right)\right)^{-1}\left(\frac{M_0}{M_S}\right) \cong \exp\left(\frac{1}{\alpha}\right) \quad (69)$$

where $\left(\frac{1}{\alpha}\right)$ is the inverse of the fine structure ratio. Forany mathematician this seems be a fun. For a cosmologist it may be an accidental coincidence. For any physicist it is an astounding and exciting coincidence. Even though it depends upon one's own choice of scie-ntific interest, from unification point of view, assuming it to be a cosmological variable it is possible to express $\left(\frac{1}{\alpha}\right)$ in the following way.

$$\left(\frac{1}{\alpha}\right)_0 \cong \ln\left[\left(1+\ln\left(\frac{M_0}{M_S}\right)\right)^{-1}\left(\frac{M_0}{M_S}\right)\right] \cong 137.047 \quad (70)$$

Here $\left(\frac{1}{\alpha}\right)_0$ may be considered as the current magnitude of 'inverse of the fine structure ratio. In atomic and nuclear physics, the fine-structure ratio (α) is a fundamental physical constant namely the coupling constant characterizing the strength [64-66] of the electromagnetic interact-ion. Being a dimensionless quantity, it has a constant numerical value in all systems of units. Note that, fromunification point of view, till today role of dark energy or dark matter is unclear and undecided.Their laboratoryor physical existence is also not yet confirmed. In this critical situation this application or coincidence can be considered as a key tool in particle cosmology. Based on the above heuristic observation and for the assumed initial conditions of the universe , if $M_t \to M_S$, $\left(\frac{1}{\alpha}\right)_S \to 0$. Based on the relation (70), if one is willing to consider the cosmological variable nature of $\left(\frac{1}{\alpha}\right)$, relation (66) can be expressed as follows.

$$T_t \cong \sqrt{\left(e^{\frac{1}{\alpha}}\right)_t} \cdot \left(\frac{bc^2}{3\pi G M_t}\right) \quad (71)$$

At the beginning of cosmic evolution for the Stoney scale,

$$T_S \cong \left(\frac{bc^2}{3\pi G M_S}\right) \quad (72)$$

From now onwards, CMBR temperature can be called as 'Comic Black Hole's Thermal Radiation' temperature and can be expressed as 'CBHTR' temperature. From ground based laboratory experiments, it is possible to measure the rate of change in $\frac{d}{dt}\left(\frac{1}{\alpha_t}\right)$. Hence the absolute cosmic rate of expansion can be measured. Thus at any time based on $\left[\frac{d}{dt}\left[(\lambda_m)_t \text{ and } (\lambda_f)_t\right], \frac{d}{dt}(T_t) \text{ and } \frac{d}{dt}(H_t)\right]$, the absolute cosmic rate of expansion can be confirmed.

At present with reference to $\left[\frac{d}{dt}\left[\left(\lambda_m\right)_0 \text{ and } \left(\lambda_f\right)_0\right], \frac{d}{dt}\left(T_0\right) \text{ and } \frac{d}{dt}\left(H_0\right)\right]$ current 'true' cosmic rate of expansion can be understood. Drop in current 'cosmic temperature' can be considered as a measure of the current cosmic expansion and 'rate of decrease in current cosmic temperature' can be considered as a measure of the current cosmic 'rate of expansion'. But if rate of decrease in temperature is very small and is beyond the scope of current experimental verification, then the two possible states are: a) cosmic temperature is decreasing at a very slow rate and universe is expanding at a very slow rate and b) there is no 'observable' thermal expansion and there is no 'observable' cosmic expansion. If observed CMBR temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable. Similarly 'rate of decrease in current 'Hubble's constant' can be considered as a measure of current cosmic 'rate of expansion'. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion. Fortunately as per the Cobe/Planck satellite data current CMBR temperature is very smooth and isotropic. and there is no data that refers to the rate of change in the current Hubble's constant. Hence it can be suggested that at present there is no significant cosmic expansion. Even though this suggestion is completely against to the current notion of cosmic acceleration [32,33], based on the proposed arguments, relations and observed data authors request the science community to review the standard cosmology. If observed CMB radiation temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable.

IV. To Understand the Physical Significance of Large Numbers in Cosmology

Great cosmologists proposed many interesting large numbers in cosmology [67-74]. Ultimately the essence of any cosmological number or ratio is to connect the microscopic and macroscopic physical constants with a possible physical meaning with in the 'evolving universe'. Clearly speaking large dimensionless constants and compound physical constants must reflect an 'observable' intrinsic property of any natural physical phenomenon. Then only the real meaning of any cosmological number can be explored. In this regard authors proposed many interesting relations in the previous sections of this paper. Authors noticed that uncertainty relation or Planck's constant or reduced Planck's constant or inverse of the Fine structure ratio or characteristic nuclear potential radius or rms radius of proton or classical radius of electron - play a crucial role in the understanding the halt of cosmic expansion. The basic questions to be answered are: 1) The general idea of large number coincidence is interesting, yet is there any observational proves? and 2) How Einstein's general theory of relativity is fitted in the theory of the large cosmological numbers ? In this regard the characteristic and key relation can be expressed in the following way.

$$\frac{c^3}{2GM_0} \cong H_0 \quad \text{Or} \quad \frac{c^3}{2GH_0} \cong M_0 \tag{73}$$

Here $\left(M_0, H_0\right)$ can be considered as the current mass and current angular velocity of the black hole universe respectively. By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\frac{c^3}{2GM_{sat}} \cong H_{sat} \quad \text{Or} \quad \frac{c^3}{2GH_{sat}} \cong M_{sat} \tag{74}$$

Here $\left(M_{sat}, H_{sat}\right)$ can be considered as the saturated mass and saturated angular velocity of the black hole universe at its ending stage of expansion. Fortunately it is noticed that, $M_{sat} \cong M_0$ and $H_{sat} \cong H_0$. Authors strongly believe that the following relations certainly help in understanding the mystery of the halting of the present cosmic expansion.

a) Role of the Uncertainty relation

It is noticed that,

$$\frac{Gm_pm_e}{R_pH_0} \cong \frac{h}{4\pi} \tag{75}$$

Here $R_p \cong \left(0.84184 \text{ to } 0.87680\right)$ fm is the rms radius of proton [57,75]. After re-arranging, it can be expressed in the following way.

$$\left(\frac{2Gm_p}{c^2R_p}\right)\frac{m_ec^2}{H_0} \cong \left(\frac{2Gm_p}{c^2R_p}\right)\left[m_ec\left(\frac{2\pi c}{H_0}\right)\right] \cong h \tag{76}$$

By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$H_{sat} \Rightarrow \frac{4\pi Gm_pm_e}{hR_p} \cong \frac{Gm_pm_e}{\left(h/4\pi\right)R_p} \tag{77}$$

$$\Rightarrow H_{sat} \cong \left(67.87 \text{ to } 70.69\right) \text{ km/sec/Mpc}$$

This is a remarkable fit and needs further study.

b) Role of the Classical Radius of Electron

It is noticed that,

$$\sqrt{\left(\frac{2G\sqrt{m_p m_e}}{c^2}\right)\left(\frac{c}{H_0}\right)} \cong \sqrt{\left(\frac{2G\sqrt{m_p m_e}}{c^2}\right)\left(\frac{2GM_0}{c^2}\right)} \cong \left(\frac{e^2}{4\pi\varepsilon_0 m_e c^2}\right) \tag{78}$$

$\left(\frac{e^2}{4\pi\varepsilon_0 m_e c^2}\right)$ is nothing but the presently believed classical radius of electron. In a broad picture or considering the interaction in between proton and electron it is a very general idea to consider the geometric mean mass of proton and electron. By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\left(\frac{c}{H_{sat}}\right) \Rightarrow \left(\frac{e^2}{4\pi\varepsilon_0 m_e c^2}\right)^2 \left(\frac{c^2}{2G\sqrt{m_p m_e}}\right) \tag{79}$$

$$H_{sat} \Rightarrow \frac{2G\sqrt{m_p m_e}}{c}\left(\frac{4\pi\varepsilon_0 m_e c^2}{e^2}\right)^2 \cong 67.533 \text{ km/sec/Mpc} \tag{80}$$

This is also a remarkable fit and needs further study.

c) Role of the Characteristic Nuclear Potential Radius

It is noticed that,

$$\frac{G\sqrt{M_0\sqrt{m_p m_e}}}{c^2} \cong \sqrt{\left(\frac{GM_0}{c^2}\right)\left(\frac{G\sqrt{m_p m_e}}{c^2}\right)} \cong 1.4\times10^{-15} \text{ m} \cong R_n \tag{81}$$

R_n is nothing but the presently believed characteristic nuclear potential radius [76] or the nuclear strong interaction range as proposed by Yukawa [77]. By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows [78-80].

$$\frac{G\sqrt{M_{sat}\sqrt{m_p m_e}}}{c^2} \Rightarrow R_n \tag{82}$$

$$H_{sat} \Rightarrow \frac{G\sqrt{m_p m_e}}{2cR_n^2} \tag{83}$$

This is also a remarkable coincidence and accuracy mainly depends upon the magnitude of the characteristic nuclear potential radius. Further study may reveal the mystery.

d) Role of the 'inverse' of the Fine Structure Ratio

In a cosmological approach fine structure ratio can be fitted in the following way [64-66]. Total thermal energy in the present Hubble volume can be expressed as follows.

$$(E_T)_0 \cong aT_0^4 \cdot \frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3 \tag{84}$$

Thermal energy present in half of the current Hubble volume can be expressed as follows.

$$\frac{(E_T)_0}{2} \cong \frac{1}{2}\left[aT_0^4 \cdot \frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3\right] \tag{85}$$

If (c/H_0) is the present electromagnetic interaction range, then present characteristic Hubble potential can be expressed as

$$(E_e)_0 \cong \frac{e^2}{4\pi\varepsilon_0 (c/H_0)} \cong \frac{e^2 H_0}{4\pi\varepsilon_0 c} \tag{86}$$

If H_0 is close to 71 km/sec/Mpc and $T_0 \cong 2.725$ K, it is noticed that,

$$\ln\sqrt{\frac{[(E_T)_0/2]}{(E_e)_0}} \cong 137.05 \tag{87}$$

By this time if the expanding black hole universe is coming to a halt, then above relation can be re-expressed as follows.

$$\ln\sqrt{\frac{[(E_T)_0/2]}{(E_e)_0}} \cong \ln\sqrt{\frac{[(E_T)_{sat}/2]}{(E_e)_{sat}}} \Rightarrow \left(\frac{1}{\alpha}\right) \tag{88}$$

$(E_T)_{sat}$ can be considered as the total thermal energy in the Hubble volume at the end of cosmic expansion.

$(E_e)_{sat}$ can be considered as the Hubble potential at the end of cosmic expansion.

V. To Fit the Nuclear Charge Radius and the Planck's Constant

The subject of final unification is having a long history. After the nucleus was discovered [76] in 1908, it was clear that a new force was needed to overcome the electrostatic repulsion of the positively charged protons. Otherwise the nucleus could not exist. Moreover, the force had to be strong enough to squeeze the protons into a volume of size 10^{-15} meter. In general the word 'strong' is used since the strong interaction is the "strongest" of the four fundamental forces. Its observed strength is around 10^2 times that of the electromagnetic force, some 10^5 times as great as that of the weak force, and about 10^{39} times that of gravitation.

The aim of unification is to understand the relation that connects 'gravity', 'mass', 'charge' and the 'microscopic space-time curvature'. Many scientists addressed this problem in different ways [78-80]. The authors also made many attempts in their previously published papers [81-84]. Experimentally observed nuclear charge radius R_{ch} can be fitted with the following strange and simple unified relation.

$$R_{ch} \cong \sqrt{\ln\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right)\cdot\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right)}\cdot\left(\frac{2GM_S}{c^2}\right) \tag{89}$$
$$\cong 1.252 \text{ fermi}$$

Considering the rest energy of proton and 1.25 fermi, semi empirical mass formula energy coefficients can be fitted very easily.

$$\frac{R_{ch}c^2}{2GM_S} \cong \sqrt{\ln\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right)\cdot\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right)} \tag{90}$$

Whether the expression $\ln\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right) \cong 90.62$ playing a 'key unified role' or 'only a fitting role' to be confirmed. With a great accuracy the famous Planck's constant can be fitted with the following relation.

$$\begin{aligned} h &\cong \frac{1}{2}\ln\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right)\cdot\left(\sqrt{m_p m_e}\cdot c\cdot R_{ch}\right) \\ &\cong \ln\sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}}\cdot\left(\sqrt{m_p m_e}\cdot c\cdot R_{ch}\right) \\ &\cong 6.63862\times10^{-34} \text{ J.sec} \end{aligned} \tag{91}$$

Recommended value of h is $6.6260695729\times10^{-34}$ J.sec and the error is 0.189%. Now above relation can be simplified into the following form [75].

$$h \cong \left[\ln\left(\frac{e^2}{4\pi\varepsilon_0 G m_p m_e}\right)\right]^{3/2}\left(\frac{e^2}{4\pi\varepsilon_0 c}\right) \tag{92}$$

Connecting quantum constants and gravity is really a very big task. At this juncture this relation can be given a chance. It casts a doubt on the independent existence of quantum mechanics. With this relation, obtained magnitude of the gravitational constant is, $G \cong 7.48183566\times10^{-11}$ m^3.kg^{-1}sec^{-2}. Independent of 'length', 'force' and other physical considerations, with this relation order of magnitude of G can be confirmed from atomic physical constants. To proceed further - at first the hierarchy of physical constants must be established and it needs further study and analysis.

VI. Conclusions

a) Need of the mass unit $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ in unification

The basic idea of unification is – 1) To minimize the number of physical constants and to merge a group of different fundamental constants into one compound physical constant with appropriate unified interpretation and 2) To merge and minimize various branches of physics. In this regard instead of Planck mass, $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ can be considered as the nature's given true unified mass unit. Using this mass unit, proton-electron mass ratio and proton rest mass can be fitted in the following way.

$$\ln\sqrt{\frac{m_p}{m_e}\cdot\left(\frac{m_p^2}{m_e}\right)} \cong \left(M_S m_e^2\right)^{\frac{1}{3}} \tag{93}$$

$$\ln\sqrt{\frac{m_p}{m_e}\cdot\left(\frac{m_p}{m_e}\right)} \cong \frac{\left(M_S m_e^2\right)^{\frac{1}{3}}}{m_p} \tag{94}$$

Here, lhs=6908.3745 and rhs=6899.7363. Accuracy can be improved with the following relation.

$$\frac{\left(M_S m_e^2\right)^{\frac{1}{3}}}{m_p} \cong \left[\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}}\right]+\ln\left[\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}}\right] \tag{95}$$

Interesting observation is that $\ln\left[\frac{\left(M_C m_e^2\right)^{\frac{1}{3}}}{m_p}\right] \cong \ln(6900) \cong 8.84$ and is close to the presently believed inverse of the strong coupling constant α_s [53]. From the above relation, magnitude of the gravitational constant [57,85,86] can be fitted in the following way.

$$\left.\begin{aligned} &\text{If } X \cong \left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}} \text{ and } M_S \cong \left[X+\ln(X)\right]^3\left(\frac{m_p^3}{m_e^2}\right) \\ &G \cong \frac{e^2}{4\pi\varepsilon_0 M_S^2} \cong 6.672681991\times10^{-11} \text{ m}^3\text{.kg}^{-1}\text{sec}^{-2} \end{aligned}\right\} \tag{96}$$

where, $m_p \cong 1.672621777(74)\times10^{-27}$ kg,
$m_e \cong 9.109\,382\,91(40)\times10^{-31}$ kg,
$e \cong 1.602\,176\,565(35)\times10^{-19}$ C.

Now the strong coupling constant can be fitted with the following relation.

$$\exp\left(\frac{1}{\ln(X)}\right)-1 \cong \alpha_s \cong 0.11978 \tag{97}$$

b) To Consider the Universe as a Growing and light speed rotating Primordial black hole

If 'black hole geometry' is more intrinsic compared to the black hole 'mass' and 'density' parameters, if universe constitutes so many galaxies and if each galaxy constitutes a central growing and fast spinning black hole then considering universe as a 'growing and light speed rotating primordial black hole' may not be far away from reality. If universe is having no black hole geometry - any massive body (which is bound to the universe) may not show a black hole structure. That is black hole structure or geometry may be a subset of the cosmic geometry. At this juncture considering or rejecting this proposal completely depends on the observed cosmic redshift. Based on the relations proposed in sections 2 and 4 observed cosmic redshift can be considered as a result of cosmological light emission mechanism. Authors are working on the assumed Hubble volume and Hubble mass in different directions with different applications [1-13] that connect micro physics and macro physics. Based on the proposed applications and short comings of the standard model of cosmology - concepts of black hole cosmology may be given at least 99% priority.

c) About the current cosmic black hole's deceleration

In view of the applications proposed in sections (2) to (4) and with reference to the zero rate of change in inverse of the fine structure ratio (from ground based experiments), zero rate of change in the 'current CMBR temperature' (from Cobe/Planck satellite data) and zero rate of change in the 'current Hubble's constant' (from Cobe/Planck satellite data) it can be suggested that, current cosmic expansion is almost all saturated and at present there is no significant cosmic acceleration [47,48]. Clearly speaking, Stoney scale cosmic black hole's growth rate is equal to the speed of light and current cosmic black hole is growing at 14.66 km/sec in a decelerating trend. It can be also be possible to suggest that currently believed 'dark energy' is a pure, 'mathematical concept' and there exists no physical base behind its confirmation. Now the key leftover things are nucleosynthesis and structure formation. Authors are working in this direction. As nuclear binding energy was zero at the beginning of cosmic evolution, by considering the time dependent variable nature of magnitudes of the semi empirical mass formula energy coefficients it is possible to show that, at the beginning of formation of nucleons, nuclear stability is maximum for light atoms only. If so it can be suggested that, from the beginning of formation of nucleons, in any galaxy, maximum scope is being possible only for the survival of light atoms and this may be the reason for the accumulation and abundance of light atoms in large proportion.

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By V.I. Bogdanov & O.S. Borovkova

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INCREASEOFPULSEATINTERACTIONOFGASMASSESINTHEPULSEJETENGINEEXHAUSTUNIT

Strictly as per the compliance and regulations of :

Increase of Pulse at Interaction of Gas Masses in the Pulsejet Engine Exhaust unit

V.I. Bogdanov [α] & O.S. Borovkova [σ]

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В настоящее время к использованию пульсирующего, с детонационным сгоранием рабочего процесса в энергодвигательных установках проявляется повышенный интерес, в основном из-за возможности повысить их термодинамическую эффективность и упростить конструкцию. Однако пульсирующий рабочий процесс интересен не только высокой термодинамической эффективностью, но и, как показывают последние исследования, открывает новые возможности для повышения тягового импульса за счет взаимодействия масс.

В ОАО «НПО «Сатурн» были проведены испытания экспериментального пульсирующего воздушно-реактивного двигателя (ПуВРД), выполненного на базе высокочастотной золотниковой камеры сгорания постоянного объема (КС V=const) нового типа (рис.1) с эжекторным усилителем тяги (ЭУТ) и без него [1,2,3]. Результаты измерений тяги экспериментального ПуВРД без ЭУТ и расчетов её (по внутридвигательным параметрам) при допущении квазистационарности процесса истечения показали, что измеренная тяга R в ~2 раза (в зависимости от частоты вращения золотника n) превысила ее расчетное значение (рис.2). Это можно объяснить тем, что ПуВРД с золотниковой КС V = const имеет скважность рабочих пульсаций ≈ 75% и в перерывах между подачами струй газа пространство за соплом заполняется воздухом из окружающей среды (атмосферы), который при истечении газа становится присоединенной массой, повышающей тягу двигателя. Это подтверждает известное расчетно-теоретическое исследование единичного цикла (одномерного разлета продуктов детонации - газа) [4], которое показало возможность увеличения импульса в атмосфере в 3 раза по сравнению с вакуумом. Там же показано, что при взаимодействии газа с атмосферой происходит колебательный процесс, в определенные моменты которого газ движется обратно к источнику. Этот газ может стать присоединенной массой для следующего цикла. При скважности рабочих пульсаций, близкой к нулю, возможно использование части цикловой массы отработанной струи газа (её «хвоста», имеющего меньшую скорость, чем фронт) в качестве присоединённой массы (рис.3). На базе полученных результатов исследований ПуВРД без ЭУТ был разработан двигатель [5], обеспечивающий высокий уровень лобовой тяги.

Результаты испытаний ПуВРД с ЭУТ представлены на рис.4,5,6 в виде зависимостей измеренных усилий на ЭУТ, динамического напора и пульсаций давления на выходе из эжекторного канала от частоты вращения золотника.

Представляет интерес изменение параметров в диапазоне частот вращения золотника n от 12000 до 13000 об/мин. При изменении n на 8,3 % усилие на ЭУТ Rэ.эксп увеличилось на 41 %. При этом резко изменилось поле скоростей на выходе из ЭУТ – произошло уменьшение скорости потока в пристеночной области канала. Для объяснения явления была выполнена расчетная оценка изменения тяги на ЭУТ Rэ.расч по параметрам потока на его выходе и выполнен анализ экспериментальных и расчетных результатов [3].

Таблица 1

Тяга ЭУТ, Н	n, об/мин	
	12 000	13 000
Rэ.расч	10,18	10,23
Rэ.эксп	12,14	17,15

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По расчетной оценке усилие на эжекторном канале значительно меньше измеренного, при увеличении n с 12000 об/мин до 13000 об/мин оно должно увеличиться всего на 0,5 %. Однако измеренное усилие при этом возросло на 41 % (табл.1). Противоречие между расчетными и экспериментальными значениями усилий, особенно при переходе с n = 12000 об/мин на n = 13000 об/мин, увяжем с резким изменением поля скоростей в этом диапазоне частот вращения золотника.

Резкое уменьшение скорости потока в пристеночной области эжекторного канала можно объяснить его отрывом потока в диффузорной части канала. Известно [6], что отрыв пограничного слоя всегда связан с образованием вихрей в результате взаимодействия прямого и обратного течений, что может быть в колебательном процессе. В этом процессе и может происходить присоединение массы, повышающее тягу [1], т.е. одна и та же масса воздуха может создавать тягу сначала как активная, а затем как присоединенная. При этом происходит преобразование кинетической энергии (динамического напора) в импульс. Этим и объясняется противоречие между измеренной тягой и результатом расчетной оценки ее по динамическому напору. Можно предположить, что на n = 12000 об/мин имеет место умеренное присоединение массы газа без отрыва потока, а на n = 13000 об/мин – более интенсивное, с его отрывом, возможно, в резонансном колебательном процессе уже с неоднократным присоединением одной и той же массы (назовём это - присоединением отработанной или собственной массы газа).

Для подтверждения этого, а также для исключения возможного присоединения внешней массы, на выходе эжекторного канала (на расстоянии 10…20 мм) устанавливался цилиндрический экран. Испытания показали [3], что динамика протекания усилия на эжекторном канале не изменилась, значения усилий с экраном и без него мало отличались для одних и тех же частот пульсаций . Характерным является и то, что динамика протекания амплитуды пульсаций ΔP (рис.6), измеренных на выходе эжекторного канала датчиком ЛХ-610 на n > 12000 об/мин такая же, как у усилия, измеренного на эжекторном канале.

Если в пульсирующей газовой струе есть взаимодействие масс, то будут и потери на удар. При этом чем выше упругость газа, тем меньше кинетической энергии при ударе преобразуется во внутреннюю и больше в импульс.

Такое взаимодействие отработанных масс газа может быть и в традиционных пульсирующих ВРД. Был выполнен анализ газодинамических, тяговых характеристик, а также геометрических параметров известных пульсирующих ВРД [7]. Здесь характерно сильное влияние отношения длины L двигателя к его диаметру d на удельный расход топлива. При увеличении данного отношения, и соответственно объёма выходного устройства двигателя, растёт присоединённая масса газа, что приводит к увеличению импульса и снижению удельного расхода топлива Cуд (рис.7). При этом максимальное давление сгорания изменяется незначительно. На рис. 8 показана схема ПуВРД SNECMA 3340 «Escopette» с увеличенным L/d с удельным расходом топлива, близком к уровню, соответствующим малоразмерным ТРД. Результаты анализа соответствуют полученным ранее в ОАО «НПО «Сатурн» результатам расчетных и экспериментальных исследований пульсирующего рабочего процесса в реактивных двигателях.

Для проверки эффекта увеличения импульса за счет взаимодействия отработанных масс газа в условиях космоса была создана экспериментальная установка (рис. 9) с привязкой к вакуумной камере ВК-25 ОАО «ВПК «НПО Машиностроения», обеспечивающей давление 0,001 МПа (технический вакуум) [8].

Отсутствие внешней среды должно было окончательно определить возможность увеличения удельного импульса реактивного двигателя за счет взаимодействия отработанных масс газа. Для измерения тяги, учитывая опыт работы с пульсирующими установками, был применен надёжный метод с использованием баллистического маятника. Тяга определялась величиной отклонения установки с помощью датчика угловых перемещений. Установка представляет собой пульсирующий реактивный двигатель с приводным от электродвигателя золотником и выходным устройством регулируемой длины. На вход в двигатель от баллонов подавался воздух, золотник сменный. Один выполнен с тремя рабочими полостями, второй - с четырьмя. Параметры рабочих пульсаций (частота, скважность) определялись типом золотника и частотой его вращения.

На рис.10 представлен один из результатов испытаний в вакууме в виде зависимости тяги R, расхода воздуха Gв и удельной тяги Rуд от частоты вращения золотника n, конфигурации двигателя и давлений перед золотником и в вакуумной камере.

Максимальные значения Rуд, полученные для каждой конфигурации двигателя (тип золотника, длина выходного устройства) в зависимости от степени понижения давления в выходном устройстве отражены на рис. 11. На этом же рисунке приведены расчетные зависимости идеальной удельной тяги для полного расширения при пульсирующем (нестационарном) истечении. Для нестационарного истечения πс равно его начальному значению.

Расчет идеальной тяги для пульсирующего истечения выполнялся методом численного интегрирования процесса квазистационарного адиабатического расширения.

По результатам испытаний в вакууме эффект увеличения удельной тяги за счет присоединения отработанной массы газа (при взаимодействии цикловых масс) подтверждается:

- превышением экспериментальных значений удельной тяги над расчетной квазистационарной; на малых πс, где потери, особенно на удар, малы, превышение может составить более 100%;
- наличием пиков на экспериментальной кривой зависимости удельной тяги от частоты пульсации, свойственных резонансу; резонанс здесь возможен при передаче энергии посредством взаимодействия цикловых масс воздуха с относительно малыми потерями на удар (так называемым малым затуханием, свойственным резонансу);

Выполненные предварительные расчётные исследования с учётом результатов эксперементальных исследований характеристик ПуВРД показали возможность повышения импульса за счёт увеличения объёма выходного устройства при конусном исполнении (рис.9). При этом для πс = 100 необходимо, чтобы объём выходного устройства был примерно в 100 раз больше объёма рабочей полости золотника, что обеспечит взаимодействие больших масс воздуха. Поэтому целесообразно продолжить исследования с учётом этой доработки. При испытаниях изменение длины выходного устройства следует производить последовательной обрезкой его концевой части.

Расчётно-теоретическим исследованием, при корректных допущениях, получены соотношения для определения тяговых характеристик с учётом присоединения отработанной (собственной) массы газа в условиях пульсирующего рабочего процесса для ВРД [9].

Тяга для пульсирующего ВРД с присоединением собственной массы газа по аналогии с известным эжекторным усилителем тяги:

$$P = G_{\text{в}} \cdot C_{\text{с}} \cdot \sqrt{(\mu+1)\cdot\eta} - G_{\text{в}} \cdot V_{\Pi},$$

где: - $\mu = \dfrac{G_{\text{пр}}}{G_{\text{в}}}$ - коэффициент присоединения массы определяется отношением присоединённого расхода газа Gпр к расходу воздуха Gв;

- η- кпд процесса присоединения массы,

а удельная тяга определится соотношением:

$$R_{\text{уд}} \approx C_{\text{с}} \cdot \sqrt{(\mu+1)\cdot\eta} - V_{\Pi},$$

Из анализа полученных соотношений следует, что скорость истечения газа не может определять удельную тягу как в обычном ВРД. Для её определения необходимо использовать известное отношение измеренной тяги к расходу воздуха через двигатель. А скорость полёта может быть больше скорости истечения, при этом характер протекания полётного кпд будет таким же как у ракетного двигателя, с оптимумом ηп.max=1,0 (рис.12).

Сложность протекания нестационарных процессов в пульсирующем реактивном двигателе требует для определения его тяговых характеристик применения современных численных методов с последующим экспериментальным подтверждением.

Наибольший эффект от взаимодействия цикловых масс в пульсирующем рабочем процессе может быть получен в реактивных двигателях, которые при стационарном истечении газа в полетных условиях имели бы низкий тяговый КПД:

- двигатели первых ступеней ракет-носителей;
- двигатели ориентации космических аппаратов;
- двигатели торможения;
- подъемные двигатели для самолетов вертикального взлета и посадки.

Интересным представляется реализация управления величиной присоединения массы, например изменением параметров рабочих пульсаций, в многорежимных реактивных двигателях для поддержания тягового кпд на высоком уровне во всём диапазоне скоростей полёта. Т.е. на малых скоростях полёта присоединение массы максимально, по мере разгона летательного аппарата оно уменьшается.

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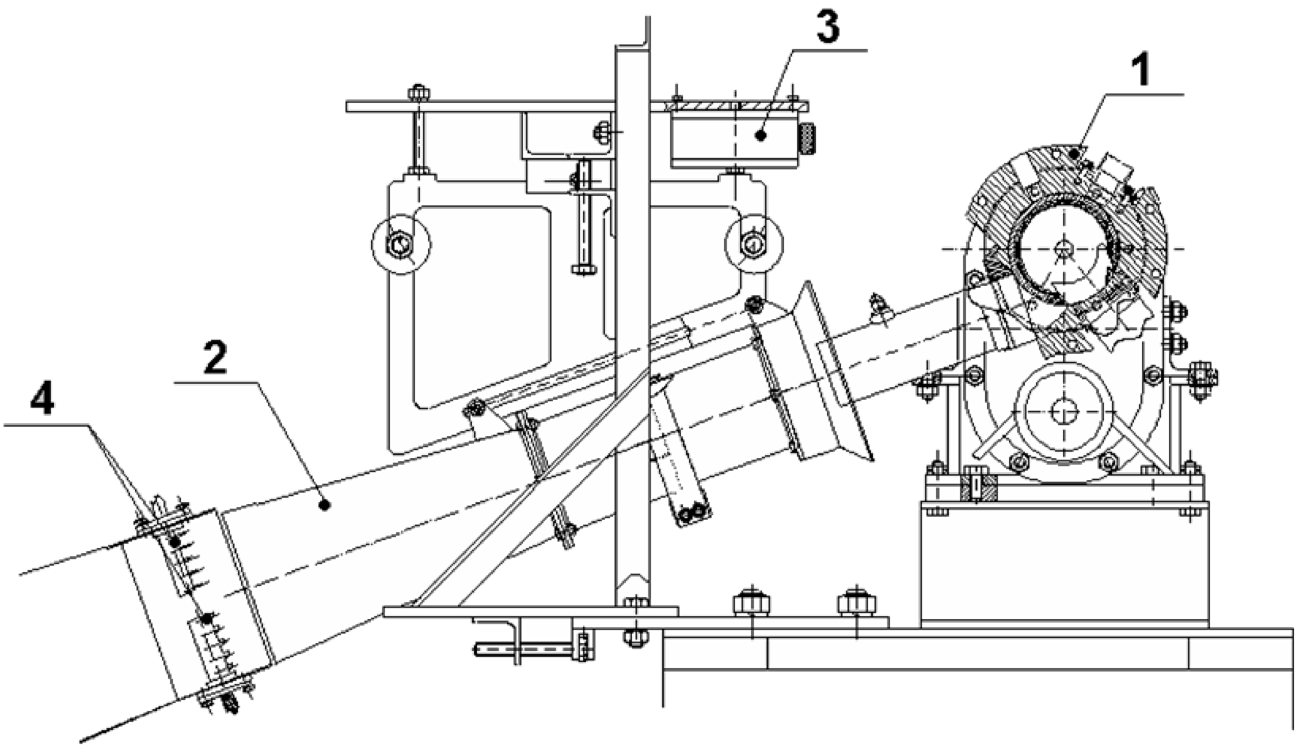

Рис 1 : ПуВРД с золотниковой камерой сгорания и эжекторным усилителем тяги: 1 - ПуВРД; 2 - эжекторный канал; 3 - силоизмерительный датчик; 4 - датчики измерения полного давления и температуры газа.

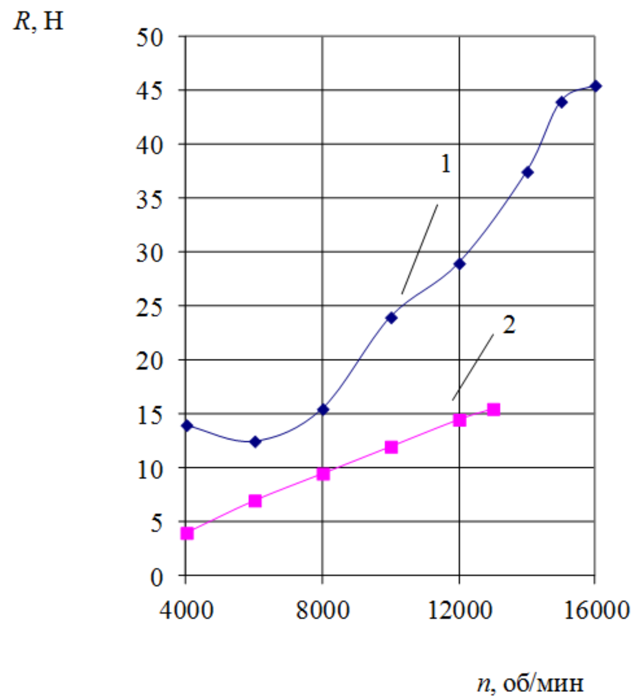

Рис 2 : Зависимость тяги ПуВРД от частоты вращения золотника: 1 – эксперимент; 2 – расчет.

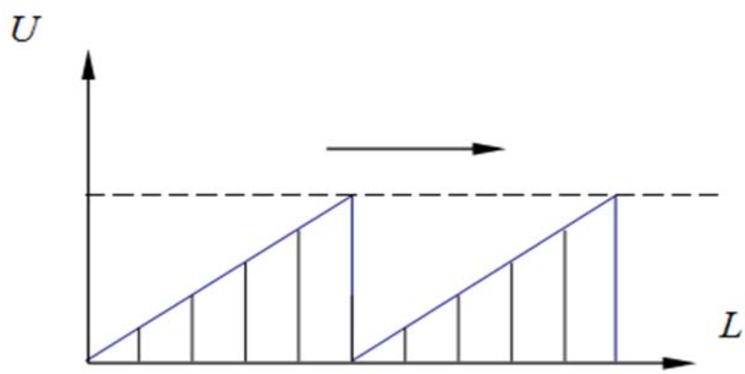

Рис 3 : Типичное распределение скорости U по длине L цикловых масс газа.

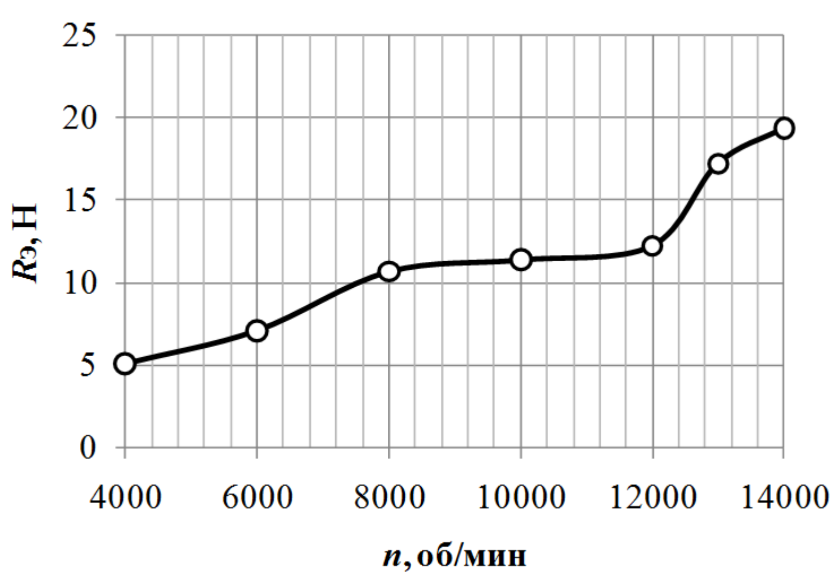

Рис 4 : Зависимость измеренных усилий на эжекторном канале от частоты вращения золотника.

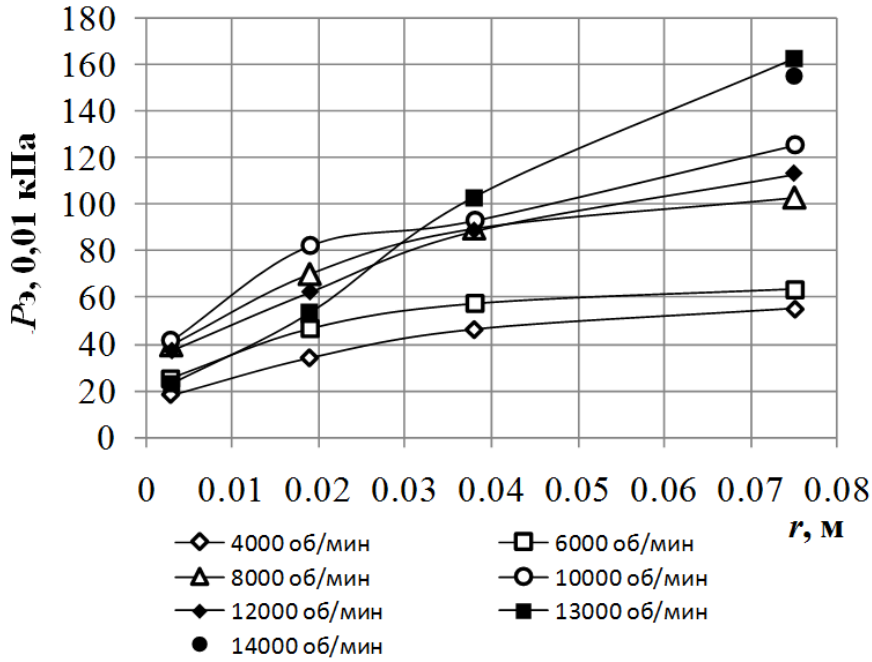

Рис 5 : Распределение измеренного динамического напора по радиусу на выходе эжекторного канала.

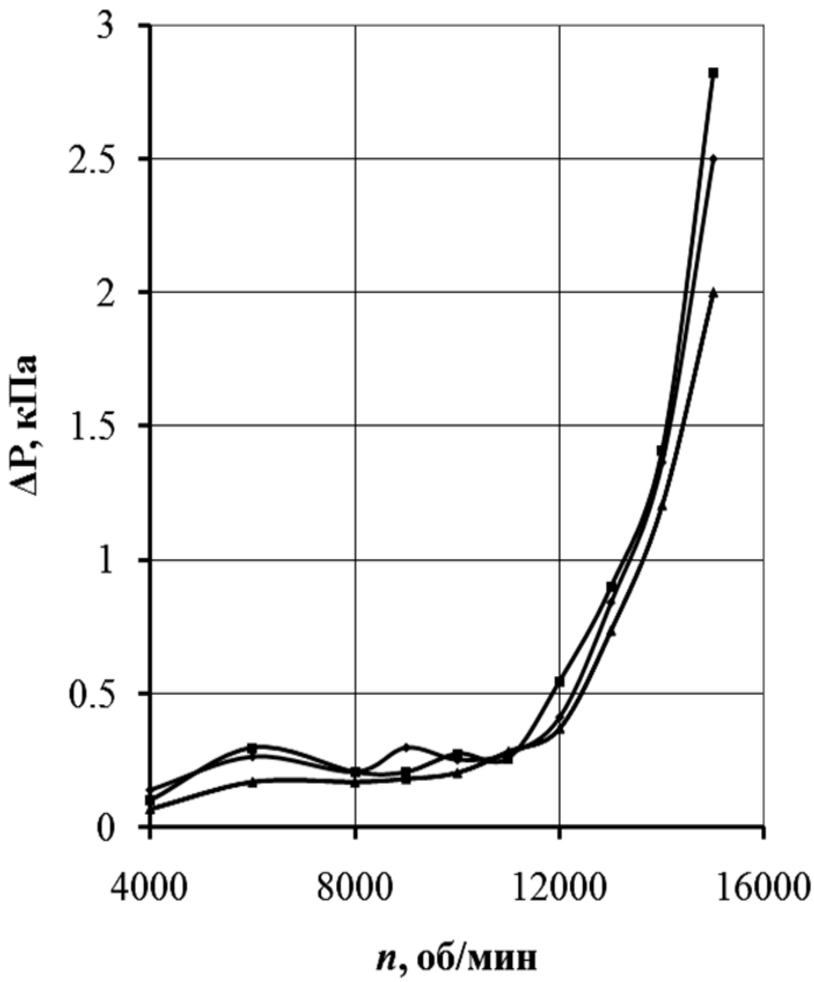

Рис 6 : Пульсации давления на выходе эжекторного канала.

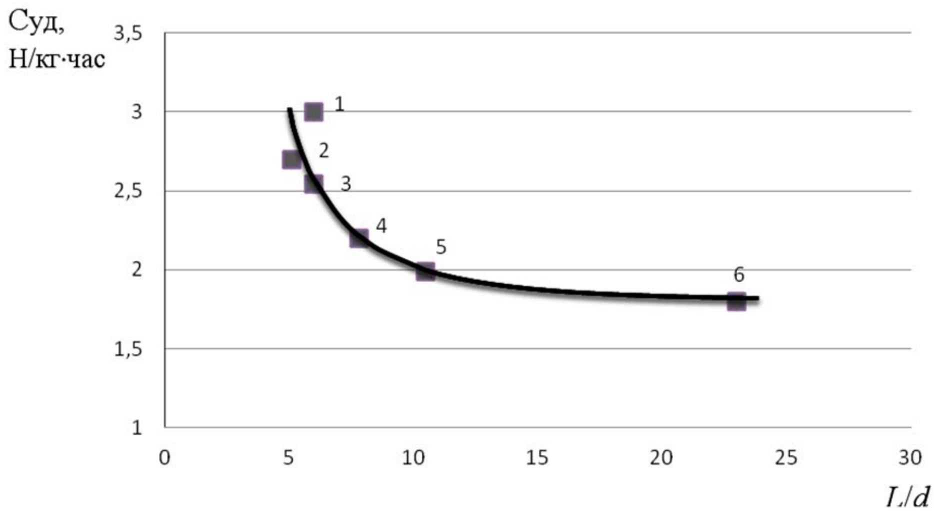

Рис 7 : Зависимость удельного расхода топлива от отношения длины двигателя к его диаметру (1 – AS014, 2 - АУ-8-75С (США), 3 - SNCAN (Франция), 4 - Саундерс-РО (Англия), 5 - AS.1 (Германия), 6 - Escopette (Франция))

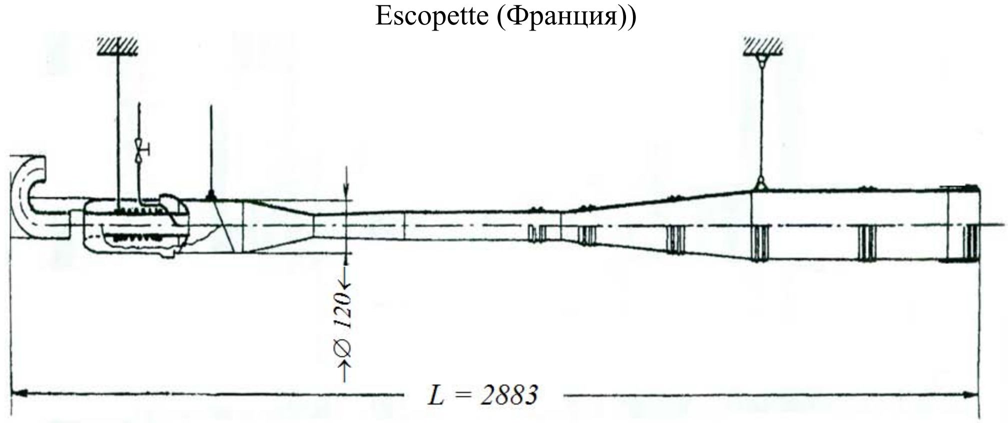

Рис 8 : Пульсирующий воздушно-реактивный двигатель SNECMA 3340 «Escopette»

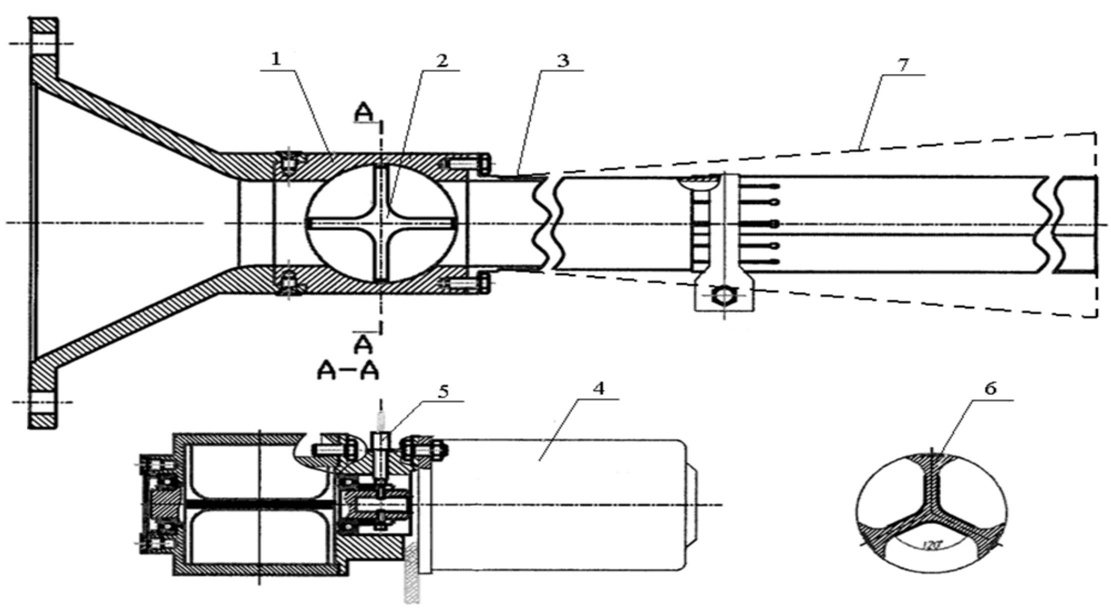

Рис 9 : Схема экспериментального пульсирующего реактивного двигателя 1 – корпус; 2 – четырехполостной золотник; 3 – выходное устройство с регулируемой длиной; 4 – приводной электродвигатель; 5 – датчик частоты вращения; 6 – трехполостной золотник; 7 – конфигурация выходного устройства с увеличенным объёмом

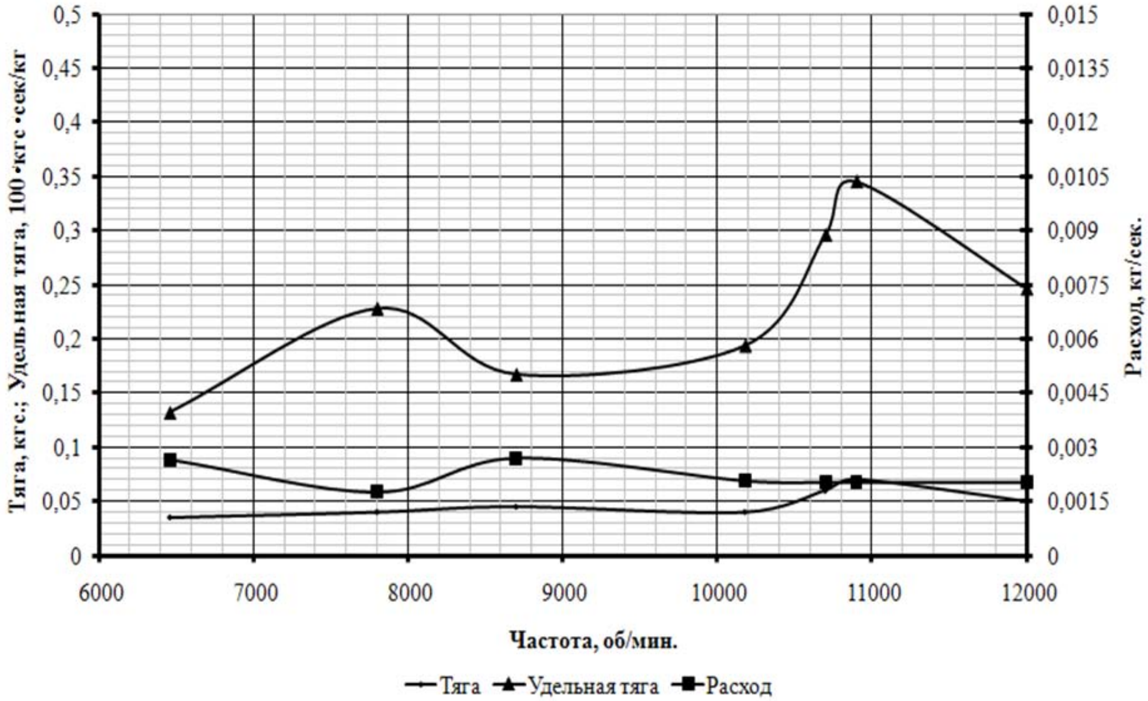

Рис 10 : Зависимость тяги двигателя от частоты вращения золотника; давление в ВК 0,0075 МПа; давление в ресивере 0,015 МПа; 3-х полостной золотник; длина выходного устройства – 400 мм

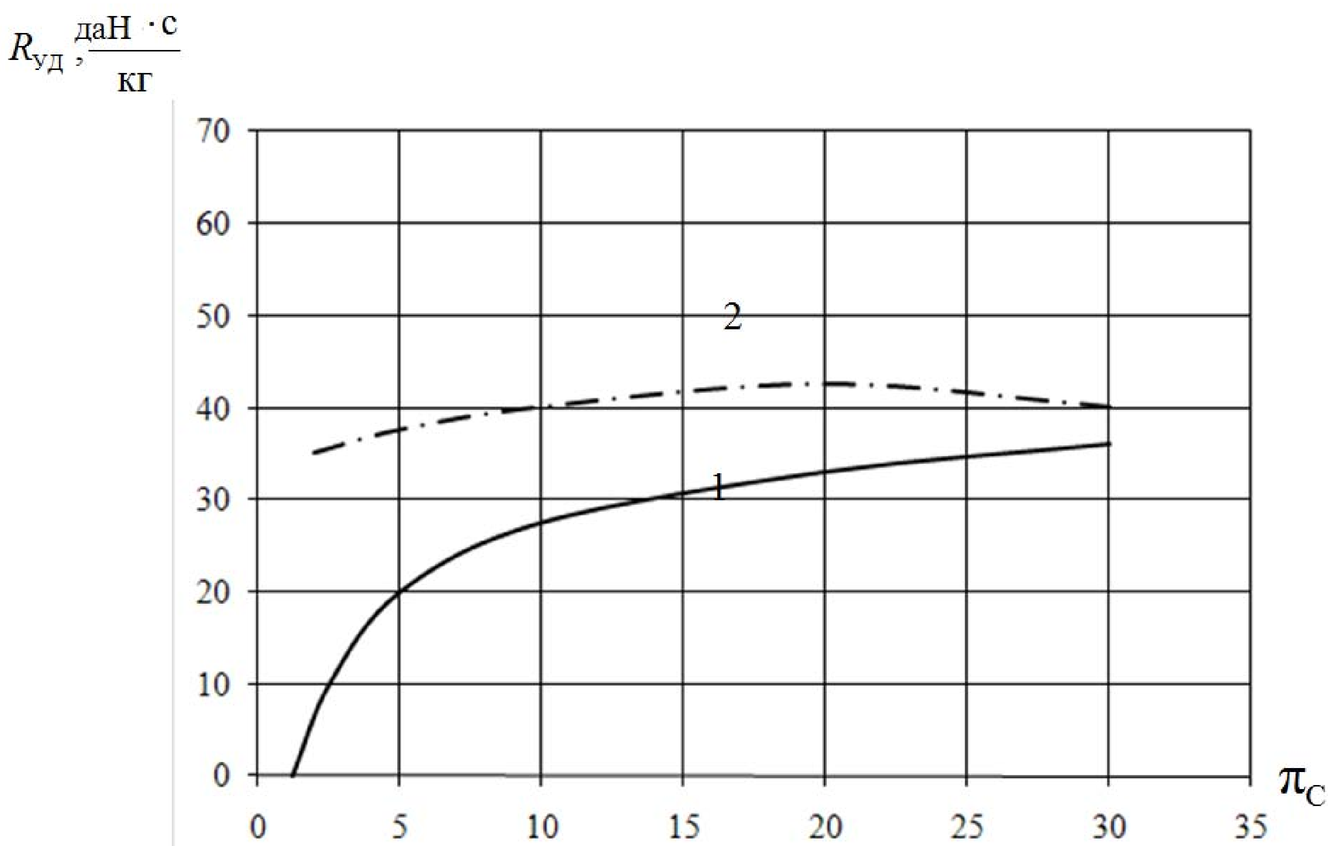

Рис 11 : Зависимости Rуд от πС при различных режимах истечения: 1 – идеальное, нестационарное, полное расширение; πС равно начальному значению; 2 – эксперимент; πС равно начальному значению

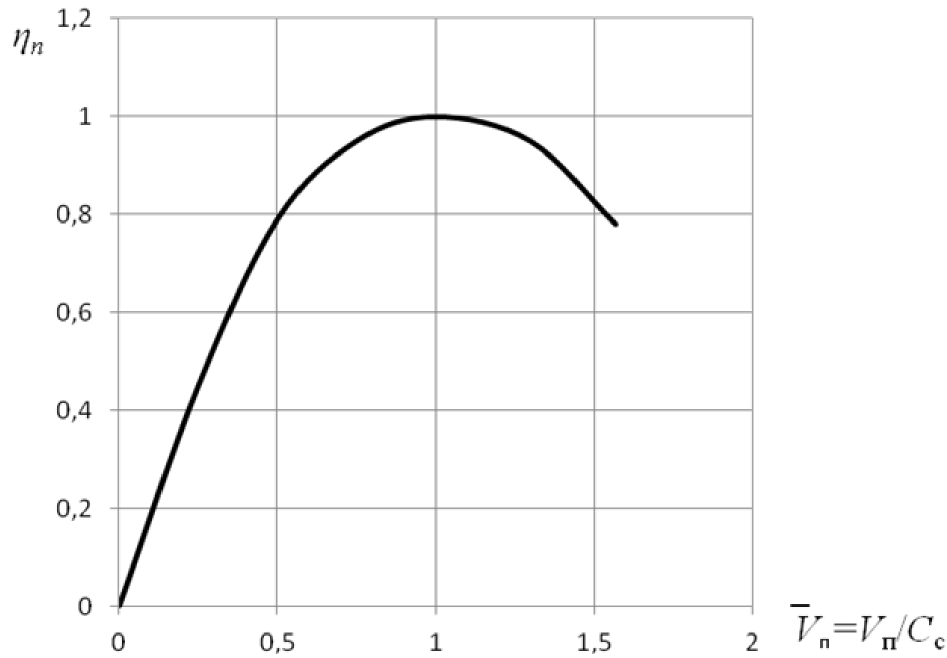

Рис 12 : Полетный КПД пульсирующего воздушно-реактивного двигателя.

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To the Study of Hidden Mass and Energy

By V.I. Bogdanov

Abstract- It is shown that such notions as the "dark matter", the "vacuum energy", which are sometimes used to explain some disputable phenomena, especially in engineering, can also be explained in terms of the newtonian mechanics.

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TOTHESTUDYOFHIDDENMASSANDENERGY

To the Study of Hidden Mass and Energy

V.I. Bogdanov

Abstract- It is shown that such notions as the “dark matter”, the “vacuum energy”, which are sometimes used to explain some disputable phenomena, especially in engineering, can also be explained in terms of the newtonian mechanics.

«Скрытая масса», «тёмная материя», «энергия вакуума» и другие подобные понятия используются при объяснении некоторых технических и космических явлений, когда возникают проблемы с применением законов, например ньютоновой механики. Однако далеко не всё получило однозначное признание. Возможно определённую ясность здесь могут внести следующие, отчасти новые, научные данные:

1.Известен такой примечательный факт из нестационарной газодинамики [1], который не сразу воспринимается даже опытными специалистами по газовой динамике.

При наполнении вакуумированного сосуда воздухом из атмосферы температура в нём увеличивается на 115К, т.е. возрастает внутренняя энергия. При этом вакуумирование может быть проведено как угодно давно даже во времена Большого взрыва. Данное явление на первый взгляд может демонстрировать так называемые энергии вакуума или гравитации, однако этому есть достаточно простое объяснение на основе первого закона термодинамики, который при отсутствии теплообмена запишется как:

$$Q = U_2 - U_1 + L_{вн.} = 0.$$

При заполнении сосуда есть изменение объёма, и следовательно есть внешняя работа $L_{вн.}$ Это приводит к изменению внутренней энергии $U_2 - U_1$ (более подробно в [1]). Здесь источником увеличения внутренней энергии является работа, затраченная ранее на вакуумирование сосуда.

2. В ОАО «НПО»Сатурн» (г.Рыбинск) были проведены испытания экспериментального пульсирующего воздушно-реактивного двигателя (ПуВРД) с эжекторным усилителем тяги, выполненного на базе высокочастотной золотниковой камеры сгорания постоянного объема (КС V=const) нового типа (рис.1) [2,3,4].

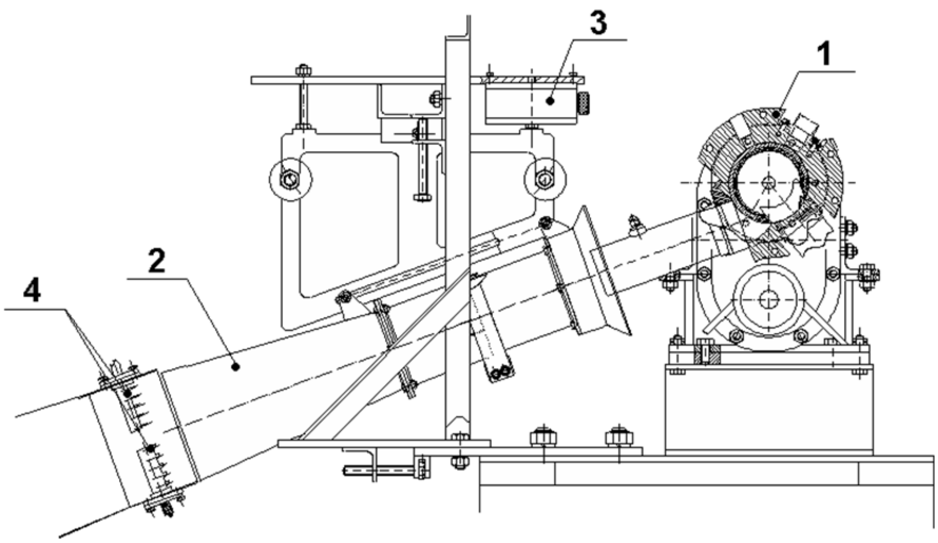

Рис 1: ПуВРД с золотниковой камерой сгорания и эжекторным усилителем тяги: 1 - ПуВРД; 2 - эжекторный канал; 3 - силоизмерительный датчик; 4 - датчики измерения полного давления и температуры газа

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При испытаниях на определённых режимах, при малом увеличении импульса газовой струи на выходе эжекторного канала непосредственно измеренное на нём усилие возрастало на 40%.

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Анализ результатов измерений параметров течения (включая пульсации) показал взаимодействие масс. В колебательном процессе может происходить присоединение массы внутри канала, повышающее тягу [2], т. е. одна и та же масса воздуха может создавать тягу сначала как активная, а затем как присоединенная. При этом происходит преобразование кинетической энергии (динамического напора) в импульс. Этим и объясняется противоречие между измеренной тягой и результатом расчетной оценки ее по параметрам газовой струи. Присоединённая масса может неоднократно участвовать в создании тяги в колебательном процессе, её трудно измерить, учесть. При определении удельных характеристик двигателя (отнесённых к расходу массы) из-за этой «скрытой» массы могут даже возникнуть противоречия с законами сохранения.

3. В Центре Гленна НАСА при экспериментальных исследованиях пульсирующего эжекторного усилителя тяги с резонансным устройством на входе [5] получен КПД эжекторного процесса на уровне 1,15, что противоречит законам сохранения. Отмечено обратное течение газа назад в определенные промежутки времени. Авторы исследования не смогли дать этому объяснения. Противоречие разрешается при условии использования одной и той же массы воздуха сначала в качестве активной, а затем, как присоединенной массы в колебательном процессе, т. е. как и в предыдущем случае.

При определённых условиях возможно и в единичном нестационарном цикле (при непрерывном истечении) преобразование активной массы в присоединённую. Это происходит, когда истекающие газы постепенно теряют кинетическую энергию, например из-за трения, или при увеличении мощности источника энергии (в течение цикла), т.е. последующие массы газа имеют большую скорость. Этот эффект можно объяснить и с помощью растянутого по времени такого наглядного нестационарного, единичного процесса, как извержение вулкана. В начале извержения первые массы извергнутой магмы остались бы рядом с кратером, создав импульс как активная масса. Однако последующие массы магмы воздействуют на первые, приводя их в движение, превращая эти массы в присоединённые, увеличивающие импульс. Т.е. одна и та же масса при течении без пульсаций участвует в создании импульса дважды – сначала как активная, затем как присоединённая.

Приведенные данные могут помочь решить проблемы, возникающие при исследовании нестационарных газодинамических процессов, особенно в части понимания их физики.

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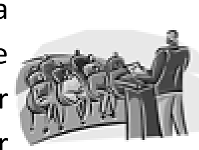

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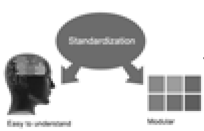

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The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

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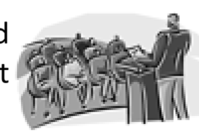
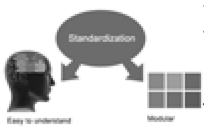


The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of “Open Association of Research Society, U.S.A (OARS)” so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.



After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
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The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

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- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
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Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone. "

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The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

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1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript’s Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

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(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

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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

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

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.

Procedures (Methods and Materials):

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

Materials:

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

Methods:

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

Approach:

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

What to keep away from

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

Results:

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

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

Content

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

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

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

Figures and tables

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

Discussion:

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

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

Approach:

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

Administration Rules Listed Before Submitting Your Research Paper to Global Journals Inc. (US)

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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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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