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The Principle of Equivalence

Quantum Mechanism of Music

Highlights

Dialectic Unity of Evolution

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Discovering Thoughts, Inventing Future

VOLUME 20 ISSUE 10 VERSION 1.0

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Physics & Space Science

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Coding Quantum Information in Van Der Waals Repulsive States

By Jianing Han
University of South Alabama

Abstract- Van der Waals interactions are dipole-dipole interactions. In this article, we study the quantum information storage using repulsive van der Waals interaction coupled states. It is shown that if one atom is excited, the second excited atom will be able to change the state distribution of the first excited atom. This can be used to do remote control at the quantum level. In addition, by analyzing the components of the first excited atom, the distance between the two excited atoms and the state distribution of the second excited atom can be extracted. Such systems are essential for developing single-atom quantum sensors.

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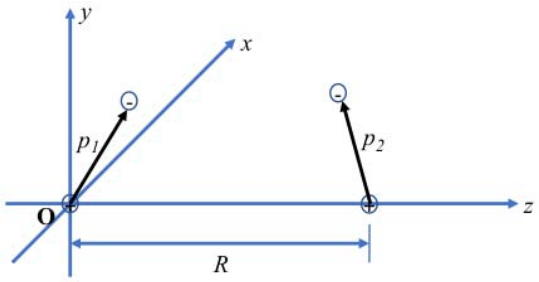

Fig. 1

I. Introduction

Van der Waals interactions are the second-order dipole-dipole interactions, which are proportional to $\frac{1}{R^6}$. Compared to the first-order dipole-dipole interactions, which are proportional to $\frac{1}{R^3}$, van der Waals interactions can be purely repulsive or attractive. Attractive interactions will lead to collisions. On the other hand, repulsive van der Waals interactions will less likely cause collisions. Recent experiments [**?**] do show that repulsive states lead to a longer coherent time. This offers a variety of opportunities for using repulsive van der Waals interactions for quantum sciences. For example, repulsive van der Waals interactions can be used for quantum gates [**? ?**]. Here we use electric-dipole electric-dipole interactions as an example. More specifically, we use a Rydberg atom [**? ?**] as an electric dipole. Therefore, the dipole-dipole interactions are Rydberg atom-Rydberg atom interactions. Such systems are especially useful for developing quantum sensors, especially single-atom sensors.

This paper is arranged in the following way: the theory is presented in the next section, which is followed by discussions about storing and extracting quantum information.

II. Theory

Van der Waals interactions have been studied in the past [**? ? ?**]. Here we will introduce repulsive van der Waals interactions. We first consider two excited atoms as shown in Fig. **??**, and we apply the Born-Oppenheimer approximation, assuming the ion cores have zero

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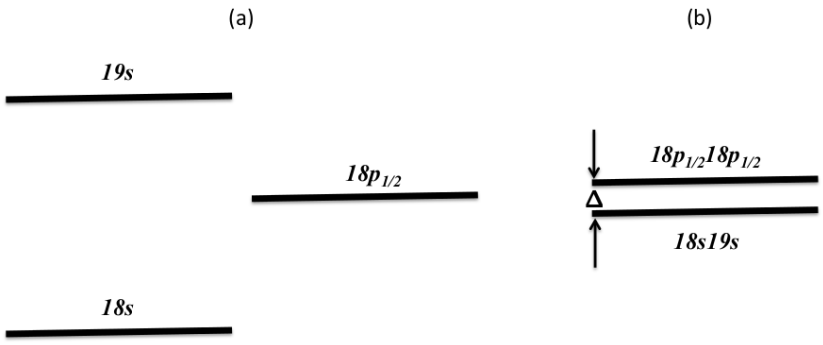

Fig. 2: (a) The atomic energy levels for s and p states. (b) Dimer energy levels, where Δ is the energy difference between the 18s19s and $18p_{1/2}18p_{1/2}$.

kinetic energy. We first consider the simplest dipole-dipole interactions between two bodies as shown in Fig. **??**(a). The two-body dipole-dipole interaction potential energy can be expressed as [**?**]:

$$V_{dd} = -\frac{1}{4\pi\epsilon_0}\frac{p_1 p_2(C^1_{1,-1}C^2_{1,1} + C^1_{1,1}C^2_{1,-1} + 2C^1_{1,0}C^2_{1,0})}{R^3}, \tag{1}$$

where $p_1 = er_1$ and $p_2 = er_2$ are the dipole moments of atom 1 and atom 2 respectively. e is one electron charge, and r_1 and r_2 are the radii of atom 1 and atom 2. R is the internuclear spacing between atom 1 and 2. $C_{k,q}$ is the spherical tensor in Edmonds [**?**], which is a normalized spherical harmonic tensor.

For simplicity, we will focus on the two-body interactions. We use ^{85}Rb as an example. Fig. **??** shows two strongly dipole-dipole coupled states, 18s19s and $18p_{1/2}18p_{1/2}$. The energy differnce between those two states is Δ=774.56 MHz as shown in Fig. **??**(b). Here we use frequency to represent energy, since frequency is often used experimentally and the relation between energy E and frequency, f, is $E = hf$, where h is the Planck constant. These two states are calculated by calculating the dimer energies as a function of the principal quantum number n. Fig. **??** shows the energy difference between $np_{1/2}np_{1/2}$ and ns(n+1)s, Δ=$E_{np_{1/2}np_{1/2}} - E_{ns(n+1)s}$, as a function of the principal quantum number n. It is shown that at n=18, the absolute energy difference is minimized.

Experimentally, the two-atom excitation can be achieved in a big molecule using the dipole-blockade effect [**? ? ? ? ? ? ? ? ? ? ? ?**]. For two-body van der Waals interactions, we consider two energetically close energy levels with energy detuning, Δ. Those

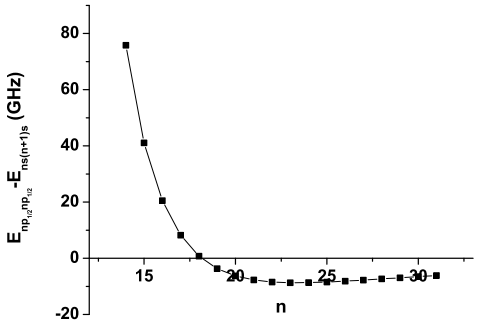

Fig. 3: The energy difference between np $_{1/2}$np$_{1/2}$ and ns(n+1)s as a function of the principal quantum number n.

two levels couple with dipole-dipole interactions, V_{dd} as shown in Eq. **??**. According to the perturbation theory, the eigenenergy and eigenfunctions can be calculated by diagonalizing the following matrix [**?**]:

$$\begin{pmatrix} 0 & < V_{12} > \\ < V_{21} > & \Delta \end{pmatrix}, \tag{2}$$

where

$$< V_{12} >=< \Psi_1^0 | V_{dd} | \Psi_2^0 >=< V_{21} >= V. \tag{3}$$

$\Psi_1^0 = |18s19s >$ and $\Psi_2^0 = |18p_{1/2}18p_{1/2} >$ are the eigen functions of the system without perturbation, or without van der Waals interactions. We further simplify the problem by assuming the left atom is in the 18s state and the right atom is in the 19s state. Δ=774.56 MHz. Diagonalizing the matrix in Eq. (**??**) gives rise to the eigen energies, λ_1 and λ_2,

$$\lambda_{1,2} = \frac{\Delta \pm \Delta\sqrt{1 + \frac{4V^2}{\Delta^2}}}{2}, \tag{4}$$

It can be shown that the eigen energies are proportional to $\frac{1}{R^6}$, if $V << \Delta$. This is the well known R^{-6} dependence for van der Waals interactions [**?**].

The normalized eigen functions are Φ_1 and Φ_2:

$$\Phi_1 = \frac{2V}{\sqrt{8V^2 + 2\Delta^2 + 2\Delta\sqrt{\Delta^2 + 4V^2}}}\Psi_1^0 + \frac{\Delta + \sqrt{\Delta^2 + 4V^2}}{\sqrt{8V^2 + 2\Delta^2 + 2\Delta\sqrt{\Delta^2 + 4V^2}}}\Psi_2^0, \tag{5}$$

and

$$\Phi_2 = \frac{2V}{\sqrt{8V^2 + 2\Delta^2 - 2\Delta\sqrt{\Delta^2 + 4V^2}}}\Psi_1^0 + \frac{\Delta - \sqrt{\Delta^2 + 4V^2}}{\sqrt{8V^2 + 2\Delta^2 - 2\Delta\sqrt{\Delta^2 + 4V^2}}}\Psi_2^0. \tag{6}$$

Ψ_1^0 and Ψ_2^0 are the eigen functions of the system without the perturbation V. From the wave functions, it is shown that the wavefunctions depend on V, and V depends on the internuclear spacing R, V$\propto \frac{1}{R^3}$. Therefore, the components of the wave functions will change as a function of the internuclear spacing.

For example, we first excite one atom, the left atom, to an 18s state. This state will be a pure 18s state. We then excite a second atom, the right atom, to a 19s state. By the time, the second atom is excited, the first atom, or the left atom, is no longer a pure 18s state, it will have the $18p_{1/2}$ component caused by the van der Waals interactions between the two excited atoms. Therefore, the component change caused by the excitation of the second atom can be used for remote control, since the two atoms are separated. In addition, by analyzing the left atom, or checking the amount of the s component and p component, the distance between those two excited atoms can be calculated. In addition, depending on the component of the first atom, the components of the second atom can be calculated.

The plot for the energy levels and the probabilities of the wavefunctions are shown in Figs. **??** and **??**. Fig. **??** shows that the 18s19s state is an attractive state, and $18p_{1/2}18p_{1/2}$ is a repulsive state. Let's focus on the 18s19s state. Again, we consider that the left atom is excited to the 18s state first, and the right atom is then excited to the 19s state. Depending upon the distance between those two atoms, once the 19s atom is excited, the 18s atoms will change components. For example, if the distance between those two atoms is about 0.2 μm, once the 19s atom is excited, about 40% of the left atom, the 18s atom, will change to $18p_{1/2}$ as shown in Fig. **??**(b). Such interaction, without direct contact, can be used for remote control. From Fig. **??**(b), it is shown that the probability of 18s19s state is 1 at R$\rightarrow \infty$. As the internuclear spacing decreases, the amount of $18p_{1/2}18p_{1/2}$ increases, and the amount of 18s19s decreases. In addition, the probabilities depend on the internuclear spacing R. Therefore, by detecting the amount of 19s atom in the right atom, the internuclear spacing can be extracted. In addition, by knowing the amount of 19s sate, the amount of $18p_{1/2}$ in both atoms and the amount of 18s atom can be extracted.

In previous sections, we excite the left atom to 18s and the right atom to 19s. It is more interesting to investigate if we excite both atoms to $18p_{1/2}$ states, which is a purely repulsive state, the red solid line as shown in Fig. **??**. The repulsive states are especially useful for practical applications, such as quantum gates. Compared to attractive states, repulsive states are less likely to cause collisions, and those states have longer coherent

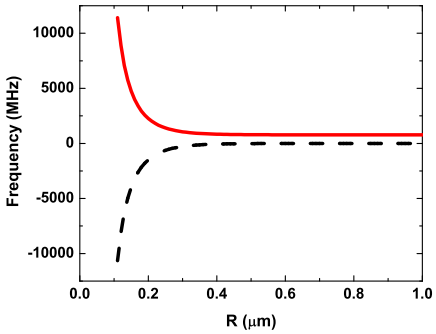

Fig. 4: The energy level 18s19s (black dash line $---$) and $18p_{1/2}18p_{1/2}$ (red solid line ——) as a function of the principal quantum number n.

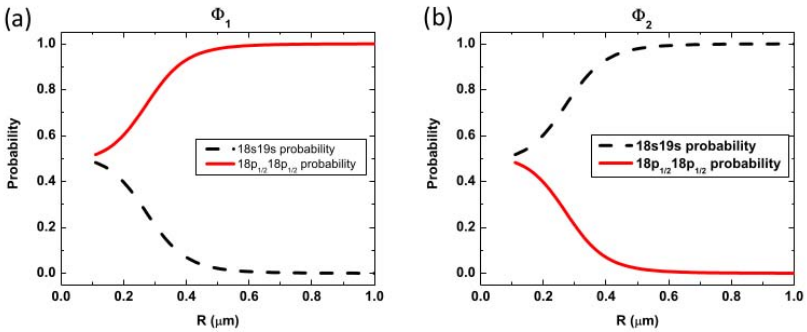

Fig. 5: (a) The probability of 18s19s (black dash line $---$) and $18p_{1/2}18p_{1/2}$ (red solid line ——) in Φ_1 as shown in Eq. (**??**). (b) The probability of 18s19s (black dash line $---$) and $18p_{1/2}18p_{1/2}$ (red solid line ——) in Φ_2 as shown in Eq. (**??**).

times [**?**]. For example, if we first excite the left atom to the $18p_{1/2}$ state and then excite the right atom to $18p_{1/2}$ state, how would the first excited atom, or the left atom, change? Would one part of the atom change to 18s state, 19s state, or both? This is a quantum mechanics problem. Here we consider the matrix composed by the following three states: $\Psi_1'^0 = |18s19s>$, $\Psi_2'^0 = |19s18s>$, and $\Psi_3'^0 = |18p_{1/2}18p_{1/2}>$ by considering the exchange symmetry. To show that this case is different from the previous case, we add prime in the labels for eigenenergies and eigenfunctions. The Hamiltonian can then be written as

$$\begin{pmatrix} 0 & 0 & V \\ 0 & 0 & V \\ V & V & \Delta \end{pmatrix}, \tag{7}$$

where V is the matrix element shown in Eq. (**??**). The eigen energies are

$$\lambda_1' = 0, \tag{8}$$

$$\lambda_2' = \frac{\Delta - \Delta\sqrt{1 + \frac{8V^2}{\Delta^2}}}{2}, \tag{9}$$

$$\lambda_3' = \frac{\Delta + \Delta\sqrt{1 + \frac{8V^2}{\Delta^2}}}{2}. \tag{10}$$

The eigen functions are

$$\Phi_1' = \frac{1}{\sqrt{2}}(-\Psi_1'^0 + \Psi_2'^0), \tag{11}$$

$$\Phi_2' = \frac{1}{\sqrt{8V^2 + \Delta^2 - \Delta\sqrt{\Delta^2 + 8V^2}}}[\sqrt{2}V\Psi_1'^0 + \sqrt{2}V\Psi_2'^0 + (\frac{\Delta - \sqrt{\Delta^2 + 8V^2}}{\sqrt{2}})\Psi_3'^0], \tag{12}$$

$$\Phi_3' = \frac{1}{\sqrt{8V^2 + \Delta^2 + \Delta\sqrt{\Delta^2 + 8V^2}}}[\sqrt{2}V\Psi_1'^0 + \sqrt{2}V\Psi_2'^0 + (\frac{\Delta + \sqrt{\Delta^2 + 8V^2}}{\sqrt{2}})\Psi_3'^0], \tag{13}$$

where $\Psi_1'^0$, $\Psi_2'^0$, and $\Psi_3'^0$ are the eigen functions of the system without the perturbation V. If the left atom is excited to the $18p_{1/2}$, the right atom is then subsequently excited to the same state. Due to the strong coupling between the $18p_{1/2}18p_{1/2}$, 18s19s, and 19s18s, 18s and 19s atomic states will be mixed in the $18p_{1/2}18p_{1/2}$ state. From Eqs.12 and 13, it is shown that Ψ'^0_1=18s19s and Ψ'^0_2=19s18s have an equal amount of probability. In other words, if the left atom is excited to the $18p_{1/2}$, the right atom is then excited to the $18p_{1/2}$, the components of each $18p_{1/2}$ atom will change to a mixture of three states $18p_{1/2}$, 18s, and 19s. That is, the probability of having 18s is the same as the probability of having 19s.

Adding more atoms in the system will lead to the complexity of the system. On the other hand, more information will be stored in such systems. The primary challenge is how to individually address each state of the system, which requires precision measurement.

III. Conclusion

In conclusion, we have shown a step to step evaluation for using van der Waals coupled states to store quantum information. More specifically, we discussed a two-atom system. It is shown that by analyzing the components of one atom, the distance between those two atoms can be extracted, and the components of the other atom can be predicted. This can be used for remote control. Furthermore, one pair of repulsive states lead to more interesting results that originated from quantum mechanics.

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On the Dialectic Unity of Evolution and Involution

By V. A. Etkin
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Abstract- In the article, based on the principle of counter-directionality of nonequilibrium processes and the law of conservation of energy, it is shown that evolutionary processes in some parts (areas, phases, components) of an isolated system are impossible without the involution of others. The simultaneity and opposite direction of these processes are proved, confirming their dialectical unity and the creative tendency inherent in nature. The inapplicability of entropy as a criterion for evolution is emphasized, and its non-entropy criteria are proposed both for systems as a whole and for each degree of their freedom. Examples of "coupled" processes of evolution and involution in objects of animate and inanimate nature are given. The erroneousness of the concept of the origin of "order" from "chaos" and the inapplicability of the concept of "arrow of time" to the Universe as a whole is substantiated.

Keywords: evolution and involution, their criteria and unity, parameters of nonequilibrium, laws of conservation, and transformation of energy.

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On the Dialectic Unity of Evolution and Involution

V. A. Etkin

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Keywords: evolution and involution, their criteria and unity, parameters of nonequilibrium, laws of conservation, and transformation of energy.

I. Introduction

Despite some successes in studying the causes and patterns of evolution of living and inanimate nature from the standpoint of nonequilibrium thermodynamics, synergetics, and bioenergetics, "the blatant contradiction of thermodynamics with the theory of biological evolution" [1] remains. This contradiction is not limited to the principle of increasing entropy, which imposes "thermal death" on the Universe as a whole, and degradation on any of its closed parts. The laws of conservation of momentum, its momentum and charge also turn out to be contradictory to evolution, since they exclude the possibility of their occurrence in the processes of evolution. Attempts to solve the problems of evolution with the help of entropy (R. Clausius) [2], the replacement of regular causal processes by “fluctuations” (L. Boltzmann) [3], the concept of the emergence of “order” from “chaos” (I. Prigogine) [4] and the “explanation” of evolution by the consumption of “negentropy” (E. Schrödinger) [5] did not give satisfactory results.

There is a need to create a theory of evolution that would not contradict the modern volume of knowledge. Classical (equilibrium) thermodynamics is not suitable for this purpose, since it is based on the concept of entropy, which does not change when the evolution of the system is carried out due to the work done on it “against equilibrium” [6]. This also applies to the thermodynamics of irreversible processes (TIP), which excludes from consideration the reversible component of real processes [7]. As a result, the use of equilibrium or locally equilibrium thermodynamics for the analysis of evolutionary problems turns out to be an attempt with obviously unsuitable means.

To study the problems of evolution on a rigorous physical and mathematical basis, parameters, or functions of a nonequilibrium state are required, which characterize the distance of the system from internal equilibrium. This problem is solved by locally nonequilibrium thermodynamics proposed in the author's doctoral dissertation [8] based on the monograph "Thermodynamics of nonequilibrium processes of energy transfer and transformation" (Saratov, SSU, 1991) and further developed in the monographs "Thermokinetics" (Togliatti, 1999) and" Energodynamics "(St. Petersburg, 2008) [9]. It proceeds from the understanding of energy as the most general measure of all forms of motion (translational, rotational and oscillatory) and interaction (gravitational, electromagnetic, etc.) of all elements of a material system, regardless of whether it is a continuum or a collection of particles. This made it possible to extend the methods of consumer goods to locally non-equilibrium systems that perform useful (reversible) work and supplement it with an analysis of the efficiency and productivity of processes of useful energy conversion.

II. Specificity of Energy Dynamics as Applied to Evolutionary Processes

The desire to preserve the main advantage of the classical thermodynamic method (the immutable validity of its consequences) led to the construction of energy dynamics on the same methodological principles of deductive (studying an object from the general to the particular) and phenomenological (based on experience) theory. This is expressed in the consideration as an object of study of the entire set of interacting (mutually moving) material objects such as the Universe as a whole, for which all conservation laws were formulated. For isolated systems, the concepts of external kinetic E^k potential E^p energy, depending on the motion and position of the system relative to the external environment, are meaningless, since all their energy is intrinsic (internal) U. Therefore, the law of conservation of the total energy of the system E as their sum

$$E = E^k + E^p + U = const \qquad (1)$$

turns out to be unacceptable for such systems. For this reason, energy dynamics is based on a more general

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expression of the law of conservation of internal energy U, proposed by N. Umov (1873) [10]:

$$dU/dt + \oint j_e d\mathbf{f} = 0, \quad (2)$$

where j_e (W m^{-2}) is the energy flux density through the vector element $d\mathbf{f}$ of a closed and fixed surface $\mathbf{f}$ (system boundaries) in the direction of the external normal $\boldsymbol{n}$ (Fig. 1).

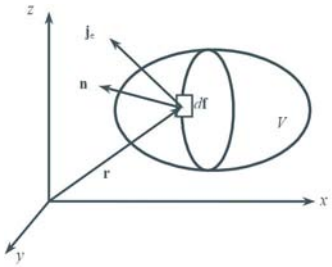

Figure 1: To the law of conservation of energy

According to the concept of short-range action inherent in this equation, the energy of the system U does not just disappear at some points in space and appears in others, but is carried across the boundaries of the system by some material energy carriers Θ_i (k-substances in the amount of N_k moles, their masses M_k, charges Q_k, entropy S_k, momenta $\boldsymbol{P}_k = M_k\boldsymbol{v}_k$, etc.).

Let us now take into account that the energy flux je through the boundaries of the system consists of the energy fluxes j_{ei} of all the i-th energy carriers Θ_i, each of which, in turn, is expressed by the product of the flux of the i-th material energy carrier $j_i = \rho_i\boldsymbol{v}_i$ by its potential $\psi_i = dU_i/dM$(specific energy), where $\rho_i = d\Theta_i/dV$ is the density of the i-th energy carrier; $\boldsymbol{v}_i$ is the local speed of its transfer across the fixed boundaries of the system:

$$j_e = \Sigma_i j_{ei} = \Sigma_i \psi_i j_i, \ (i=1,2,\ldots,n). \quad (3)$$

We now transform $\oint \psi_i j_i \cdot d\mathbf{f}$ based on the Gauss-Ostrogradskii theorem into the integral $\int \nabla\cdot\psi_i j_i \cdot dV$ over the volume of the system V. Then, after decomposing $\nabla\cdot(\psi_i j_i)$ into independent components $\Sigma_i \psi_i \nabla\cdot j_i + \Sigma_i j_k \cdot \nabla\psi_i$, the energy conservation law (2) takes the form:

$$dU/dt + \Sigma_i \int \psi_i \nabla\cdot j_i dV + \Sigma_i \int j_i \cdot \nabla\psi_i dV = 0, \quad (4)$$

If in (4) we introduce the concept of a local thermodynamic force $\boldsymbol{x}_i = -\nabla\psi_i$ and take outside the integral sign some average value Ψ_i of the potential ψ_i and the average value $\boldsymbol{X}_i$ of the force $\boldsymbol{x}_i$, then equation (4) can be expressed through the parameters of the system as a whole, as is customary in classical

$$dU/dt = \Sigma_i \Psi_i J_i + \Sigma_i \boldsymbol{X}_i \cdot \boldsymbol{J}_i, \quad (5)$$

where $J_i = -\oint j_i \cdot d\mathbf{f} = -\int \nabla\cdot j_i dV$ is the scalar flow of the i-th energy carrier into the system; $\boldsymbol{J}_i = \int j_i dV = \Theta_i \overline{\boldsymbol{v}}_i$ is the displacement impulse of this energy carrier within the boundaries of the system; is the average speed of this displacement.

As we can see, taking into account the non-static (final velocity) of real processes ($\boldsymbol{v}_i, \overline{\boldsymbol{v}}_i > 0$) is inevitably accompanied by the emergence of a local in homogeneity $\nabla\psi_i$ of the fields of temperatures, pressures, chemical, electrical, gravitational, etc. potentials, i.e., the appearance of additional parameters $\boldsymbol{x}_i$ and $\boldsymbol{X}_i$, meaning the intensity of these fields. This circumstance reveals the internal inconsistency of the TIP, based on the hypothesis of local equilibrium and allowing the possibility of describing an inhomogeneous continuum with the same set of variables as in equilibrium.

Expression (5) focuses on the existence of two fundamentally different forms of energy exchange between the system and the environment. The first sum (5) characterizes the elementary work $đW_i'$ performed on the system per unit time when a certain amount of mass M is introduced into it during mass transfer, a certain number of moles of k substances N_k during diffusion, charge Q_k during electrification, etc.[1]:

$$đW_i'/dt = \Sigma_i \Psi_i J_i, \quad (6)$$

Energodynamics also refers to this type of work as conductive heat exchange, understanding by it the work of entering the entropy S into the system as a measure of the amount of chaotic motion. All types of input work do not cause the system to move in space and therefore refer to the disordered form of work by energy dynamics. This work replenishes that part of the energy of the system that is incapable of energy conversion and therefore is called *anergy* $\overline{U}$ for short.

A different kind of work $đW_i''$, performed by vector forces $\boldsymbol{x}_i$ or $\boldsymbol{X}_i$, similar to thermodynamic forces in TIP. They create an internal directional flow of displacement of the energy carrier $\boldsymbol{J}_i = \Theta\overline{\boldsymbol{v}}_i$ with a speed $\overline{\boldsymbol{v}}_i = d\boldsymbol{R}_i/dt$, where $\boldsymbol{R}_i$ is the radius vector of the center of value Θ_i. This form of energy exchange is related to the redistribution of the energy carrier and its displacement within the system by the value $\Delta\boldsymbol{R}_i$, which creates in it some "moments of distribution $\boldsymbol{Z}_i = \Theta_i\Delta\boldsymbol{R}_i$ of the energy carrier Θ_i. This process is associated with the transfer of the energy carrier Θ_i in the inhomogeneous potential field ψ_i and overcoming the forces $\boldsymbol{F}_i = \Theta_i\mathbf{X}_i$ in there. In this case, the work $đW_i'' = \boldsymbol{F}_i \cdot d\boldsymbol{R}_i = \boldsymbol{X}_i \cdot d\boldsymbol{Z}_i$ against equilibrium "in the system is performed. It replenishes the non-equilibrium (ordered) part of the energy of the

[1] The sign of the incomplete differential "đ" emphasizes that the work in the general case depends on the path of the process in the space of variables Θ_i

system, which is called in energodynamics for short *inergy* $\tilde{U}$ [2]:

$$d\tilde{U}/dt = \Sigma_i dW_i'/dt = \Sigma_i \boldsymbol{X}_i \boldsymbol{J}_i, \quad (7)$$

This work, called useful or technical in classical thermodynamics, is associated with the transformation of energy from one (*i*-th) form to another, *j*-th. Due to this, *inergy*, as a function of the system's performance, gives the researcher a general measure of the distance of the system as a whole from internal equilibrium, the change of which can serve as a universal criterion for both the approach of the system to equilibrium and the distance from it.

III. Alternative to the Entropy Criteria of Evolution

According to the postulate of R. Clausius [2], all thermodynamic systems (possessing to one degree or another internal thermal energy) tend to thermodynamic equilibrium, characterized by the termination of any macroscopic processes in them. Since the concept of force and the condition of equality of forces in thermodynamics was absent, as a criterion for such an equilibrium, he introduced a new parameter entropy *S*, the change in which during heat exchange *TdS* plays the same role in relation to thermal energy[3]as the impulse $\boldsymbol{P}_k = M_k \boldsymbol{v}_k$- with an increase in kinetic energy $\boldsymbol{v}_k d\boldsymbol{P}_k$. It is therefore natural that the entropy increases for any processes in isolated systems, in which ordered forms of energy transform into disordered (thermal), i.e., dissipate (dissipate). As a result, the efficiency of thermal energy also decreases, due to the presence in the system of sources and receivers of heat with different temperatures. Seeing no exceptions to this circumstance, R. Clausius raised it to the rank of the second law of thermodynamics, giving it the name of the principle of increasing entropy and extending it to the Universe as a whole. This was most clearly manifested in his catchphrase "the energy of the Universe is unchanged, the entropy of the Universe is increasing".

The paralogism of this statement, called the "heat death of the Universe", has given rise to many attempts to prove or disprove this principle. However, they all turned out to be so lax that the scientific community saw in this an "incorrigible logical flaw." Only with time did the facts come to light, indicating that dissipation is by no means limited to the appearance of heat sources. It is known, for example, that when cutting metals, a part of the dissipative work expended is transferred into the internal energy of the chips and exceeds the amount of frictional heat generated Q^d. The same is observed in the processes of crushing bodies, in which part of the work is spent on increasing the surface energy of the powder. In technology, both of these effects are taken into account by introducing a "heat output coefficient" less than one. It is also known "indirect impact" of bodies when part of the energy expended on accelerating the translational motion increases the impulse of the rotational motion. The number of moles N_k of the kth products of chemical reactions, tensors of deformation of plastic materials, etc., which also change in irreversible processes along with entropy, behave similarly. From this point of view, the very idea of R. Clausius to describe all dissipation processes with parameters of only one (thermal) degree of freedom looks at least strange.

Indeed, a change in the amount of any energy carrier $d\Theta_i/dt$ in nonequilibrium systems is caused not only by its transfer across the system boundaries ($d_e\Theta_i/dt = -J_i$), but also by the presence of "internal sources" $d_u\Theta_i/dt = \int \sigma_i dV$ with a density σ_i. This circumstance is taken into account in TIP by the balance equation $d\Theta_i = d_e\Theta_i + d_u\Theta_i$, which in differential form has the form [7]:

$$d\rho_i/dt + \nabla \cdot \boldsymbol{j}_i = \sigma_i. \quad (8)$$

Considering (8) together with (5), we find that for an isolated system (where $J_i = 0$)

$$dU/dt = \Sigma_i \Psi_i d\Theta_i/dt - \Sigma_i \int \psi_i \sigma_i dV + \Sigma_i \int \boldsymbol{x}_i \cdot \boldsymbol{j}_i dV. \quad (9)$$

Because in equilibrium

$$dU = \Sigma_i \psi_i d\Theta_i, \quad (10)$$

then from (9) follows a previously unknown connection between energy sources σ_i and local thermodynamic forces $\boldsymbol{x}_i$:

$$\Sigma_i \psi_i \sigma_i = \Sigma_i \boldsymbol{x}_i \cdot \boldsymbol{j}_i, \quad (11)$$

In TIP, as in classical thermodynamics, the presence of sources of σi was recognized only for the entropy σ_s, which reduced expression (11) to the dissipative function $T\sigma_s = \Sigma_i \boldsymbol{x}_i \cdot \boldsymbol{j}_i$ and turned the entropy into a "scapegoat" for any irreversibility [7]. Meanwhile, according to (11), internal sources should exist in principle for any energy carriers Θ_i. In particular, they are present in all *k*-x substances, the number of moles N_k of which change in the course of chemical reactions, as well as in their impulses $\boldsymbol{P}_k = M_k \boldsymbol{v}_k$, which change in the processes of mutual diffusion of the components of a heterogeneous mixture and internal friction in closed systems. Otherwise, new degrees of freedom in the system could not arise if they are not present in the environment.

Moreover, it directly follows from relation (11) that in locally equilibrium systems ($\boldsymbol{x}_i = 0$) the appearance of any new forms of energy ψiσi is excluded

[2] *Inergy* is the antipode of *anergy*, like exergy *Ex*, but in contrast to it, it characterizes the system's ability to perform not external (technical) but internal work (against equilibrium).

[3] For this property, energodynamics calls entropy "thermoimpulse" - an impulse that has lost its vector nature due to the chaotic nature of thermal motion.

($\Sigma_i \psi_i \sigma_i = 0$). This means that the evolution of isolated systems is possible only as a result of the transformation of various forms of energy in it, when $\Sigma_i \boldsymbol{x}_i \cdot \boldsymbol{j}_i \neq 0$, that is, if their energy carriers exchange impulses ji with each other. However, this is impossible, these impulses obey the laws of conservation of their mass, impulse, its moment, charge, etc. Therefore, not only the principle of increasing entropy but also the laws of conservation of energy carriers comes into conflict with the laws of evolution. It is no accident that these laws have been proved only for homogeneous systems ($\boldsymbol{x}_i = 0$), when the occurrence of internal sources σ_i is excluded.

It is also no coincidence that classical thermodynamics lacks rigorous proofs of the principle of increasing entropy. The point is that there can be no such evidence in the framework of equilibrium thermodynamics. Indeed, suppose we have an equilibrium system with two degrees of freedom: thermal (characterized by entropy *S*) and deformation (characterized by volume *V*). The internal energy of such a system *U* as a function of its state has the form $U = U(S, V)$. In this case, considering the entropy *S* as the inverse function $S = S(U, V)$, we find that in isolated systems (U, V = const), the entropy remains unchanged:

$$S_{is} = S(U, V) = \text{const}, \qquad (12)$$

From a physical point of view, this conclusion is quite obvious: in an equilibrium system, no processes, including dissipation processes, can arise. They are possible only in the absence of equilibrium, when the number of parameters characterizing the energy of the system *U* includes the parameters of nonequilibrium, for example, the forces $\boldsymbol{X}_i$, which can change in isolated systems, i.e., $U_{is} = U(S, \boldsymbol{X}_i, V)$. Then the entropy of such a system can change in place with $\boldsymbol{X}_i$. However, in this case, the very principle of increasing entropy will not be needed, since the parameters $\boldsymbol{X}_i$ themselves can play the role of criteria, evolution, moreover, much simpler, understandable, easily computable and informative, since they can reflect not only involution, but also the evolution of the system, and not only the system as a whole, but also each degree of its freedom separately:

$$d\boldsymbol{X}_i < 0 \text{ (involution)}; \; d\boldsymbol{X}_i > 0 \text{ (evolution)}. \qquad (13)$$

If the researcher wants to find out the behavior of the system as a whole, then here too the energy of the system can serve as an alternative to entropy, which is also capable of reflecting both its evolution and involution:

$$d\tilde{U}/dt = \Sigma_i \boldsymbol{X}_i \boldsymbol{J}_i < 0 \text{ (involution)}; \; d\tilde{U}/dt = \Sigma_i \boldsymbol{X}_i \boldsymbol{J}_i > 0 \text{ (evolution)}. \qquad (14)$$

This expression, like (13), makes it possible to establish the cause of irreversibility and evaluate the contribution to the dissipation process of each real process, which is extremely important in analyzing the ways of its improvement.

IV. Does "Order" Arise from "Chaos"?

In recent decades, the idea has become popular that the process of evolution has the character of "self-organization" of the system and that "order" in systems far from equilibrium arises due to "chaos" [4]. At the same time, there are often statements about the possibility of self-organization not only of open but also of isolated systems, which is in even greater contradiction with thermodynamics. As a rule, this is done without any evidence of the erroneousness or limitations of thermodynamics, that is, it is essentially postulated in the same way as the concept of equilibrium as molecular "chaos". As a result, the concept of the emergence of order from chaos not only does not eliminate the contradictions between thermodynamics and evolution but already diverges from both of them.

Meanwhile, the very opposite of "chaos" to "order" is purely intuitive. Most often, "chaos" is understood as disorder, unpredictability, randomness. However, it is necessary to distinguish between what we refer to these concepts: a state or a process. If to a state, then in it the signs of chaos are the variability of the relationships between the parameters characterizing this state, their inconstancy. If we are talking about a process, the signs of its chaos (stochasticity) will be the unpredictability of the nature of this process, that is, its trajectory in the space of the above variables. The concepts of state and process are so different that their confusion can only occur from misunderstanding.

In particular, when we talk about entropy as a measure of "disorder" and "chaos," we mean the chaotic nature of thermal motion, that is, the unpredictability of the trajectory of each particle separately. Thus, the concept of "chaos" is referred to as completely deterministic states of thermal, mechanical, chemical, electrical, etc. balance. It is no coincidence that a homogeneous state has recently been increasingly called "equilibrium order", which exists due to the inhomogeneous, and nevertheless the most probable and quite predictable "Maxwell-Boltzmann" distribution of particles in terms of velocities and momenta.

No less controversial is the concept of evolution as a "self-organization" of a system. The etymology of this term indicates the spontaneity of this process, that is, the absence of any external compulsion. Meanwhile, according to the main postulate of classical thermodynamics (the principle of self-inviolability of equilibrium), no system that has reached equilibrium can spontaneously leave it. On the other hand, in isolated systems all internal processes are

spontaneous. Therefore, it would be more correct to speak not about the "self-organization" of the system as a whole, but about individual processes taking place in isolated systems in the direction of moving away from the state of equilibrium. Indeed, according to the conservation law (5), for closed systems in which there is no transfer of any energy carrier Ji across the boundaries of the system, the law of conservation of energy during interconversions is also valid:

$$dU/dt = \Sigma_i X_i \cdot J_i. \qquad (15)$$

This means that in isolated nonequilibrium systems ($dU/dt = 0$; $X_i, J_i \neq 0$)

$$\Sigma_i X_i \cdot J_i = 0, \qquad (16)$$

that is, it contains $X_i \cdot J_i$ terms of different signs, characterizing the work $đW_i'/dt$ both against the forces of scattering and against equilibrium. In other words, in the processes of interconversion of energy, some types of work are performed against equilibrium due to the inertia of other degrees of freedom. This means that, contrary to the ideas of I. Prigogine, the order in such degrees of freedom of the system arises not from chaos, but from "order" in others, including due to the inertia of the environment, contained in its force fields. It is advisable to start the analysis of such processes with a very widespread crystallization process.

a) Crystallization as removal from equilibrium.

The process of formation of single crystals can be thought of as a kind of phase transformation processes associated with the formation of elementary volumes V_j of a new phase [6]. Let us imagine a single crystal of volume V as the sum of volumes V_j of imaginary pyramids with height h_j, the vertices of which are located at some common "Wolfe point" inside the crystal, and the base of which is the corresponding j-th face of the single crystal with area f_j. In this case, the formation of a single crystal appears as a growth process of the crystalline phase with a volume $V = \Sigma_j V_j = \frac{1}{3}\Sigma_j f_j h_j$, which satisfies the Wolfe law

$$X_j/h_j = \text{const}, \qquad (17)$$

where X_j is the surface tension of the faces. According to this law, the stable shape of a single crystal is characterized by the fact that its faces are removed from the common top of the pyramids by a distance proportional to the surface tensions of the faces. According to this law, the growth rate of individual faces of a single crystal is proportional to surface tensions X_j.

It is easy to see that in such a model of the crystallization process, the centers of the volume of each of the pyramids turn out to be displaced relative to the center of the single crystal (Wolfe's point) by an average value of $dR_i = \frac{2}{3}h_j$ under the action of the driving force X_j. Therefore, the formation of a single crystal requires the cost of some work $đW_j''$[17]:

$$đW_j'' = X_j\, dR_j = \frac{2}{3}X_j h_j > 0, \qquad (18)$$

which leads to a corresponding increase in the energy of the single crystal by the evolution criterion (14).

b) The emergence of new degrees of freedom of ordered motion

Let us now consider an example when the evolution of a system is expressed in the emergence of another form of ordered motion in the system. Suppose we have a system that is stationary as a whole, the macroscopic part of which (the kth component) rotates like an unbalanced top (Fig. 2).

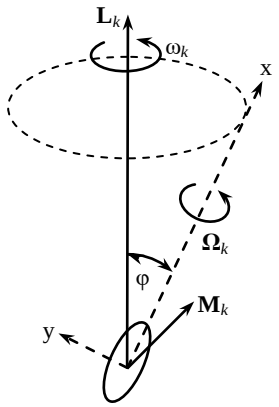

Fig. 2: Top precession

The angular momentum of such a top L_k does not coincide with its axis of rotation, as a result of which, in addition to rotation around its axis with an angular velocity Ω_k, it experiences precession with an angular velocity $\boldsymbol{\omega}_k$. If we combine the x-axis with the symmetry axis of the top, and the y-axis with the plane formed by the vectors $\mathbf{L}_k$ and $\mathbf{\Omega}_k$, then the angular velocity of rotation of the top about its axis $\Omega_k = |\mathbf{\Omega}_k|$ and the angular velocity of its precession $\boldsymbol{\omega}_k = |\boldsymbol{\omega}_k|$ can be expressed by the ratio:

$$\Omega_k = L_k \cos\varphi / I_x;\ \ \omega_k = L_k / I_y\ , \qquad (19)$$

where $L_k = |\mathbf{L}_k|$; I_x, I_y is moments of inertia of the top relative to the x and y axes; φ is the angle formed by vectors $\mathbf{L}_k$ and $\mathbf{\Omega}_k$. These angular velocities correspond to the internal kinetic energies of the main $U_к^c = L_k^2 \cos^2\varphi / 2I$ and precession $U_к^p = L_k^2/2I_y$ rotation so that the total kinetic energy of the top under consideration $U_к = L_k^2(\cos^2\varphi + I_x/I_y)/2I_x$ is in the general case a function of not only the momentum $\mathbf{L}_k$ but also the angle φ, which determines the orientation of the axis of its rotation in space. Comparing it with the value $U_{ко} = L_k^2/2I_x$, we find that it exceeds that in the absence of precession (at $\boldsymbol{\varphi} = 0$) by the value:

$$U_к - U_{ко} = L_k^2\ (I_x/I_y - \sin^2\varphi)/2I_x. \qquad (20)$$

This corresponds to the criteria of evolution (14) and means that new degrees of freedom in ordinary (baryonic) matter arise as the system moves away from the state of equilibrium due to the work done "against equilibrium". In isolated systems, this work can be done only by those degrees of freedom of the system that are not themselves in internal equilibrium, that is, are ordered. Consequently, "order" in some degrees of freedom of an isolated system can arise only due to "order" in others, but not due to "chaos", as it is stated [11].

c) Antidissipative processes in biosystems

The application of consumer goods to biosystems encounters serious difficulties. One of them is that according to the laws of Onsager

$$J_i = \Sigma_j L_{ij} X_j, \qquad (21)$$

all the terms of the "flow" J_i (generalized velocity of the *i*-th relaxation process) have the same sign and disappear simultaneously with the onset of complete equilibrium. As a result, these equations describe only the processes of involution and turn out to be inapplicable to the analysis of evolutionary processes. Moreover, for relaxation processes, they contradict the experiment, according to which the fluxes Ji disappear not simultaneously, but one after the other as the corresponding degrees of freedom "degenerate", that is, in the order opposite to their appearance as the system evolves. This is expressed in the passage of the system as it approaches equilibrium of the so-called "stationary states of a lower order", in other words, states of "partial" (incomplete) equilibrium.

Further, according to the principle of energy interconversion (16), even after the isolation of biosystems from the environment, along with relaxation processes in which $\boldsymbol{X_i \cdot J_i} < 0$, "antidissipative" processes take place in which $\boldsymbol{X_i \cdot J_i} > 0$. This is expressed in different signs of individual terms (21). These processes include, in particular, the transfer of a substance to an area with its increased concentration (the so-called "active transport" of substances), as well as the so-called "conjugate" chemical reactions "going in opposite directions in relation to their affinity, including "Chemical clock" (Belousov - Zhabotinsky reaction) [12,13]. As is known, these phenomena play a decisive role in ensuring the life of biosystems. It is due to the performance of work against equilibrium that the approach of the biosystem to equilibrium (physical death) slows down. Here lies the key to understanding the basic law of evolution of biosystems - the "principle of survival", according to which those bioorganisms live longer, for which the share of work "against equilibrium" is higher.

d) Wave formation process in the primary matter of the Universe

From the energy conservation law in the form (5) it follows that any forces, both $\boldsymbol{X_i} = \nabla\psi_i$ and $\boldsymbol{F_i} = \Theta_i \boldsymbol{X_i}$, are generated by the spatial in homogeneity of the medium. This also applies to that overwhelming part of the mass of the Universe, which for three centuries was called ether, and after its expulsion from theoretical physics - "hidden mass", "physical vacuum", "dark matter", "non-baryonic matter" etc. etc. In energy dynamics, it is called primary matter (prototype), so as not to associate its properties with any specific model. The density of this "primary" matter, from which all types of matter in the Universe were formed, ranges from 10^{-27} g / cm^3 in "voids" to 10^{18} g / cm^3 in stars of the "white dwarf" type, that is, it is extremely unevenly distributed in it. since all types of ordinary (observed) matter of the Universe were formed from it. Therefore, oscillations inevitably arise in it, associated with the formation of standing waves between any celestial bodies or ring waves, closed on themselves [14].

The formation of such waves is associated with the transfer of a certain amount of it M from a position with a radius vector $\mathbf{r}'$ to a position $\mathbf{r}''$, that is, a shift of the center of mass M by a half-wavelength $\lambda_i/2$ (Fig. 3). The speed of this shift $\boldsymbol{v}$ changes from zero in the antinode of the wave to the maximum in its nodes. Therefore, the process of formation of standing waves is inextricably linked with overcoming the Newtonian forces of inertia $\boldsymbol{F_i} = -d\boldsymbol{P_i}/dt$ and with the performance of work [15].

The value of this work is easy to calculate if we take into account that the displacement modulus $|\boldsymbol{r}'' - \boldsymbol{r}'|$ radius vector of the center of mass M, equal to the half-wavelength $\lambda_i/2$, occurs during the half-period of the wave $\tau_i/2 = (2\nu_i)^{-1}$ so that the average the speed of this displacement is:

$$\overline{\boldsymbol{v}_i} = \lambda_i \nu_i \qquad (22)$$

This value determines, as is known, the speed of propagation of oscillations in the considered medium ci In the absence of dispersion when this speed does not depend on the frequency $c_i \neq c_i(\nu) = c$, the required work is determined especially simply:

$$W_i = \int \boldsymbol{v}_i \cdot d\boldsymbol{P_i} = \int c^2 dM = Mc^2. \qquad (23)$$

Hence it follows that the "condensation" of primary matter under conditions with = const is associated with an increase in the energy of ordinary (baryonic) matter by the amount $dU = c^2 dM$. This energy is then spent on all types of evolutionary processes in it, from the formation of nuclei of future atoms to metagalaxies. Thus, the only source of ordered energy (inergy) for the baryonic matter of the Universe is the vibrational component of the gravitational energy of its prototype [16].

It is so great that in the processes of substance synthesis, its excess amount is released in the form of radiation, mistakenly taken for the energy of "cold" or "hot" synthesis in condensation products.

The fact of the presence of such radiation can be easily explained if we take the displacement $|r''-r'| = \lambda_i/2$ for half the amplitude of the longitudinal wave A_k. This immediately leads to the well-known expression for the wave energy density [17]:

$$\rho_v = \rho_i \upsilon_{ik}^2/2 = \rho_i A_i^2 \nu_i^2/2, \text{ J m}^{-3}. \quad (24)$$

The power of this radiation $dU_r/dt$is expressed similarly to other types of work by the product of some "radiation" force $\boldsymbol{X}_r$ by the flux $\boldsymbol{J}_r$ of its energy carrier [17]:

$$dW_r/dt = \boldsymbol{X}_r \cdot \boldsymbol{J}_r \quad (25)$$

Due to the presence in this study of a deeply penetrating component of a non-electromagnetic nature, it becomes responsible for the synthesis of all living things.

V. Coupling of the Processes of Evolution and Involution

The energy of the system U and any of its extensive parameters Θ_i can be represented by the integral of its (his) density $\rho_u = dU/dV$ and $\rho_i = d\Theta_i/dV\Theta_i$. On the other hand, the same parameters can be expressed through their average value $\overline{\rho}_u = U^{-1} \int \rho_u dV$ or $\overline{\rho}_i = \Theta_i/V = \Theta_i^{-1} \int \rho_i dV$. Hence,

$$\int [d(\rho_u - \overline{\rho}_u)/dt] dV \equiv 0 \quad (26)$$

The vanishing of this integral at $\rho_u \neq \overline{\rho}_u$ is possible only if there are subsystems (regions, phases, components) in the volume of the system V, in which the velocities $d(\rho_u - \overline{\rho}_u)/dt$ of any i-th energy conversion process have the opposite sign. In other words, in any non-equilibrium system, there are subsystems that simultaneously and oppositely change their state [18]. This most important position referred to in energy dynamics as the "principle of the opposite direction of processes", is true for both isolated and non-isolated systems. Due to its generality, identity (26) can serve as a mathematical expression of the dialectical law of "unity and struggle of opposites".

The application of this principle to the processes of the evolution of the Universe as a whole makes dramatic changes in our understanding of the origin and evolution of the Universe. If moving away from equilibrium (evolution) $d(\rho_u - \overline{\rho}_u)/dt > 0$ in some of its regions is inevitably accompanied by the approach to equilibrium (involution) of other $d(\rho_u - \overline{\rho}_u)/dt < 0$, then acoustic fluctuations of its density inevitably arise in the prototype of the Universe. This means that in any inhomogeneous isolated system there are always regions in which the change in energy and the direction of the processes are opposite. In other words, the evolution of the visible (observable) substance of the Universe (from atomic nuclei to metagalaxies) is invariably accompanied by the involution of that part of its hidden mass (proto-matter) that is not yet involved in oscillatory motion. This circumstance, illustrated in Fig. 3, provides a permanent concentration of matter in some of its regions (up to singularity) and expansion ("big bang", "big gap" - in others, which ensures the unlimited existence of the Universe in time.

To show that the homogeneous distribution of matter in the Universe is unstable, we represent the modulus of gravitational acceleration $g = GM/R^2$ in Newton's law of universal gravitation as a function of the density ρ of the gravitational field, writing this law for a sphere of unit volume V with radius R and mass $M = \rho V$:

$$g = (GV/R^2)\rho, \quad (28)$$

where G is the gravitational constant, R is the distance from the center of mass M to a point on its surface with the potential $\psi_g = -GM/R$.

According to this expression, the specific gravitational force g on the surface of a unit sphere is proportional to the density of the substance contained in it and increases with its increase. This means that if any density gradient of matter spontaneously arises in any region of the Universe, then the forces of gravity lead to its further increase, i.e. to the compaction of some, and the rarefaction of other regions of the Universe, followed by the "condensation" of proto-matter in areas of increased density and the formation of baryonic (structured) matter from it with other forms of energy (thermal, deformation, chemical, electrical, nuclear, etc.) and its subsequent compaction [19].

In these "coupled" processes, the gravitational energy of the proto-matter U_g decreases by the value of the total energy $\Sigma_j U_j$ of all newly acquired j-x forms by baryonic matter, without violating the law of conservation of energy. In this case, the process, which is evolutionary for baryonic matter, is relaxation for *protomatter*. This conclusion does not depend on any physical models of baryonic or non-baryonic matter.

The non-trivial consequences of this approach are the confirmation not only of the principle of mutual convertibility of energy (16) but also of the principle of counter-directionality of processes in the baryonic and non-baryonic parts of the Universe matter, without requiring the involvement of general relativity and without going beyond the Newtonian theory of gravity. At the same time, energy dynamics does not exclude the possibility of singularities and "big bangs" emerging in the Universe, which are the cause of the circulation of matter and energy in the Universe. The latter means that the concept of "arrow of time" does not apply to it as a whole.

The simultaneity (conjugation) of the processes of evolution and involution reveals their dialectical unity and exposes the fundamental inadmissibility of the postulation by D. Hilbert, A. Einstein and A. Friedman of a unified gravitation equation for the Universe in the form of a postulate that the space curvature tensor $\mathbf{G}_{\mu\nu}$ is proportional to the energy-momentum tensor $\mathbf{T}_{\mu\nu}$ [20] :

$$G_{\mu\nu} = 8\pi G T_{\mu\nu}. \qquad (27)$$

where G is the gravitational constant, which serves as the proportionality coefficient in this equation.

It was enough to take into account the opposite direction of the evolutionary processes in various regions of the infinite Universe and to limit this ratio (with or without the Λ term) to those regions where these processes are in phase so that the mathematical analysis of this ratio given by A. Friedman would lead to quite consistent with observations the conclusion about the inevitability of the concentration of matter in some of its areas, and its dispersion - in others. This would prevent the emergence of an absurd "standard model" of the evolution of the Universe, asserting the birth of the entire Universe from a single "singularity".

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A Theoretical Proof for the Principle of Equivalence

By G. Alagar Ramanujam & D. Padma Priya
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Abstract- In our recent papers [1][2][3]we proposed two axioms for the primordial Space and using them we derived Newton's law of gravity without using Kepler's laws of planetary motion. Using our axioms, we were able to obtain cosmological equations with dark energy built-in[4]. We show here that the Principle of Equivalence which is the base for Einstein's General theory of relativity follows from our axioms. Based on the day to day common experience Aristotle declared that the time taken by an object dropped at a height to reach the ground will depend upon the heaviness of the object; the more the object is heavy, the lesser the time it takes. After about 2000 years, Galileo took a different view and declared that the time taken by a dropped body to reach the ground is independent of its heaviness. His declaration was against the popular belief and hence he had to establish the truth of his declaration by his famous experiment from the tower of Pisa. After Galileo, several experiments with advanced techniques have confirmed time and again the result that the time taken by a dropped body to reach the ground at a height is independent of its heaviness. We show here that our axioms for Space lead us to a theoretical proof for the above experimental result, which in turn leads to the 'Principle of Equivalence'.

Keywords: principle of equivalence, axioms for space, mass formula, derivation of law of gravity, dark energy.

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A Theoretical Proof for the Principle of Equivalence

G. Alagar Ramanujam [α] & D. Padma Priya [σ]

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I. Introduction

Through his formula F = ma, Newton brought out the capacity of mass to offer resistance to a force applied on it. The greater the mass is, the lesser is the effect produced on it by an applied force. Einstein through his formula $E=mc^2$ brought out the energy equivalent of a given Mass. But in both the cases the question 'What is mass?' remains unanswered. While we know what mass does, we do not know what mass is? From our axioms for the Space, we obtained a formula for mass in terms of the factors that contribute to the mass [1]. By using this mass formula, we obtain here a theoretical proof for the Principle of Equivalence. We prove here that the gravitational acceleration of an object say B towards another object A is completely independent of the massiveness of object B.

From the days of Galileo up to a few years ago, several experiments with most sophisticated techniques have clearly confirmed the Principle of Equivalence. Below given are details of few such experiments. [5]

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To quote the reference [5]:"Galileo apparently deduced it by timing balls falling along descending slopes...Yet Newton verified it as early as 1687, by observing that pendulums of equal length with bobs made of different materials indeed swung at the same speed, with a precision to three decimal points.

In 1889, using more sophisticated pendulums (torsion pendulums), the Hungarian physicist Loránd Eötvös confirmed it to eight decimal points. In 2008, the US Eöt-Wash group of physicists refined the Principle of the torsion pendulum with beryllium and titanium, and was able to reach a precision to thirteen decimal points, the current record!"

During the Summer of 1971, on the Moon, the US astronaut David Scott drops a feather and a hammer on the Moon floor, and both reach the ground simultaneously.

The goal of CNES microsatellite, Microscope 2 is to verify the Principle of Equivalence with a precision to fifteen decimal points."

We give below a theoretical proof for the experiment of Galileo.

II. Proof for the Principle of Equivalence

Following the spirit of Le-Sage,[7] we obtain here a proof for Principle of Equivalence. Around the year 1748 Louis Le Sage developed a theory called kinetic theory of gravity wherein the universe was assumed to contain a field of randomly moving tiny particles called ultra-mundane corpuscles with special properties assigned.

An isolated object A is struck by these corpuscles equally from all sides resulting in an inward directed pressure but no net directional pressure. With the second object B present, a fraction of corpuscles that would otherwise have struck A from the direction of B, is intercepted. So, B works a shield. Similarly, the object A works as a shield for the corpuscles that would have normally struck B. Because of these shielding effects of different values, the corpuscles drive A and B towards each other. Thus, the apparent attraction between the bodies becomes in this theory, the corpuscles pushing the objects towards each other. The kinetic theory of gravity later on came to be called push gravity or Le sage gravity. In a similar theory presented

here we have replaced the ultra-mundane corpuscles by the Space.

Our axioms for Space are as follows:

1. Space is all-pervading and is endowed with potential energy. It has the property of constant self-compression and continually exerting compressive pressure on every system in it.
2. Self-compression results in the formation of infinitesimal spinning quanta of Space, called ''formative dust''. Due to the surrounding compressive pressure of Space, dust are pressured into formation of discrete groups we know as fundamental particles; every group of dust formed by the surrounding compressive pressure of Space has a spin and hence becomes a source of a radial field with a repulsive pressure at every space–time point.

Explaining our axioms, we state the following: The self-compression of Space results in the infinitesimal spinning quanta of Space called dust. A group of dust formed by the compressive pressure of Space becomes a fundamental particle with spin. From a spinning fundamental particle, energetic constituent dust are thrown out. Each such thrown out dust produces an outgoing wave in Space. These waves produced by every fundamental particle, constitute the Dark energy. The dark energy waves from one particle try to push the other particles away. Like gravity, Dark Energy is present everywhere. The role of Dark Energy is anti-gravity.[1]

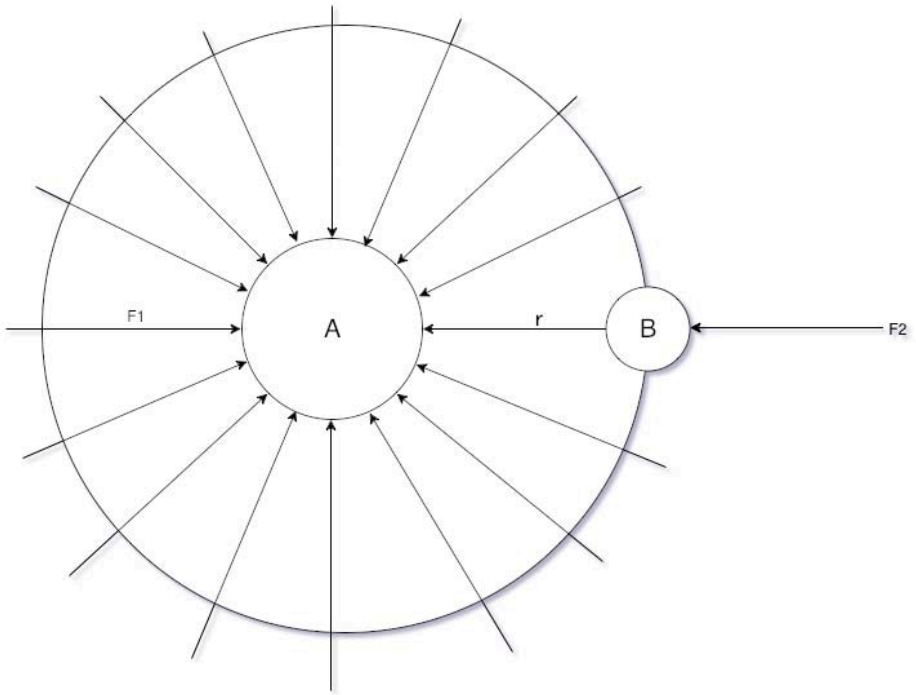

Fig. 1

Let C_1 be the compressive pressure on the Unit area of an object (A) due to the Space. Let R_1 be the repulsive pressure per unit area of the surface of the object A due to the spin of the particles constituting the object A. $C_1 - R_1$ is the net compressive pressure on the object. The total net compressive thrust on the object will be $A1(C_1-R_1)$. Let us denote the net compressive thrust on the first object by the letter G^1_s.

$$G_s^1 = A_1(C_1-R_1) \text{ Newton} \qquad (1)$$

The greater the grip is, greater will be the difficulty for a pressure applied on the object to move it. Thus, massiveness of the object or the mass of the object (M) is directly proportional to the grip on the object. Therefore

$$M_1 = \beta G_s^1 \text{ where } \beta \text{ is a constant and its unit is kg/N.} \qquad (2)$$

The above formula for mass is called 'The Vethathirian mass formula'.

Here, mass of the object is a consequence of the grip on the object due to the Space. It must be noted here that mass is not an inherent property of the object. But it is a property imposed on the object by the Space.

The total thrust, $A_1(C_1-R_1)$ converging on the object A,passes through the sphereof radius r (Fig.1). Therefore, the thrust passing through unit area of the sphere will be

$$A_1(C_1-R_1)/4\pi r^2$$

If we place an object B at a distance r, B will experience a force F_2 pushing it towards A due to the thrust passing through the sphere.

The pushing force F_2 due to Space on B is directly proportional to $A_1(C_1\text{-}R_1)/4\pi r^2$.

Hence $F_2 = k_2\ A_1(C_1\text{-}R_1)/\ 4\pi r^2$ where k_2 is a factor depending upon the nature of the object B.

The factor k_2 can be considered as the effective area offered by the object B, through which the thrust passes before it converges on the object A.

F_2 is the force acting on object B due to the Space. By Newtons third law, as a reaction to F_2 we have F_1 due to Space acting on the object A. By symmetry, we have

$$F_1 = k_1A_2(C_2\text{-}R_2)/\ 4\pi r^2 \qquad (3)$$

where k_1 is the effective area offered by the object A.

Because of the forcesF_1 and F_2on the objects A and B due to Space, the objects will move towards each other.

Since Space is invisible for us and since Space was considered as vacuum in Newton days the cause for the motion of B towards A was placed on the object A and it was declared that a particle attracts another particle. As explained above it is the Space that gives both the forcesF_1 and F_2 such that A and B move towards each other. The force with which the object B moves towards A is called gravitational force and as explained above, Space is the cause for the gravitational force.

Since F_1 and F_2 are equal according to Newton's third law,

$$k_2\ A_1(C_1\text{-}R_1)/4\pi r^2 = k_1A_2(C_2\text{-}R_2)/4\pi r^2$$

$$k_1\ A_2(C_2\text{-}R_2)) = k_2\ (A_1(C_1\text{-}R_1))$$

$$k_1/k_2 = A_1(C_1\text{-}R_1)/\ A_2(C_2\text{-}R_2)$$

Solving the above eqn., we get

$$k_1 = \mu(r,t)(A_1\ (C_1\text{-}R_1))$$

$$k_2 = \mu(r,t)(A_2(C_2\text{-}R_2))$$

where μ is a factor and is a function of (r,t) and its unit is L^2N^{-1}

$$F_1 = \mu A_1(C_1\text{-}R_1)\ A_2(C_2\text{-}R_2)/4\pi r^2 \qquad (4)$$

$$F_2 = \mu A_2(C_2\text{-}R_2)\ A_1(C_1\text{-}R_1)/\ 4\pi r^2 \qquad (5)$$

$$F_2/\ A_2(C_2\text{-}R_2) = \mu\ A_1(C_1\text{-}R_1)/\ 4\pi r^2$$

Using eqn.2 we have,

$$F_2/\ G^2{}_s = \mu\ \ G^1{}_s\ /4\pi r^2 \qquad (6)$$

The message from eqn.(6) is highly significant. The net grip on object B plays the role of inertia opposing the force F_2 and the net grip on the object A plays the role of gravity.

Using our mass formula, eqn.(2) we write,

$$\beta F_2/M_2 = \mu\ M_1/\beta 4\pi r^2$$

$$F_2/M_2 = \mu\ M_1/\ \beta^2 4\pi r^2$$

$$F_2/M_2 = G\ M_1/\ r^2 = a_2 \qquad (7)$$

where $G(r,t) = \mu/\beta^2 4\pi$ and $a_2$is the acceleration of the object B towards the object A.

G is called gravitational constant and its dimension is determined by those of μ and β. The dimension of G is $L^3T^{-2}M^{-1}$. For Newton, G is a proportionality constant, but for us G(r,t) is a combination of two factors and its dimension emerges from the theory.

The eqn.(7)shows that the acceleration a_2 of the object B is completely independent of the nature and the parameters of the object B and thus represents a proof for the Principle of Equivalence.

It is extremely gratifying that our axioms have the potential to lead us to a theoretical proof for the famous experimental results of Galileo. In this connection it is interesting to see the work of Berry [8] and of Paulo Christillin [9] on the concept of the Principle of Equivalence.

III. Conclusion

Our axioms for Space, as shown in this paper have the potential to predict the Principle of Equivalence. Einstein used this principle as the base for his general theory of relativity [10]. In the current Physics, since mass is considered as the cause of gravity, there is a necessity to introduce gravitational mass defined as the capacity of an object to attract another object. In the theory presented here, for every object there is only one mass given by our mass formulaeqn. (2). The mass defined by us in eqn.(2) is not only a measure of the inertia of the object but also a measure of the gravitational force between the object A and any other object.

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Quantum Mechanism of Music in Theory and Practice

By Dr. Shahzad Aasim
Kashmir Advanced Scientific Research Centre

Abstract- Music is such a vast and infinite subject specifically, from the research point of view, it is an endless journey to know where it originates and where it is destined to. Music as time and again has been defined as source of entertainment through playing of some particular instruments. Singing and dancing is considered as standard definition of music this has been taken as 1st part of this research that discusses music in a new perspective, the practical or performing art has been named as Chemistry of Music like different arrangement of chords in a different way creates different effective sounds or Music with musical composition and musical instruments. Secondly, science behind the music has been discussed thoroughly as it is assumed that the sound with its medium not only communicates with a melodious tone but also brings forth some information that in actual way makes a person feel ectasias on receiving that information this is a collaboration between music and science and herein has been named as Physics of Music. And finally the 3rd one is Clinical part, how it interacts with matter whether living or non-living with different formulas and methods. This belongs to music therapists and music healers. It discusses overall effects with all states of matter whether solid, liquid or gases and finally acquires a title Quantum Mechanism of Music in theory and Practice. Hope this will open up a new window for researchers.

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I. Introduction

Quantum Mechanism of music is a concept that hasn't been revealed yet and is only identified by some laws. One important law is Quantum Mechanism of Physics. To understand Quantum Mechanism of Music, the genesis of The Quantum Mechanism of Physics must be learned in the beginning. Numerous theories have been written[1]. When Quantum Mechanism level is discussed, it is found that the mechanism is only available in particle nature. When taken to the higher level, the results are different and same is the case with the Theory of Relativity. It means when approached upwards with same law, like in the Theory of Relativity, happens and when entered in, Quantum Mechanism is found[2]. It means that there is no complete theory in the universe published and are still lagging behind in the field of science and research. Music comes under sound wave and physics, having its own laws. We have understood music in classified definition. So far as classical definition of music is concerned, Singing, dancing and playing of instruments is called music, but my definition of music is somewhat different, when we researched on music we found these are soft vibrations connected with effects of resonance[3]. Thought came in my mind during my PhD that if everybody has same respiratory track, same vocal chords and same frequencies are produced why can't everybody sing? This I documented as 'Secret of music'. This with no going back paved way for my research called "Quantum Mechanism of music in theory and practice". When sound wave is quantumized, lowest unit is revealed called frequency[4]. When this wave goes to its receptor, it gets demodulated and receptor makes it out first and feels ecstatic. But this sound wave also carries an information that reaches the receptor with this information. Receptor not only listens but also understands the information that comes along with sound wave[5]. So far as this information is concerned, its mechanism is not known to us. This is what has been procured to be decoded and recognize the game of this information. As said by Anderson, "Where words fail, music speaks". We know this world has existed since the Big Bang. And it is everywhere. So, it has to appear in the arts too. But how and where? Before discussing music in detail, Let us categorized music in three parts:

II. Applied Music or Chemistry of Music

Applied music is vocal or instrumental musical performance subject to instruction in college or school as contrasted with musical theory and literature also known as practical music[6].

III. Musicology or Physics of Music

The science behind the music, especially in physics, there is of course a difference between normal sound and musical wave for the reason that musical wave has temptation but the normal sound sans temptation. Normal sound where frequencies fluctuate is recognized as noise or cacophony, discordance or unmusicality[7]. But the question is, there is also a difference in these musical waves as well like some are more harmonious and some are less. What I did, I quantumized it as quantum Qubits, Nubits and quantum lobits and extracted its quantum mechanism, what it is basically and how it works with this bit system?

IV. Clinical Music

It is an important part of Music having connection with its interaction with matter, living and

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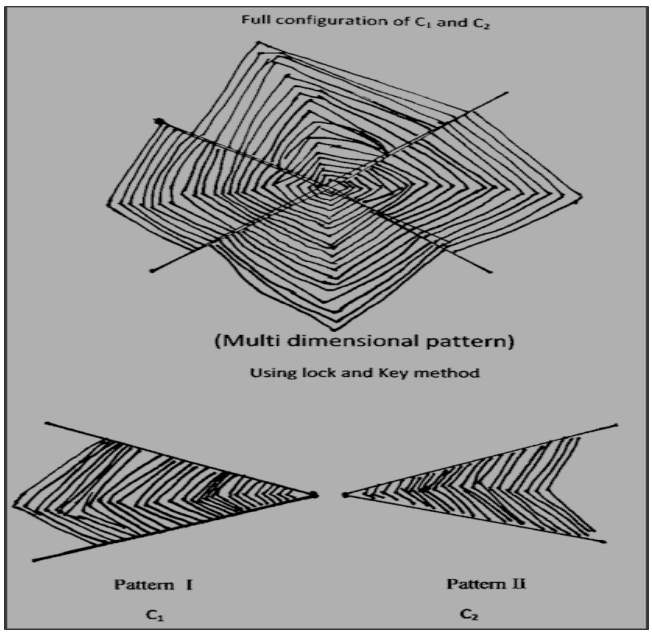
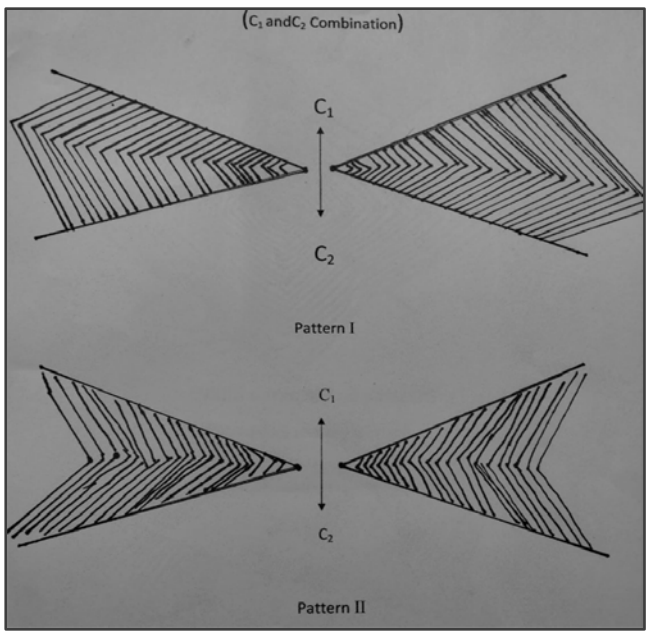
non-living, existing in the Universe including baryonic and non-baryonic forces, anti-mass concept and gravity etc. Presently Clinical aspect of Music as a music therapy is the use of music by a certified professional as an involvement to improve, restore, or maintain a non-music-related behavior in a patient. Music therapist treats many people having different health disorders especially patients with Parkinson's disease knows how music can provide an external cure for patients. Music therapist also uses group singing to help patients with Parkinson's, improve their respiratory control and swallowed organs. It is an evidence-based clinical use of musical interventions to improve clients' quality of life. Music therapists use music and its many facets—physical, emotional, mental, social, aesthetic, and spiritual— to help clients improve their health in cognitive, motor, emotional, communicative, social, sensory, and educational domains by using both active and receptive music experiences. These experiences include improvisation, re-creation, composition, receptive methods, and discussion of music[8]. Let me shed some light on this clinical part of the music. The impact of music is on each and every matter of the universe, in other words, sound interacts with all types of matter existing in this universe. This we can better understood through Cymatics (interaction of musical wave and matter) and music therapies, a concept in which sound waves are directed at the body with the aim of promoting health. We can see even color impacts with a particular music type. This also get patternized through the configuration of Cubits from both sides. It interacts with the neurological part of the human body. It touches all aspects of the mind, body, brain and behavior[9]. It provides a distraction for the mind, it slows the rhythms of the body, and it alters or changes the aura, which in turn can influence behavior[10]. Trained and certified music therapists' work in a variety of healthcare and educational settings. When combined together the impact of cubits, and their inaction at the quantum level and externally provide relief to the client finally a new outset is generated called the power of music. There are some unknown occurrences connected with the world of particles that we neither see with naked eye nor with any scientific gadget but that does exist. Specifically, there exists an information anonymous and new but intangible and indescribable. In my opinion, these quantum particles have a specific configuration and that varies from person to person and this configuration is simply called lock and key Method.

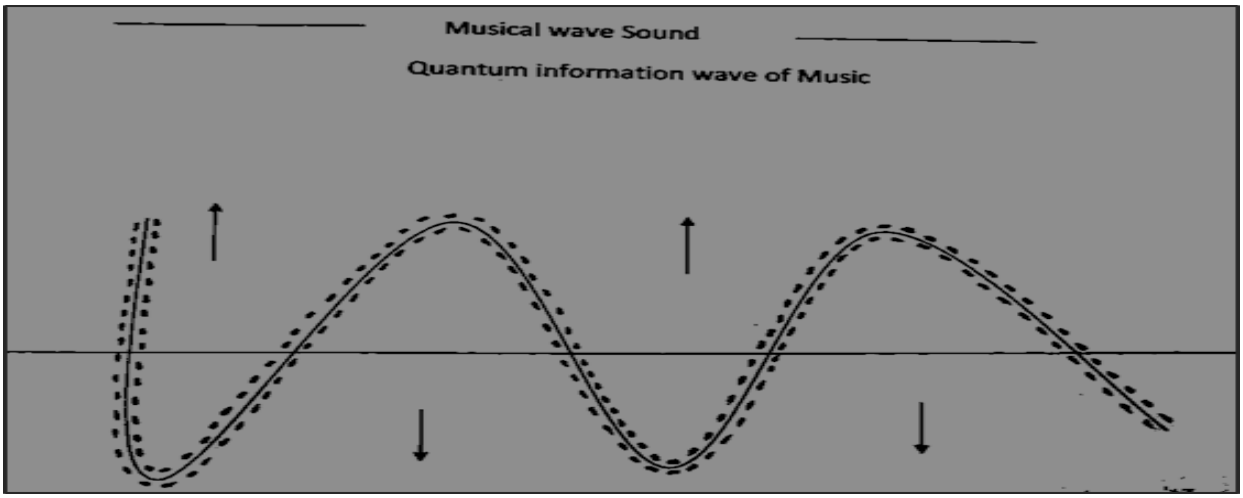
V. Lock and Key Method

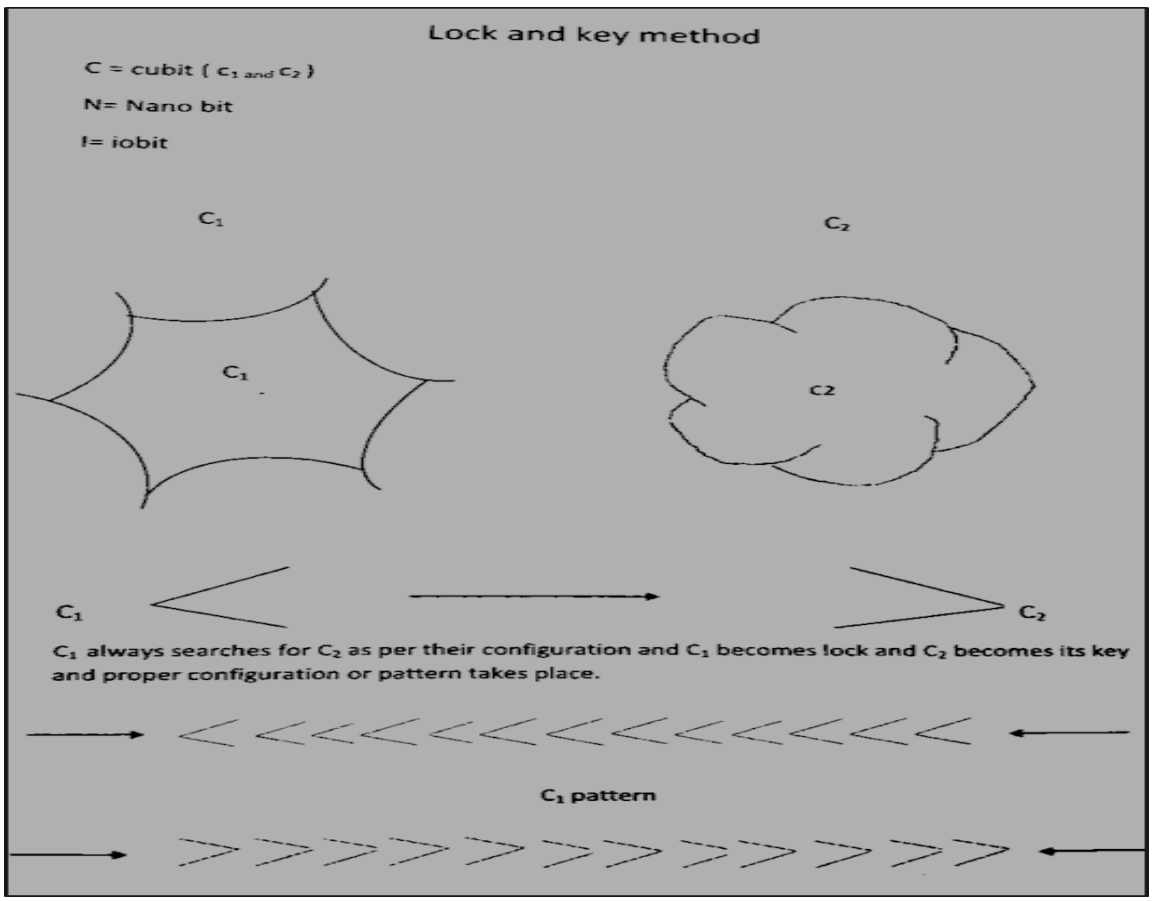
When two species are taken, having the same type of mechanism, same magnitude, same frequency and same parameters but different results received, having everything similar and identical. It discloses that something is still undiscovered[11]. To understand this secret, music sound wave must be taken to the Quantum level after that it can be understood that why different results come out. For example if two musical waves with same parameters are selected but the output won't be same, it means there is one more system working within it and that is very important to understand. If my brain is listening to musical waves and feels ecstatic, so how it feels ecstatic[12]. When we quantumize it we get to know that cubits are in connection with Artist's cubits irreversibly giving birth to a configuration when we further quantumize it.

Cubits = nubits = iobits









These particles goes into configuration or maturation phase and convenes through the patch up of lock and key method from the donor (Artist) and the receptor and creates a smooth pattern at that time brain signals receive a smooth fashion. The more smoothness it receives, more it mesmerizes its receptor. Now, if it's not liked by receptor then the configuration is not seasoned to level it should have been. If receptor likes half of the musical wave and the rest he feels appalled that means 50% of the particles have gone into the phase of configuration. This way the quantum mechanism of music streams its course of action.

As per scientific knowledge, we already know the definition and background of sound but there are few things that has not been brought to light yet. Frequency the lowest unit of sound is measured in terms of oscillations per second or hertz. Observing vibrations while circulating in terms of frequency interacts and gets synchronized with the applied frequency created by the external force known as resonance and this process also creates dissonance as a result of disequilibrium between natural and applied frequencies. At quantum level, this natural frequency which is a source of amount of mass, its stiffness and

gravitational mechanism is actually a part of super natural energy creating vibrations at quantum particle level that will be revealed later in the super infinity wave mechanism and interaction of sound in terms of phonons and gravity in terms of gravitons at quantum level. So far as the quantum mechanism of music is concerned, it works as per an important concept called, LOCK and KEY method that plays a dynamic role in liking and disliking of sound waves apart from resonance and dissonance and varies in several respects in terms of interaction with the living and non-living matter of universe because in some cases noise or dissonance becomes the good signal for a living being that means resonance or dissonance has no role in terms of liking and disliking e.g. a noise becomes a good signal or alluring sound under the proper arrangement and control on pitch loudness, magnitude timbre and volume etc. musical wave becomes disliking at certain points that indicates a primary role of LOCK and KEY method in addition to resonance or dissonance which effects or interacts with the matter in a softer way and has connection with super infinity wave and gravitational mechanism etc.

Now, let us go over to LOCK and KEY method of quantum mechanism of music that not only has frequency present at quantum level but when we observe frequency internally; we detect that sound is actually made of cubits which are further made of nanobits and nanobits are further made up of iobits. Consequently, it results in the formation of configuration and this configuration is a result of cubits that is these cubits take a particular shape and these cubits combine with the cubits of receptor object creating a maturation and result in formation a softness and this softness is referred as like. Apart from sound we also find colors appealing. So, what is the mechanism behind this occurrence, as there is no resonance in colors? This effect is attached to every matter that is to say cubits have an interaction within matter. Our point is that cubits are the main cause of liking and disliking.

VI. Role of Lock & Key Method

Experts are well acquainted with how music therapy reacts with neurons and heals the person suffering from any disease/disorder in other words to minimize the intensity of disease or any disorder otherwise divert it with melody of music. This we receive as a basic mechanism like in a patients suffering from any disease/disorder, we can perceive through this sound that the cubits in patient with intensity or configurational formula after maturating them. Now, it is all-inclusively acclaimed that some diseases or disorders specifically cardiac related health complaints or mental health issues can be treated with music therapy but what I disclose is that, each sound has a different combination thus carries an altogether different information but we need to unlock its configuration mathematically only in that fashion, we can specialize the sound for the particular disease/disorder and can definitely minimize the effect of the disease we are dealing with. This concept with its quantum will be thoroughly examined in my next paper.

VII. Conclusion

This paper and the concepts about dealing with quantum information in a compositional way is just an opening. I will be exploring scales for different types of musical instruments needs much more time and experimentation than what is possible within the 3-year Quantum Music. What has been proven throughout this research, is that quantum information is indeed viable as a way of generating musical material with an undiscovered information. As shown in the composition Super Position, it is possible to create melodies, harmonies and rhythmical patterns based on quantum leap frequencies as well as using the information as a time structuring element. Certainly, the entrances have been opened into the field of music composition.

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Relation between Mass, Angular Momentum and Spin Parameter of Black Holes

By Dipo Mahto
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Abstract- In the present research work, a well known relation between mass (M), angular momentum (J) and spin parameter (a*) has established by entirely new mathematical operation using the model for first law of black hole mechanics given by the equation $\delta M = \frac{k}{8\pi}\delta A + \Omega\delta J - \upsilon\delta Q$ (Bardeen et al. 1973) and the relation $\Omega = M/2J$. (Meinel, 2006), which concludes that the angular momentum may be regarded as additional characterizing parameter of black holes.

Keywords: *angular momentum, spin parameter and surface gravity.*

GJSFR-A Classification: *FOR Code: 020199*

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Relation between Mass, Angular Momentum and Spin Parameter of Black Holes

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I. Introduction

The three quantities such as mass, spin and charge are treated as fundamental quantity of black hole physics to characterize the black holes [1]. There are so many physicists and researchers who had done their works in these fields whose contribution in these directions are in the years given as: Oppenheiner (1939), Bardeen et al. (1973), Hawking (1974. 1975), Strominger & Vafa (1996), Florov et al. (1997), Transchen (2000), t Hooft (2000) Wald(2001), Narayan (2005), Carlip(2009) , Mahto et al.(2014, 2016, 2017, 2018) [1-17]. The mass of the stellar bodies like black holes ranging from 5 solar masses to 20 solar masses are existing in XRBs[11] and from 10^6 solar masses to 10^{10} solar masses are existing in AGN [1]. The spin of black holes ranging from +1 to -1 including zero for co-rotating and counter rotating black holes respectively are used to charaterise the nature of the black holes. The zero spin is used to characterize the non-spinning black holes [11]. The -1/2 and +1/2 are also possible to charaterise the nature of the black holes. On the event horizon, the mass is equal to the charge of black hole (M=Q)[8], usually, the charge is neutralized by plasma which surrounding the black holes[11]. In the present research work, a well known relation ($J=a^*M^2$) between mass(M), angular momentum(J) and spin parameter(a*) have established by entirely new mathematical operation using the model for first law of black hole mechanics and the relation of mass, angular velocity and angular momentum ($\Omega = M/2J$).

II. Theoretical Discussion

The first law of black hole mechanics is simply an identity relating the change in mass, angular momentum, horizon area and charge of a black hole represented by the following relation [10, 11].

$$\delta M = \frac{\kappa}{8\pi}\delta A + \Omega\delta J - \upsilon\delta Q \quad \ldots\ldots\ldots\ldots(1)$$

Where $\Omega =$ Angular velocity of the horizon. $\upsilon =$ difference in the electrostatic potential between infinity and horizon.

The entropy and surface area of the black holes are related by the following equation

$$S = \frac{A}{4} \quad \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The above equation is differentiated partially, we have

$$\delta S = \frac{\delta A}{4} \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The use of above equation into the equation (1) gives the following equation

$$\delta M = \frac{\kappa}{2\pi}\delta S_{bh} + \Omega\delta J - \upsilon\delta Q \ldots\ldots\ldots\ldots(4)$$

The equation(4) is also known as First law of black hole mechanics representing the change in mass due to change in entropy, angular momentum and charge of black holes, where K is the surface gravity given by the following equation called Kerr solution [13].

$$\kappa = \frac{(M^4 - J_H^2)^{1/2}}{2M\{M^2 + (M^4 - J_H^2)^{1/2}\}} \ldots\ldots\ldots\ldots(5)$$

Actually an astronomical black hole is not likely to have any significant electric charge, because it will usually be rapidly neutralized by surrounding plasma [11] and hence due to this reason substituting $\delta Q = 0$ in the eqn (4), we have

$$\delta M = \frac{\kappa}{8\pi}\delta A + \Omega\delta J \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

and

$$\delta M = \frac{\kappa}{2\pi}\delta S_{bh} + \Omega\delta J \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

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The above relation shows the change in mass corresponding change in the angular momentum and entropy of black holes.

In two dimensional parameter space, the mass, angular momentum and angular velocity of spinning black hole is related by the following equation [18].

$$M = 2\Omega J \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

The relation is satisfied for a continuous sequence of stationary anti-symmetry, uniformly rotating perfect fluid bodies with a cold matter and finite baryonic mass can reach a Kerr black hole [19]. From equation (8), we have

$$\Omega = \frac{M}{2J} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

With the substitution of equation (9) in eq^{n} (7), we get

$$\delta M = \frac{\kappa}{2\pi}\delta S + \frac{M}{2J}\delta J \quad \ldots\ldots\ldots\ldots\ldots(10)$$

The surface gravity (κ) of the black holes on the fluid side of transition line vanishes on the black hole side of the transition line as $V_0 \to -\infty$ [19]. This leads that the first term of the right side will be equal to zero and gives the following relation.

$$\delta M = \frac{M}{2J}\delta J \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(11)$$

or

$$\frac{\delta J}{J} = 2\frac{\delta M}{M} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(12)$$

Now the both sides of the above equation is integrated, we have

$$\int \frac{\delta J}{J} = 2\int \frac{\delta M}{M} + cons\tan t \quad \ldots\ldots\ldots\ldots\ldots(13)$$

or

$$\log_e J = 2\log_e M + \log_e a*$$

or

$$\log_e J = \log_e M^2 + \log_e a*$$

or

$$\log_e J = \log_e (a*M^2)$$

or

$$J = a*M^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

The equation (14) is the final model relating the mass, spin and angular momentum of black holes in which the term $a*$ is a proportionality constant having values 0, +1, -1, +1/2 & -1/2. This constant denotes the spin parameter of different test black holes. We know that the spinning parameters are $a*$=1 for co-rotation and $a*$=-1 for counter rotation in the bosonic field of black holes, while for non-spinning black holes $a*$=0. [11]. The relation as in equation (14) can be obtained as follows:

The angular momentum (J) of spinning black holes is given by the following equation [11].

$$J = \frac{a*GM^2}{c} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(15)$$

In the above equation, the symbols a*, G, M and c are spin parameter, gravitational constant, mass and velocity of light respectively. The gravitational constant (G) and the velocity of light (c) are the universal constant and for convenience, it is assumed that G=c=1. Putting these values in equation (15), we obtain exactly the same result as in the equation 14). With the substitution of spin parameter (a*=0, +1 & -1), the equation (14) becomes to

$$J = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(16)$$

$$J = \pm M^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(17)$$

Or $\ldots\ldots$

$$|J| = M^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(18)$$

This also holds good $a*$=1/2 for co-rotation and $a*$=-1/2 for counter rotation in fermionic field of black holes. Hence the equation (14) becomes to

$$J = \pm\frac{1}{2}M^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(19)$$

Or

$$|J| = \frac{1}{2}M^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(20)$$

In the equation (17), the quantity angular momentum is the characterizing parameter of the extreme Kerr black hole limit of rotating perfect fluid bodies in equilibrium to study quasi-stationary transitions leading the black holes [20]. This category belongs to bosonic character of extreme Kerr black holes. In my opinion, there should be same explanation of the equation (19) for fermionic character of extreme Kerr black holes.

It is well known that the angular momentum (J) is related to the moment of inertia as well as kinetic energy. Hence the variation in angular momentum of bosonic/Fermionic field of black holes affects the moment of inertia and their kinetic energy. The model as proposed in the present work shows that the angular momentum, moment of inertia and kinetic energy bosonic field of black holes (except zero spin) is always greater than to that of fermionic field of black holes.

The whole situations from equation (16) to (20) can be summarized in the following table.

Table 1: Angular Momentum of black holes (J)

S. No.	Spinning parameters (a*)	Angular Momentum (J)	Category of black holes
1.	0	0	Non-spinning black holes/black holes of bosonic character of zero spin
2.	$+\frac{1}{2}$	$+M^2/2$	Black holes of Fermionic character of half spin
3.	$-\frac{1}{2}$	$-M^2/2$	Black holes of Fermionic character of half spin
4.	$+1$	$+M^2$	Black holes of bosonic character of spin +1
5.	-1	$+M^2$	black holes of bosonic character of spin -1

III. Physical Significance of Proportionality Constant (A*)

In equation (14), the proportionality constant (a*) is the spin parameter and gives a lot of information regarding the black holes. This parameter has very important role to decide the black hole is either spinning or non-spinning. This also shows the Bosonic and Fermionic character of black holes depending on its values. This value is different for bosonic and fermionic character of black holes. The values of spin parameter (a*) equal to 0, +1 or -1 representing bosonic field of black holes and this category of black holes is non-spinning for a*=0 and spinning for a*=+1 or -1, while for a*=+1/2 or -1/2 representing bosonic field of spinning black holes. The black holes for which the spin parameter (a*) is positive known as co-rotating black holes and negative values of the spin parameter (a*) is known as counter rotating black holes.

IV. Result and Discussion

The research work is mainly concerned with the relation between the mass, angular momentum and spin parameter of black holes. In this work, the well known relation between the mass, angular momentum and spin parameter of black holes ($J=a^*M^2$) is established by entirely new method using the first law of black hole mechanics $\delta M = \frac{\kappa}{2\pi}\delta S + \Omega\delta J - \upsilon\delta Q$ (Bardeen et al. 1973) and the relation between angular velocity, mass and angular momentum of black holes given by $\Omega = M/2J$. (Meinel, 2006). With proper mathematical operation by applying some limit/condition on stationary anti-symmetry, uniformly rotating perfect fluid bodies of cold matter and finite baryonic mass to be a Kerr black hole, the required relation is obtained. From equation (18) and (20), it is clear that the magnitude of the angular momentum of bosonic field of black holes except zero spin (a*=0) is twice to that of the magnitude of the angular momentum of Fermionic field of spinning black holes. Hence the moment of inertia of bosonic field of black holes except zero spin (a*=0) is twice to that of the magnitude of the moment of inertia of the Fermionic field of spinning black holes, because the angular momentum and moment of inertia is related by $J = I\Omega$, where I represents moment of inertia of black holes. This also shows that the kinetic energy of of bosonic field of black holes except zero spin (a*=0) is greater than to that of the kinetic energy of the Fermionic field of spinning black holes.

We know that the mass, spin and charge are the fundamental quantities used to characterize the black holes. The angular momentum (J) is product of spin parameter (a*) and square of its mass(M), i.e. ($J=a^*M^2$). Hence the angular momentum may be used as characterizing parameter of black hole in addition to mass, spin and charge.

V. Conclusion

The following conclusions may be drawn from the present research work.

1. The angular momentum may be used as additional characterizing parameter of black holes.
2. The angular momentum, moment of inertia and kinetic energy of of bosonic field of black holes except zero spin (a*=0) is greater than to that of the Fermionic field of spinning black holes.

VI. Future Plan of Present Research Work

1. The calculation of angular momentum of different test black holes in both categories of black holes like XRBs and AGN.
2. The determination of angular momentum of black holes may be used to calculate moment of inertia and kinetic energy of the black holes and hence temperature of the black holes.

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The Electrostatic Generator of Mende

By F. F. Mende

Abstract- The survey of the methods of separation and accumulation of charges is carried out and the existing constructions of electrostatic generators are examined. Is proposed the new method of the separation of electric charges in the liquids, which flow in the magnetic field. Is given the schematic of the electrostatic generator, based on the application of a method of the magnetic separation of charges, and they are represented the results of experimental studies.

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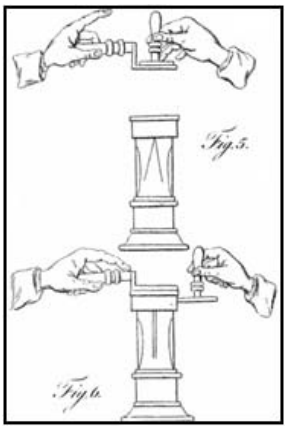
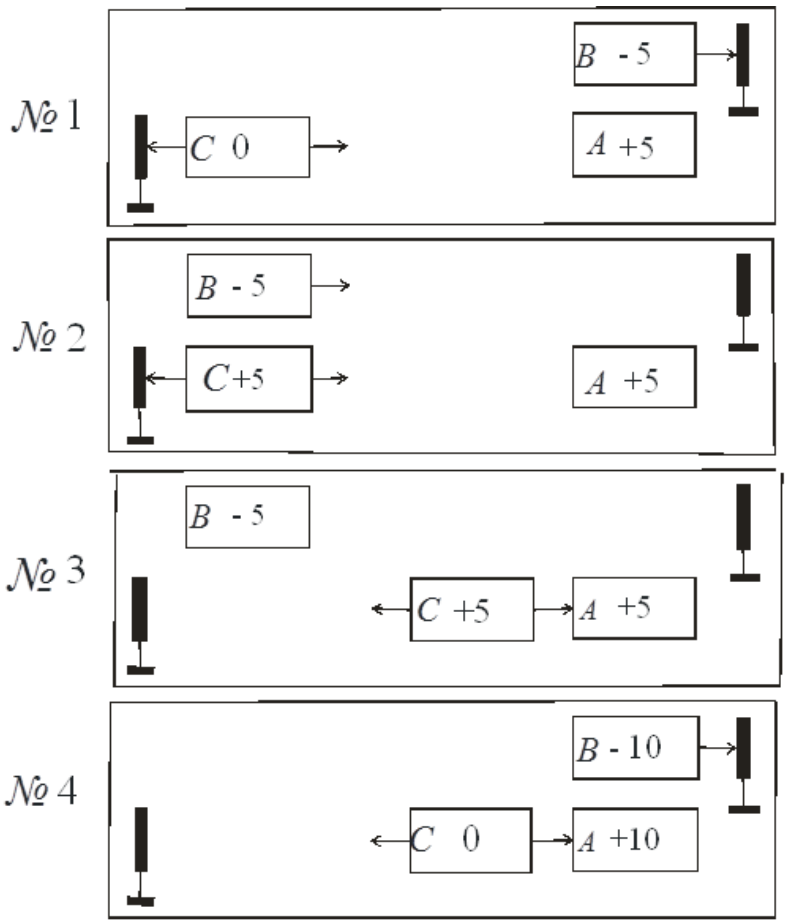
I. Methods of Separation and Accumulation of the Charges

All existing types of electrostatic generators are based on the electrical method of the separation of charges. Manual the method of the accumulation of charges was proposed by the unknown author still in the end of the 14th century and depicted on the engraving



The sequence of operations of the accumulation of charge according to this diagram can be presented as follows



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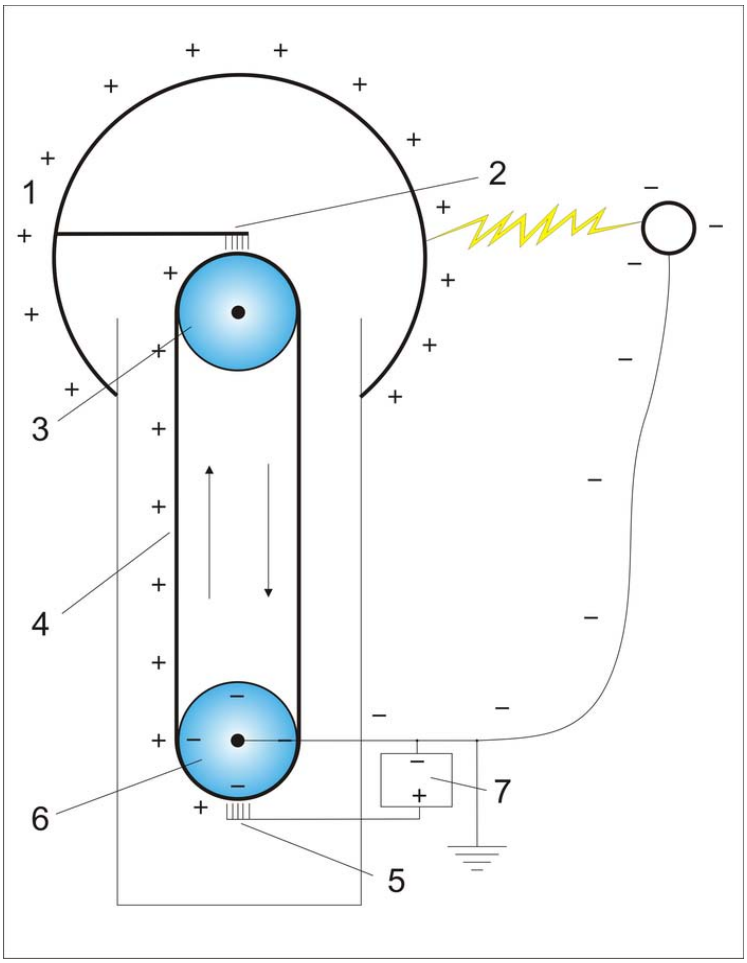
In the position №1 the initial charge of body A comprises +5 ones, body B is grounded and its charge -5 of ones. Body C is also grounded and its charge is equal 0.

In the position №2 the body B located above the body C directs in it the charge +5 ones.

In the position №3 the body B is located on the previous place, and body C is torn off from the earth and is moved to the body A to the contact with it. In the position №4 the body B returns to the initial position and it is grounded. In this case the charge of body A grows to +10 ones, and body B acquires the charge of -10 ones. The body C returns to the foothold and is grounded after this, and cycle is repeated. With the following cycle the charge in the body A will be doubled and will comprise + 20 ones.

Three are today known basic of the type of the electrostatic generators, utilized for obtaining the high voltages. These are belt generator [1], electroform generator [2] and Calvin's dropper [3].

The electrical oscillator circuit of Van de Graaf is represented in Fig. 1.



Ris.1: Electrical oscillator circuit of van de Graaf

Belt generator consists of the dielectric (silk or rubber) tape 4, of that revolving on the rollers 3 and 6, moreover upper roller dielectric, and lower metallic and is connected by the earth . One it goes from the parts of the tape during the rotation of rollers in the metallic sphere 1. Two electrodes 2 and 5 in the form brushes are located at small distance from the tape on top and from below, moreover electrode 2 is connected with the internal surface of the sphere 1. Through the brush 5 air is ionized from the source of the high voltage 7. Resultant positive ions under the action Coulomb force they move to the grounded 6 roller and they settle on the tape. The moving tape transfers charge inside the sphere 1, where it is removed by brush 2, , also, under the action Coulomb force charges are pushed out to the surface of sphere and field inside the sphere is created only by booster charge on the tape. Thus, on the external surface of sphere is accumulated electric charge. The possibility of obtaining the high voltage in this generator is limited by the corona discharge, appearing with the ionization air around the sphere.

In Fig. 3 it is shown the common form of Van de Graff's generator.

Fig. 3: Belt generator for the first in Hungary the linear accelerator, on which in 1952 the year stress MV was 1 obtained

Electroform generator developed by German scientist Wimshurst, is depicted in Fig. 4.

Fig. 4: Electrophorus the generator Wimshurst

In the generator there are two revolving in the opposite direction disks, made from a good insulator, for example ebonite. To the disks the conducting plates, which form capacitors, are stuck with the plates of opposite disk. In the process of rotating the disks the capacitance of these capacitors changes, since. the area of the overlap of the conducting plates changes. In the process of rotating the disks along the conducting plates the brushes, which connect the oppositely placed plates on both disks, slide. On both sides disks are two pairs of point contacts, located on the appropriate holders. These contacts during the rotation of disks do not concern the conducting plates, but charges on these contacts appear with the electrical breakdown between the contacts and the conducting plates. On the contacts indicated are collected the charges of the opposite signs, with the aid of which are charged Leyden jars. The holders of ball-shaped discharger are located on the Leyden jars. The Electroform generator operation diagramoccurs according to the diagram represented below, where the conducting plates, which gather the charges of different signs are depicted as red and green color.

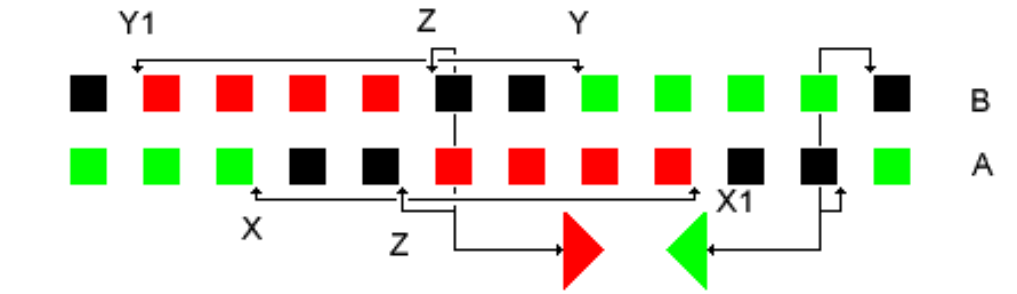


Fig. 5: Electroform generator operation diagram

Let us examine how the accumulation of charges in the generator occurs. Let us assume that the first circle has a deficiency in the free charges, which in our case indicates a deficiency in the free electrons in the metallic plates. During the motion of the second disk its plates will alternately come into contact with brushes and on them will be, correspondingly, formed the surplus of free charge carriers. This occurs because the plates from both sides, between which is located the dielectric (material of disks), are the parallel-plate capacitor, whose facings move.

The following further occurs. Plates, the second disk, after reaching the brushes, will return their electrons into the capacitor in the form of Leyden jar. This jar will accumulate the charge -Q. Then will come the turn of the plates following after them and so on. Analogous process occurs also on the first disk, since it so revolves, but in other direction. In this case free carriers pump out themselves from another Leyden jar, thus forming on it a deficiency in the electrons, and it means, by it is acquired the charge Q.

The more frequent the plate of both disks they come into contact with brushes on the conductors, the greater the quantity of charges is accumulated on them. Leyden jars will be charged, to those times, thus far the Coulomb forces they will not begin to counteract further accumulation of charges. This means that there is a limit of accumulation, which represents a potential difference between the Leyden jars.

The dropper is the simplest electrostatic generator Calvin, its diagram is depicted in Fig. 6.

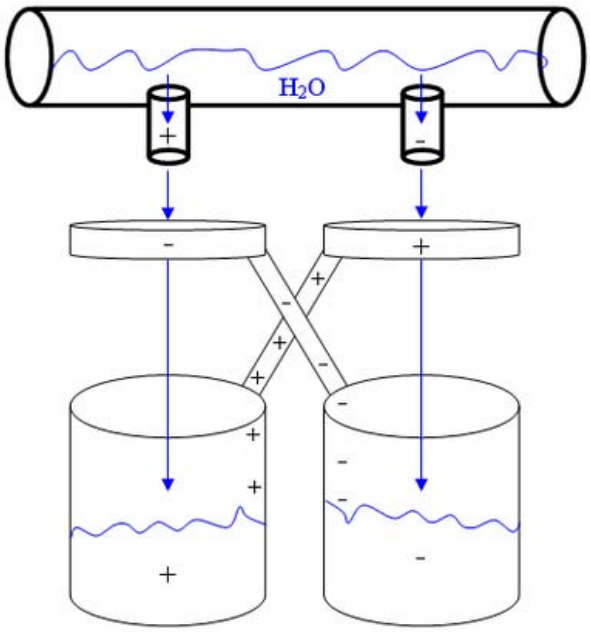


Fig. 6: Schematic of Calvin's dropper

Originally entire installation has neutral charge. It is unknown in view of the symmetry of installation and absence of charge, on which of the jars positive or negative charge will be accumulated. A small potential difference always is present because of different external actions between the left and right side of the installation, therefore the installation requires no starting charging of jars for the starting of system. By the force electrostatic induction ferrules direct in the reservoir

with the water in that place, under which they are located, opposite charges. As a result a quantity of charges on the opposite edges of reservoir becomes different. After falling, drop they fall into the jar, which corresponds to its charge, thus increasing its charge, which creates still larger electric field near the rings, strengthening the separation of static charge and a potential difference it grows. Thus Calvin's dropper accumulates the electric charges of opposite signs in its lower banks

Generators for separation and accumulation examined above of charges are used the laws of electrostatic induction, and magnetic fields in this process of participation do not assume. Hall's law is at the same time known, who gives the possibility to separate the moving charges.

In the simplest examination the Hall effect is represented in Fig. 7.A magnetic field B passes through the conducting plate in the normal direction with induction and through the same plate an electric current flows with density j under the action of the electric field E. The magnetic field will deflect charge carriers of opposite signs to one of the plate faces.

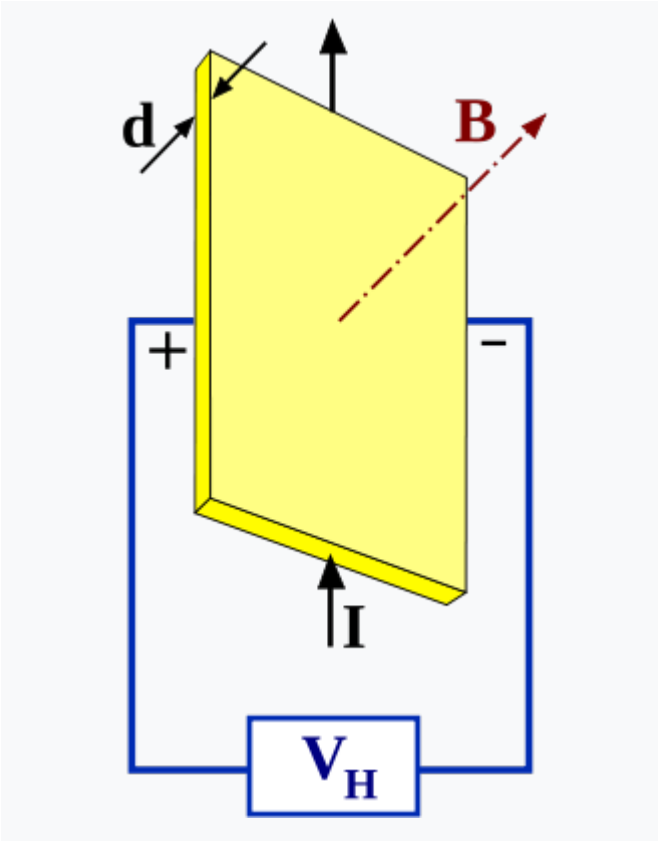


Fig. 7: Diagram of Hall effect

Thus, Lorentz force it will lead to the accumulation of negative charge near one face of plate, and positive- near the opposite. The accumulation of charge will continue to those times, thus far arisen the electric field the charges E_1 it does not compensate for Lorentz force:

$$eE_1 = evB \text{ or } E_1 = vB,$$

where e - electric charge.

Hall effect can be used not only for measuring the magnetic field, but also for the separation of charges in the fluxion, for example to water. In the water (if we exclude the distilled water), are always ions the dissolved in it salts. Their that it is possible to divide with the aid of the Hall effect. If water will move normal to the direction magnetic field, then the ions of different signs will be accumulated on the different sides of flow. Dividing further flow to two parts, it is possible to obtain two separate flows, in which will be concentrated the ions of different signs. The circuit of separation of charges the method indicated is Fig. 8.

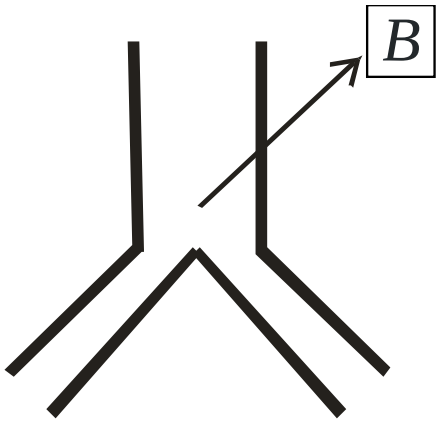


Fig. 8: Circuit of separation of charges with the magnetic separation

Gathering these flows into the different capacities, as is done in Calvin's dropper, it is possible to create the electrostatic generator (Fig. 9).

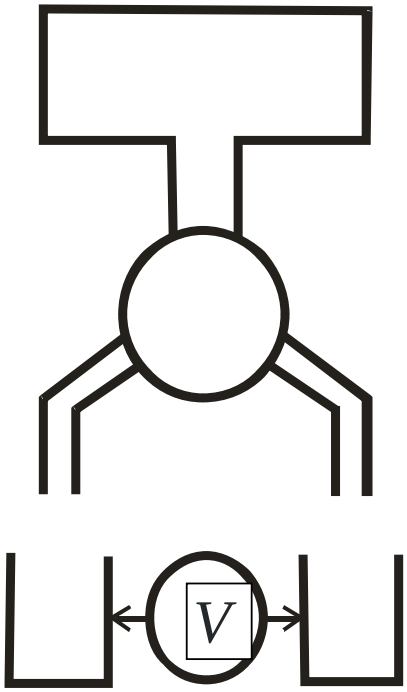


Fig. 9: Schematic of electrostatic generator with the magnetic separation of the charges

Water from the upper capacity flows along the flat duct between two annular magnets. In the area of action of the magnetic field, created by the annular magnets, the channel is divided on two channels and waters, which flows of them, it falls into two lower capacities, between which is created a potential difference. On the experimental installation with the use of two annular samarium magnets, between which the tension of magnetic field composed 0.5T was obtained a potential difference 50 kV.

Since this method of the separation of charges in the scientific publications earlier is not represented, let us name this generator Mende generator.

The general view of the experimental model of the Mende generator is shown in Fig.10.

Puc. 10: General view of the experimental layout of the Mende electrostatic generator

II. Conclusion

The survey of the methods of separation and accumulation of charges is carried out and the existing constructions of electrostatic generators are examined. Is proposed the new method of the separation of electric charges in the liquids, which flow in the magnetic field. Is given the schematic of the electrostatic generator, based on the application of a method of the magnetic separation of charges, and they are represented the results of experimental studies.

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4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

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

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

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

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

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

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

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

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon 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 for 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 of 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 criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to 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 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 avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

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

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite 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 approaches 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. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a 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 limit the initial two items to no more than one line each.

Reason for writing the article—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 for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity 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 of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets 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 for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory 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 soundly written procedures segment allows a capable scientist to replicate 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 to give the least amount of information that would permit another capable scientist to replicate 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 section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show 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:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the 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—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and 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 as 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. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give 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 manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit 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 section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an 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 implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully 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 the prospect, and let it drop at that. Make a decision as to whether each premise is supported or 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 an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of 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 other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

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Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

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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