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Physics and Space Science

One Way Street Entropy

Parametric Electric Generator

Highlights

Bose-Einstein Condensate

Investigation of Classical Systems

Discovering Thoughts, Inventing Future

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Entropy is Not a One Way Street Entropy has Symmetry According to this New Unified Field Theory

The Cosmic Dark Matter Fractal Field Theory

By T. Fulton Johns DDS

Abstract- There is much agreement in theoretical particle physics that black holes (BH) exist not only at massive galactic scales but also at the subatomic Planck scale, Planck Virtual Black Holes (PVBH). It is very possible that white holes (WH) exist there as well, both are predicted to exist from Einstein's General Relativity Theory (GR). "The possibility of the existence of white holes was put forward by Russian cosmologist Igor Novikov in 1964. White holes are predicted as part of a solution to the Einstein field equations known as the maximally extended version of the Schwarzschild metric" according to Wikipedia. Working in a quantum field dynamic of Planck-foam interconnected wormholes, these enigmatic (GR) derived organs of virtual Planckian origin, create the cyclical flux of the energy/information of baryonic matter (BM) across the baryonic matter/dark matter membrane barrier of two different worlds; while creating the virtual particles required for organic as well as inorganic reality. This highly energetic thermodynamic zone seems to exhibit reverse entropy as PVBH's produce cyclical energy/information as BM is consumed, conserved, and recycled through WH dynamics creating a memory of nature through a feedback loop process I call biomorphic transradiation. The philosophical implications of this phenomena are staggering but in this paper I will focus on the thermodynamic reassessment of entropy to be considered.

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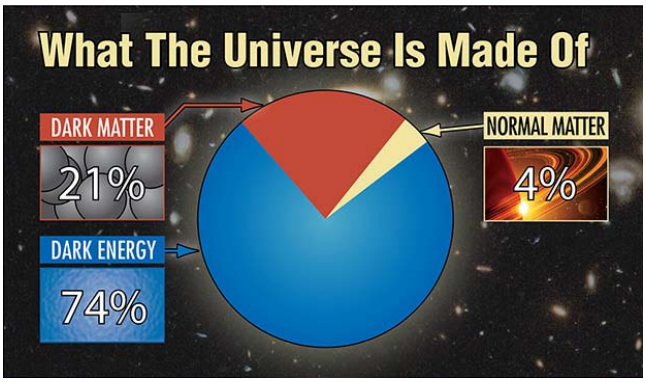
I. The Cosmic Dark Matter Fractal Field Theory (CDMFFT)

Our reality is indeed illusory when taken into full context as a part of an expanse that sits almost exactly in the middle of a scalar continuum from the Planck scale to the vast visible universe and the super-massive objects known to exist there. Even more illusory when we consider that all of the matter that we can perceive through scientific inspection and even our individual sensory perceptions make up only 4% of our entire cosmos. The presence of dark matter and dark energy accounting for the other 96% leaves quite a void in our pretense to understand the cosmos. However, there are significant clues that lead to clarity when the body of scientific research is considered across multiple disciplines. That is what I have done for most of my professional years as a perpetual student of the sciences and have discovered a common thread that encompasses all forces of nature including the neglected life force. So it is not as an authority on any one subject that I bring this theory forward for your consideration but as a student who has uncovered a concept that keeps answering questions I have pondered for decades.



Figure

The work of Dr. Rupert Sheldrake, for example, is an intensive study on morphogenetic fields and is a revealing investigation of the inner workings of our biosphere and its interaction with multiple energy fields in our environment. It is his research and years of work of many others that have provided the foundation to this theory I present in the book 'The Great Cosmic Sea of Reality'. However, the short version of the theory is that our reality at every scale is made up of a cascade of iterated fractal nested fields of influence. Sheldrake says it this way in his book:

'The Presence of the Past, Morphic Resonance and the Memory of Nature on the theory of Formative Causation':

"Morphic fields, like the known fields of physics, are nonmaterial regions of influence extending in space and continuing in time. They are localized within and around the systems they organize. When any particular organized system ceases to exist— as when an atom splits, a snowflake melts, an animal dies— its organizing field disappears from that place. But in another sense, morphic fields do not disappear: they are potential organizing patterns of influence and can appear again physically in other times and places,

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wherever and whenever the physical conditions are appropriate. When they do so, they contain within themselves a memory of their previous physical existences. The process by which the past becomes present within morphic fields is called morphic resonance. Morphic resonance involves the transmission of formative causal influences through both space and time. The memory within the morphic fields is cumulative, and that is why all sorts of things become increasingly habitual through repetition. When such repetition has occurred on an astronomical scale over billions of years, as it has in the case of many kinds of atoms, molecules, and crystals, the nature of these things has become so deeply habitual and effectively changeless or habitual."

Consider also this work done by Nobel laureate Luc Montagnier, using careful protocol proved that the DNA of virus and bacteria could emit electromagnetic signals (EMS) and transmit the information to duplicate the DNA into a separate vile of sterile water. This discovery was first rejected over ten years ago when Montagnier and his research team reported it.

These results have since been repeated by all of the different researchers you see below and even more remarkable the digitized electromagnetic signals of the DNA being sent to other labs over the internet by email. This information was then used to duplicate the results of Luc Montagnier and his team. One key element was always critical for success that the tubes of water were always exposed to the Schumann resonance between 7-8 Hz, Earths EMS pulse.

"*Transduction of DNA information through water and electromagnetic waves*

Luc Montagnier [a, b], Emilio Del Giudice [c, *], Jamal A¨ıssa [b], Claude Lavallee [a], Steven Motschwiller [d], Antonio Capolupo [e, f], Albino Polcari [g], Paola Romano [g, h], Alberto Tedeschi [i], and Giuseppe Vitiello [e, f]

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II. Theoretical Analysis

Our formerly reported experiments (Fig. 2 and ref. (Montagnier, A¨ıssa, Lavallee, et al., 2009)) indicate that the ability of electromagnetic signal EMS production can be transmitted from tube 1 containing an emitter DNA dilution to tube 2 of “naive” water, provided the system is excited overnight by electromagnetic waves of a minimal frequency of 7Hz.Presumably tube 1 transmits waves to the water in tube 2, which did not originally contain any trace of the DNA at the origin of the signals. In the previous Section we have reported the experimental observation that EMS can be emitted by diluted aqueous solutions of bacterial and viral DNA under proper conditions. Moreover, it has been observed that duplication of the emitting DNA segment can be obtained by using pure water exposed to the corresponding DNA EMS and, upon addition of enzymes, primers, etc., submitted to PCR (Polymerase Chain Reaction) cycles. Such a transduction process has been observed to occur also in EMS exposed living cells of tumor origin”.

This ground breaking original study presents many implications but the most important question is how did the atoms that make up the DNA in vile #2 align and form in the previous experiment by Montagnier? Water contains only two atoms hydrogen and oxygen that's a long way from deoxyribonucleic acid, however, the nucleotides added to vile #2 by the PCR enzymes provided the needed atoms but no structure or instructions for assembly. The CDMFF theory explains it this way; the field of the DNA was projected or transmitted to the second vile of water that had been tuned to a receptive resonate frequency (7 HZ), the electromagnetic pulse of this planet. The morphogenetic field of the DNA was projected from the first vile to the water of the second vile which received it presumably as a radio-like signal imprinting this transmitted DNA morphogenetic field in the water by breaking the bipolar symmetry of the water creating the coherent domain (CD) of the morphogenetic field of the DNA molecule. This allowed elemental particles to be attracted to the correct position to create the molecular bonds necessary for the nitrogen, phosphorus, and carbon atoms to be attracted to the correct position in the right orientation as needed.

This occurred through quantum electrodynamics (QED) according to the DNA field blueprint now present in the second vile presumably by way of scalar resonate coherence filling in the DNA quantum field in the required positions. This elemental particle alchemy formed through molecular phase locking of the nitrogen, phosphorus and carbon atoms in the sterile water creating the molecular form directed by the scalar CD of the DNA molecule that had been transmitted to the second vile.

https://globaljournals.org/GJSFR_Volume18/1-Entropy-is-Not-a-One.pdf

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This is just one of the predictions of the CDMFFT; the one I find most intriguing involves the interaction of morphogenetic fields with black holes. Black holes (BH) appear to be the incinerator of baryonic matter (BM) as they sit at the center of all galaxies and exist elsewhere at different scales known as rogue solo black holes (RSBH). The Black Hole at the center of our galaxy is estimated to be 3 billion solar masses. This produces extreme density of mass in the resulting BH, therefore producing extreme gravity along with what is known as an event horizon also known as the Schwarzschild radius.

The Schwarzschild radius is a zone around the BH that is the point of no return once BM crosses this theorized line. The BM will be consumed within the core space-time singularity and according to the CDMFF theory changed to something else that conserves and carries the information contained within into this great vortex of immense energetic gravity and recycled as the memory of morphic fields at the Planck scale at the BM/CDMFF/I of all BH's.

III. The White Hole

The CDMFFT predicts that white holes are more like an interface (WH/I) with wormhole dynamics within the foam-like Planck interface as described by Prof. Steven Hawking in his work on (BH) dynamics at the Planck scale (October 6, 1994 paper entitled 'Virtual Black Holes').

"It seems that topological fluctuations on the Planck scale should give space time a foam-like structure. The wormhole scenario and the quantum bubbles picture are two forms this foam might take. They are characterized by very large values of the first and second Betti numbers respectively. I argued that the wormhole picture didn't really fit with what we know of black holes. On the other hand, pair creation of black holes in a magnetic field or in cosmology is described by instantons with topology S2 ×S2. This shows that one can interpret S2×S2 topological fluctuations as closed loops of virtual black holes".

The CDMFFT predicts that there is an," oil mixed with water like" relationship between baryonic matter and dark matter not just in outer space but inner space, throughout the fabric of space-time and, less well understood, in the very room where you sit. There are clear indications that this theory has very specific things to say about not only the clearly solid tangibility of our reality, which is so solid because 96% of the gravity of the entire universe supports it, but also the sample size that science has access to evaluate and determine such outlandish conclusions of reality being a projection of consciousness (only there when you look at it) is only 4% of the known sample size. This baryonic matter/cosmic dark matter fractal field/interface (BM/CDMFF/I) represents a dynamic barrier where high energy dynamo-like action occurs as our planet moves constantly through at least three different vectors at high velocity. Earth travels in a never ending corkscrew path as one of many rotating planets orbiting a star, as one of many solar systems moving around the galactic center of one of many hundreds of billions of self-similar galactic black hole centric galaxies in our universe. This energy/mass produced from this highly dynamic universal inertia provides the mechanism by which information/ energy/entropic feedback loops are setup through Morphic fields by the recycling of these baryonic loaded coherent domains through the process of these fields being stripped of their baryonic matter as they are engulfed within the singularity of PVBH and returned to our baryonic world through the WH/I.

To properly understand this we must understand our reality from a different point of view. Scale is in many ways relativistic to an observer and can determine your perception of many things. As you sit, seemingly at rest, reading this paper you are moving in at least three different vectors (directions) at different scales at three different velocities in a corkscrew shaped path through "not so empty" outer space of The Great Cosmic Sea while in constant rotation.

The Earth rotates on its virtual axis toward the east at approximately 1000 mph, the Earth revolves around the Sun at approximately 66,000 mph that requires 365 days (1 year) to complete a revolution and as a part of our star centric solar system, Earth revolves around the black hole at our galactic center at about 500,000 mph requiring approximately 225,000 earth years to complete a revolution as our galaxy moves in an ever accelerating fabric of space-time. Therefore, there is no doubt that there is plenty of motion out of our awareness contributing to the mass therefore the gravity of our reality.

This explanation of mass/gravity is described by Hal Puthoff along with Bernie Haisch of the Max Planck Institute as well as another mathematician Alfonso Rueda of the California University Long Beach collaborating on this paper that was printed in 1994 by Physical Review.

"The paper demonstrated that the property of inertia possessed by all objects in the physical cosmos was simply resistance to being accelerated through the Zero Point Field (CDMFF). In their paper they showed that inertia is what is termed a Lorentz force – a force that slows particles moving through a magnetic field. In this instance, the magnetic field is a component of the Zero Point Field, reacting with the charged subatomic particles. The larger the object, the more particles it contains and the more it is held stationary by the field. What this was basically saying is that the corporeal stuff we call matter and to which all physicists since Newton have attributed an innate mass was an illusion. All that was happening was that this background sea of energy was opposing acceleration by gripping on to the

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subatomic particles whenever you pushed on an object. Mass, in their eyes, was a 'bookkeeping' device, a 'temporary place holder' for a more general quantum vacuum reaction effect."

McTaggart, Lynne. The Field Updated Ed: The Quest for the Secret Force of the Cosmos (Kindle Locations 824-825). Harper Collins. Kindle Edition.

There is more recent work done by the researchers below, Haggard and Rovelli that gives further confirmation to the prediction of the CDMFFT concerning the combination of the BH/WHI dynamic at work in the Planck scale arena involving quantum tunneling and the flow of energy being created out of white holes.

Hal M. Haggard∗ and Carlo Rovelli† Aix-Marseille Universit´e and Universit´e de Toulon, CPT-CNRS, Luminy, F-13288 Marseille (Dated: Fourth of July, 2014)

"We show that there is a classical metric satisfying the Einstein equations outside a finite space-time region where matter collapses into a black hole and then emerges from a white hole. We compute this metric explicitly. We show how quantum theory determines the (long) time for the process to happen. A black hole can thus quantum-tunnel into a white hole. For this to happen, quantum gravity should affect the metric also in a small region outside the horizon: we show that contrary to what is commonly assumed, this is not forbidden by causality or by the semi-classical approximation, because quantum effects can pile up over a long time. This scenario alters radically the discussion on the black hole information puzzle."

- They further state this

"Surprisingly, we find that such a metric exists: it is an exact solution of the Einstein equations everywhere, including inside the Schwarzschild radius, except for a finite—small, as we shall see—region, surrounding the points where the classical Einstein equations are likely to fail. It describes in-falling and then out-coming matter."

- They conclude

Relation with a Full Quantum Gravity Theory

"We have constructed the metric of a black hole tunneling into a white hole by using the classical equations outside the quantum region, an order of magnitude estimate for the onset of quantum gravitational phenomena, and some indirect indications on the effects of quantum gravity. This, of course, is not a first principle derivation. For a first principle derivation a full theory of quantum gravity is needed. However, the metric we have presented poses the problem neatly for a quantum gravity calculation. The problem now can be restricted to the calculation of a quantum transition in a finite portion of space-time. The quantum region that we have determined is bounded by a well defined classical geometry. Given the classical boundary geometry, can we compute the corresponding quantum transition amplitude? Since there is no classical solution that matches the in and out geometries of this region, the calculation is conceptually a rather standard tunneling calculation in quantum mechanics. Indeed, this is precisely the form of the problem that is adapted for a calculation in a theory like covariant loop quantum gravity [26, 27]. The spin-foam formalism is designed for this. Notice that the process to be considered is a process that takes a short time and is bounded in space. Essentially, we want to know the transition probability between the state with the metric on the lower to upper E-Δ surfaces. This may be attacked for instance, in a vertex expansion, to first order. If this calculation can be done, we should then be able to replace the order of magnitudes estimates used here with a genuine quantum gravity calculation. And, in particular, compute from first principles the duration τ of the bounce seen from the exterior. We leave this for the future."

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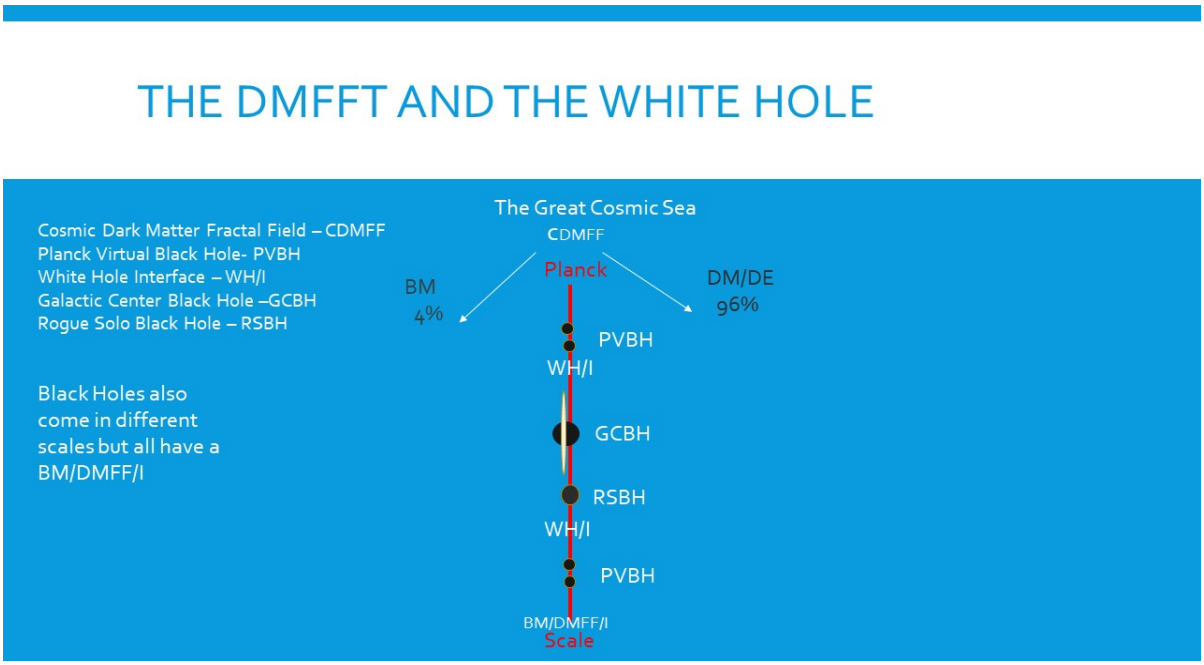

Figure

This interface, at the Planck scale, is the point of creation of virtual particles which provide the subatomic particles under certain conditions.

(See Possible Origins of Virtual Particles):-

https://globaljournals.org/GJSFR_Volume17/1-Possible-Origins-of-Virtual.pdf

the raw material of the atoms that make up our baryonic world, the cusp of creation of baryonic matter (BM), the headwaters of The Great Cosmic Sea. This occurs under the influence of morphic fields and the never-ending inertial motion of our baryonic world related to its density and velocity moving through space-time, at the BM/CDMFF/I. That process is what produces what we experience and observe as gravity as stated in Einstein's theory of general relativity and Puthoff's explanation of gravity produced as a drag force created by the acceleration and gravity as an emergent property of this dynamic motion of our cosmos of subatomic particles through the Lorentz force, a magnetic field of the CDMFF.

IV. Information Transfer to Morphogenetic Fields

However, there is another important creation occurring as this happens, and that is the information-enhanced fabric of space-time; the literal recycling of what was destroyed/changed at the macroscale singularity of black holes, for it too has a BM/CDMFF/I, where the CDMFF prevails and carries information with it in some unknown way and leaving older BM behind while passing its information forward into the CDMFF. There is a process of ongoing cyclical creation and enhanced reformation in our cosmos that begins at the baryonic matter/cosmic dark matter fractal field/ interface directed by the formative causation through morphic resonance working within the CDMFF, producing our baryonic reality at the Planck scale, flowing out of the white hole interface a process I call biomorphic transradiation. This cycle is then completed as this baryonic matter makes its way through the flow of space-time to the black hole space-time singularity in the PVBH, at the core of galaxies and other rogue solo black holes dispersed throughout the universe. This is where both space-time and baryonic matter, with its information, is engulfed, preserved, and returned to its source in the CDMFF. Therefore, the flow of space-time starts in our baryonic world at the Planck BM/ CDMFF/I and its creation of matter and gravity, which occurs like BM rainfall on a dark matter/dark energy mountain range with many different chreodes or undulations, peaks, valleys and water shed-like directing of the flow and form of BM, determining volume (mass) and direction of the flow all through the process of morphogenetic fields with formative causation influenced by the morphic resonant memory retained within the CDMFF brought from the past to the present.

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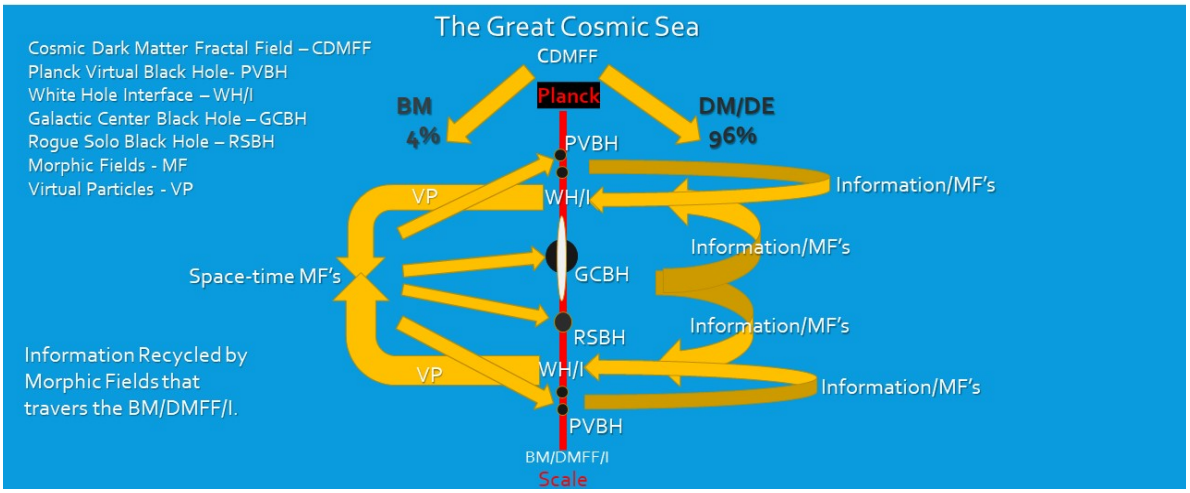
IT IS THE PREDICTION OF THE CDMFFT THAT THIS WHITE HOLE ISN'T A HOLE AT ALL BUT AN INTERFACE OF TWO DISSIMILAR WORLDS THAT OCCURS AT THE OPPOSITE END OF THE COSMIC SCALE, AT THE PLANCK LEVEL OF OUR REALITY. THIS INTERFACE, AT THE PLANCK SCALE, IS THE POINT OF CREATION OF VIRTUAL PARTICLES WHICH PROVIDE THE SUBATOMIC PARTICLES UNDER CERTAIN CONDITIONS, THE RAW MATERIAL OF THE ATOMS THAT MAKE UP OUR BARYONIC WORLD, THE CUSP OF CREATION OF BARYONIC MATTER (BM); THE HEADWATERS OF THE GREAT COSMIC SEA, EVERYWHERE EXCEPT IN BH'S.



Figure

It is also very probable that morphic fields traverse the BM/ CDMFF/I within all BH's stripping away the BM and imprinting the information it carries possibly in a holographic format on BM/ CDMFF/I or it remains with the MF as it is recycled back through the larger DM/DE zone of the CDMFF, producing the so called memory of morphic resonance described by Sheldrake. The BM is then returned through the process I am calling biomorphic transradiation of virtual/elementary particles to our reality repopulating the recycled MF as in Luc Montagnier's experiment along with its memory of former evolutionary change retained from the previous cycle. It is therefore reasonable to predict that the BM of our reality is then recycled by way of a white hole/interface (WH/I) along with this morphic resonant memory at the BM/CDMFF/I by way of virtual particles and QED filling in the atomic structure of quantum field fractal scalar coherent domains, the strange attractor (MF) completing the cycle of life, as well as the formation of our evolving reality throughout all worlds in our cosmos!

V. Conclusions

The Cosmic Dark Matter Fractal Field Theory clearly brings into question our current understanding of the second law of thermodynamics as it was understood in late 1900's through the work of Ludwig Boltzmann who took this entropic conundrum to deeper understanding and inspection. This Italian scientist and mathematician along with a few others began to look at these thermodynamic realities at much smaller scales. Viewed at these atomic directed scales the actions involved with heat became a bit easier to begin to understand and explain.

However, at this period of time the existence of atoms was only a theory but could provide an acceptable explanation for much of the behavior of heat and its transfer dynamics and through Ludwig Boltzman's work the mathematics of this atomic scale reality began to provide answers that were providing a foundation for experimental proofs that followed. Using this model of the atom theory Bolzmann could begin to explain what Rudolf Clausius could not and of course these dedicated scientist had no concept of quantum dynamics or dark matter and because of that I am now explaining what they could not.The CDMFFT reveals that their conclusions about entropy were incomplete. There is undeniable proof that there are many aspects of the laws of thermodynamics that work well under certain conditions, however, like Newton's laws of gravity they are scale dependent, but unlike Newton's laws, the laws of thermodynamics are based on a static paradigm which our highly dynamic cosmos definitely is not. The conclusion that this new unified theory of our universe points too is that our reality is much more like a perpetual self-regenerating cosmic being not a dying machine losing power. The first law of thermodynamics is also in questionable stance with CDMFFT, because energy is constantly being produced at the BM/CDMFF/I as Puthoff et al showed in there 1994 paper. The second law of thermodynamics is also inconsistent with CDMFFT which should lead us to a new way of thinking about the functional and structural dynamics of our cosmos.

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Alternative of the Theory of Relativity

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Annotation- We offer alternative GRT the theory of gravitation approving existence not only attractions, but also repulsive forces, and the explaining gravitation not curvature of space, but non-uniform distribution of mass in him. This theory is based on modification of the Newton's law in relation to continuous media and on the corresponding generalization of a classical thermodynamic method of characteristic functions. She considers all set of the interacting (mutually moving) material objects as non equilibrium system and offers the absolute reference system (ARS) connected with motionless space. Such approach excludes his participation in the studied processes and doesn't need attraction contradicting the postulates of SRT and GRT offered of this theory. The data of observations and experiments confirming justice of this theory are provided and the conclusion about expediency of return of physics on the classical way of development is drawn.

Keywords: *principle of legibility, conservation laws, failure of postulates, nature and law of gravity, absoluteness theory.*

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Alternative of the Theory of Relativity

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Annotation- **We offer alternative GRT the theory of gravitation approving existence not only attractions, but also repulsive forces, and the explaining gravitation not curvature of space, but non-uniform distribution of mass in him. This theory is based on modification of the Newton's law in relation to continuous media and on the corresponding generalization of a classical thermodynamic method of characteristic functions. She considers all set of the interacting (mutually moving) material objects as non equilibrium system and offers the absolute reference system (ARS) connected with motionless space. Such approach excludes his participation in the studied processes and doesn't need attraction contradicting the postulates of SRT and GRT offered of this theory. The data of observations and experiments confirming justice of this theory are provided and the conclusion about expediency of return of physics on the classical way of development is drawn.**

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I. Introduction

There have passed 100 years from the moment of emergence of the theory of relativity (RT). Nevertheless still proceeds, a discussion about justice of the postulates which are been its basis and their consequences. Attempts to answer these questions from positions classical and the quantum mechanics (QM) encounter a contradiction with electrodynamics that, actually, and became the reason of deep crisis of theoretical physics.

Search of a compromise between QM and TR will proceed, apparently, beyond all bounds long if "scientific community" doesn't realize that not only the mechanics, but also electrodynamics have to follow as the investigation of the uniform physical doctrine considering quantum mechanics and the theory of relativity as special cases of mechanics of discrete processes and relativistic speeds. To do this, it is necessary to change the research methodology and move on to the deductive method and the system approach, which requires studying the subject of research "from the general to the particular" and "from the whole to the part".

The closest to these requirements is so-called " energodynamics " [1] today. She represents result of consecutive generalization of classical thermodynamics [2] at first on non-uniform environments [3] and non-static (irreversible) processes of transfer of any forms of energy in them [4], and then – on processes of useful transformation of energy in thermal and not thermal engines $. This theory extends the deductive thermodynamic method of researches based on properties of characteristic functions of an object of a research in general [5] to the isolated non-uniform polyvariant systems including all set of the interacting (mutually moving) material objects. At the same time, it does not exclude from consideration any (irreversible or reversible) part of real processes[1]. So general approach along with classical concepts of space as a receptacle "all real", does excessive attraction of any postulates SRT and GRT and allows to compare their conclusions with classical thermodynamics which consequences have character of indisputable truths.

II. Methodological Features of «Energodynamics»

Energodynamics as the uniform theory of real processes of transfer and transformation of any forms of energy denies a priority of the hypothetical inertial reference systems (IRS) as in the Universe rotary motion prevails for which there is a preferable reference system. Together with it is denied also the need of record of physical laws for a form, invariant in relation to IRS. This idea is proved only by the fact that "we have no opportunity to be convinced of whether we participate in such movement or not" [8]. Leaning on the same argument, energodynamics puts forward "*the principle of absoluteness*": *physical laws should be written down in a reference system which doesn't change at course of the studied processes*. Otherwise, obviously, internal (own) energy of U isolated systems as function of her parameters changes with change of a state RS in violation of the law of her preservation. For this reason in classical thermodynamics the temperature T, pressure p and entropy S are measured only in an absolute scale, which zero correspond to full degeneration (disappearance) of the thermal movement [2].

As such "absolute" reference system (ARS) of the power loudspeaker considers any point of the motionless (Newtonian) space occupied by the isolated system and also any material object in him which state remains with an acceptable accuracy invariable during course of the studied process. Such space isn't material and is considered as the scene which is containing in

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1. In contrast to the so-called "pseudo-thermostatics" of W. Thomson [6] or the "quasi-thermodynamics" of L. Onzager [7].

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itself all characters, but not participating in the action played by them.

Other feature of energodynamics is the refusal of the concept of hypothetical "conservative" systems accepted in all "classical" theories [9-11]. It is reached by consideration as an object of a research of such set of material objects which with an acceptable accuracy can be considered the isolated system. Her energy remains to *U* invariable despite the spontaneous nature of all processes proceeding in her that created the known problem of thermodynamic inequalities [2].

Further, energodynamics refuses crushing of non-uniform system on an infinite set of conditionally equilibrium elementary volumes to which the mechanics of continuous media [12], non-equilibrium thermodynamics [13], the theory of a warm mass exchange [14] and some other disciplines resort, obviously or implicitly based on a hypothesis of local equilibrium [15]. Thanks to it energodynamics avoids loss of so-called "backbone communications" which are peculiar to system in general and obviously are absent in each her part. It, by fair recognition of A. Poincare, was the reason "the biggest and deepest shock which was felt by physics since the time of Newton" [8].

At last, energodynamics complements a deductive method of a research (from the general to the particular) with system approach (from whole to a part) that allows her to receive the consequences of the most general character having the same status of indisputable truths, as classical thermodynamics [2]. These methodological features of energodynamics allow her to avoid many paralogisms peculiar to "post-classical" thermodynamics [16].

Being free from hypotheses and postulates, energodynamicstakes as a principle the constructions "axiom legibility" of the processes. In accordance with centuries of experience, it reflects the *opportunity to distinguish by means of all arsenal of experimental means independent processes not only for the reasons of their emergence and character, but also on that special, phenomenologically distinguishable and irreducible to other changes of a condition of system which they cause.* This axiom allows to prove (by contradiction) the theorem according to which number of arguments of own energy *U* any systems are equal to number of the independent processes proceeding in it.

Thanks to this theorem the general scientific methodological "principle of compliance" acquires more concrete contents and more rigorous mathematical form which prevents attempts to present energy of the isolated system *U* as missing or excess number of arguments[1)].

From here follows, in particular, that if in non-uniform systems processes of redistribution in its volume of the *V* any extensive sizes Θ_i proceed (the mass of *M*, the number of moles of *k*-th substances N_k, their entropy S_k, the charge $\mathcal{Z}_k$, impulse of their relative movement $\mathbf{P}_k$, etc., then along with these parameters needs introduction generally of the same number *n* of additional parameters of "spatial heterogeneity" $\mathbf{Z}_i$. Such parameters called by us "*the moments of distribution of the energy carrier* Θ_i" are in power dynamics on situation shift the radius vector of $\mathbf{R}_i$ of their center concerning his starting position of $\mathbf{R}_{io}$ in uniform system:

$$\mathbf{Z}_i = \Theta_i(\mathbf{R}_i - \mathbf{R}_{io}) = \int(\rho_i - \overline{\rho}_i)\mathbf{r}dV \qquad (1)$$

Here $\rho_i = d\Theta_i/dV$ and $\overline{\rho}_i = \Theta_i/V$ - the local and average density of parameter Θ_i as quantitative measure of the carrier of any *i*-th form of energy U_i; $\mathbf{R}_i - \mathbf{R}_{io}$– shoulder of the moment $\mathbf{Z}_i$; r – the running (Euler) spatial coordinate. As the provision $\mathbf{R}_{io}$ remains invariable at any internal processes in system and coinciding with the center occupied by the isolated system of volume of *V*, it can be accepted for absolute zero counting of any $\mathbf{Z}_i$ parameter.

Thanks to introduction of such "moments of distribution" of $\mathbf{Z}_i = \Theta_i\mathbf{R}_i$ the classical method of a thermodynamic research of processes on the basis of system parameters as whole manages to be extended also to non-uniform (internally nonequilibrium) systems. At the same time the full differential of internal energy of system *U* as the sums of "partial" energies of all its *i*-thforms $U = \Sigma_i U_i(\Theta_i, \mathbf{R}_i)$can be represented in the form of the identity [1]:

$$dU \equiv \Sigma_i \Psi_i d\Theta_i - \Sigma_i \mathbf{F}_i \cdot d\mathbf{R}_i, \qquad (2)$$

where $\Psi_i \equiv (\partial U/\partial\Theta_i)$ is the volume-averaged value of the generalized potential of the system ψ_i (the absolute temperature *T* and pressure *p*, the gravitational potential ψ_g, the chemical μ_k and the electric φ_k potential of the any *k*-th substances, the components υ_k of the relative velocity $\boldsymbol{\upsilon}_k$ of their displacement, etc.); $\mathbf{F}_i \equiv -(\partial U/\partial\mathbf{R}_i)$ - forces in their all-physical understanding; $i = 1,2, \ldots, n$ is the number of independent forms of energy of all components or a phase of the system.

In isolated systems, the identity (2) vanishes, reflecting the law of conservation of their energy. In the particular case of homogeneous (internally equilibrium) systems (where $d\mathbf{R}_i = 0$), it goes over to the generalized equation of the first and second principles of the equilibrium thermodynamics of complex (multivariant) systems [2]. Such a form emphasizes the conservation of the energy of the system when it is exchanged with the environment in the form of heat $\delta Q = TdS$, the expansion work $\delta W_p = pdV$, the work of inputting the any *k*-th substance $\delta W_k = \mu_k dN_k$, its charge $\delta W_e = \varphi_k d\mathcal{Z}_k$, and so on.

1. In particular, this is the hypothesis of local equilibrium, which justifies the description of a nonequilibrium system by the same variables as in equilibrium; the theory of "hidden variables"; the concept of an "orientable point", etc. This is the source of most of the methodological errors of modern theories [1].

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In the isolated systems the identity (2) vanishes in zero, reflecting conservation law of their energy. In that specific case uniform (internally equilibrium) systems (where $d\mathbf{R}_i = 0$) it passes into the generalized equation of the 1st and 2nd beginnings of equilibrium thermodynamics of difficult (polyvariant) systems [2]. At the same time members of the first sum (2) gain sense of elementary heat exchange $\delta Q = TdS$, expansion works $\delta W_p = pdV$, works of input of any k-th substance $\delta W_k = \mu_k dN_k$ or his charge $\delta W_e = \varphi_k d\mathcal{Z}_k$, etc. We combine all these kinds of influences into one category of disordered works δW_i^n, since they are not connected with overcoming the resulting $\mathbf{F}_i$ internal forces:

$$\delta W_i^n = \Psi_i d\Theta_i. \qquad (3)$$

The work described by the second sum (2) has a fundamentally different character:

$$\delta W_i^e = \mathbf{F}_i \cdot d\mathbf{R}_i = \mathbf{X}_i \cdot d\mathbf{Z}_i. \qquad (4)$$

It is distinguished by the presence of the resultant $\mathbf{F}_i$ and is related to the directional displacement $d\mathbf{R}_i$ of the energy carrier Θ_i in the process of its redistribution through the system and therefore is in the energodynamics by the ordered work δW_i^e. It is this category of work that is considered in mechanics, electrodynamics, and thermodynamics of irreversible processes (TIP) [17]. In this case, the basic for the TIP concepts of the flow $\mathbf{J}_i$ acquire a sense of an impulse of the energy carrier Θ_i:

$$\mathbf{J}_i \equiv d\mathbf{Z}_i/dt = \Theta_i d\mathbf{R}_i/dt = \Theta_i \boldsymbol{\upsilon}_i \qquad (5)$$

and "the thermodynamic force"

$$\mathbf{X}_i \equiv -(\partial U/\partial \mathbf{Z}_i) = -\Theta_i^{-1}(\partial U/\partial \mathbf{R}_i) = \mathbf{F}_i/\Theta_i \qquad (6)$$

– sense of tension of the field of temperatures, pressure, chemical, electric, gravitational etc. potential.

Such a generalization of the law of conservation of energy by the identity (2) makes it possible to carry out the synthesis of classical thermodynamics with mechanics and other disciplines that operate with the concept of force $\mathbf{F}_i$ and obtain the most important principles, laws and equations of these disciplines as consequences of energodynamics [18].

III. Generalization and Unification of the Concept of Force

Theory of Relativity (TR) and quantum mechanics (QM) have abolished a concept of force, fundamental for a number of basic disciplines, as the causes of this or that process. At the same time TR has attributed the reason of their emergence for curvature of space, and QM has gone further away, having changed a concept of work as quantitative measure of process of power transformation for exchange interaction. In standard model this interaction is carried out by emission and absorption of bosons (elementary particles - interaction carriers). As their properties in process don't change, exchange interaction can carry out only the power transfer described by the 1st sum of identity (2), but not the transformation of energy demanding presence of forces of $\mathbf{F}_i$ and change of the energy carrier from any i-th on j-th. Thereby TR and QM have ceased to perform the most important function of science – to explain these or those phenomena. Already one it deprives of the bases of their claim to be a basis of fundamental disciplines.

Otherwise the situation with energonomics which develops is and deepens idea of forces. Though from her positions action is always equal to counteraction, his result depends on that what forces of the nature counteract the applied (active) force $\mathbf{F}_i^a$. If force of reaction $\mathbf{F}_i^r$ has the same i-th nature ($\mathbf{F}_i^r = -\mathbf{F}_i^a$), the system remains in balance. Such is, for example, force of reaction of a support. However if among the counteracting forces of reaction there are forces other, j-th nature, for example, dissipative force $\mathbf{F}_j^d$, then there is a transformation of i-th form of energy U_i into U_j corresponding to it. There of the total force of $\mathbf{F}=\mathbf{F}_i+\mathbf{F}_j$ becomes the power transformation process reason. Thanks to it energonomics gains ability to distinguish ordered work of W_i^e as a quantitative measure of process of transformation of energy from the disordered work of W_i^n as a quantitative measure of process of her transfer. More clear is also a sense of the 1st and 2nd sums of identity (2).

According to identity (2), any force of $\mathbf{F}_i$ is determined by a uniform image as derivative of energy of system U by the corresponding parameter of spatial heterogeneity of system (1). Such is, in particular, force of inertia $\mathbf{X}_\upsilon$, defined as derivative of kinetic energy $U_k = M\boldsymbol{\upsilon}^2/2$ on the moment of distribution of mass of $\mathbf{Z}_m = M\mathbf{R}_m$, that taking into account $d\mathbf{R}_m = d\mathbf{r}$ leads to expression [1]:

$$\mathbf{X}_\upsilon = -\partial U^k/\partial \mathbf{Z}_m = -\boldsymbol{\upsilon}\cdot\nabla\boldsymbol{\upsilon} \qquad (7)$$

This expression indicates specifications of a concept of acceleration, which is determined in Newton's mechanics as full derivative of speed $\boldsymbol{\upsilon}$ by time t. For this purpose we will present to $d\boldsymbol{\upsilon}/dt$, as usual, in the form of the sum local $(\partial\boldsymbol{\upsilon}/\partial t)_\mathbf{r}$ and a convective component $(\boldsymbol{\upsilon}\cdot\nabla)\boldsymbol{\upsilon}$. As to accelerate a body, without moving it in space, it is impossible, $(\partial\boldsymbol{\upsilon}/\partial t)_\mathbf{r} = 0$, and $\boldsymbol{a} = (\boldsymbol{\upsilon}\cdot\nabla)\boldsymbol{\upsilon} = \nabla(\upsilon^2/2)$.Therefore, in Newton's mechanics it would be necessary to understand any increase in kinetic energy of a body including connected with acceleration of rotary motion as acceleration. It follows also from expression a speed vector gradient $\nabla\boldsymbol{\upsilon}$ as

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tensor of the second rank which includes a vortex component. Mean while still accelerated call also uniform rotation of a body, meaning change of the direction of speed and so-called "centripetal acceleration", mistakenly predicting on this basis inevitable falling of an electron on an atomic nucleus.

Offered by energodynamics unification of a concept of force results in understanding that any force field of $\mathbf{F}_i(\mathbf{r})$ or $\mathbf{X}_i(\mathbf{r})$ is generated not by the masses, charges or currents in itself, and their uneven distribution in space. At the same time becomes obvious that not scalar, vector or tensor fields as functions of their distribution in space [18], and their carriers are material. It isn't less important that distribution of a concept of force on the phenomena of any nature allows to carry out synthesis of classical and nonequilibrium thermodynamics with the mechanics and other disciplines operating with a concept of force $\mathbf{F}_i$ and to receive the major principles, laws and the equations of these disciplines as a result of energodynamics [19].

IV. Incompatibility of the Newtonian and Relativistic Understanding of the Mass

According to the all-physical principle of compliance, I. Newton's mechanic should consider a special case of power dynamics in the annex to rectilinear motion of bodies. At such (deductive) approach the mass of M should be considered one of energy arguments that quite corresponds to her Newtonian understanding as as "measures of amount of matter proportional to density and its volume" [9]. It is easy to notice also that the definition of force given by Newton

$$\mathbf{F}=d\mathbf{P}/dt = M\boldsymbol{a}, \qquad (8)$$

is a consequence of expression of $\mathbf{F}= - M\mathbf{X}_v$(7) in the conditions of constancy of mass of M put in expression of an impulse $\mathbf{P} = M\boldsymbol{\upsilon}$ and private derivative $\partial U^k/\partial \mathbf{R}_m$. Thus, the law of force (8) didn't determine the size $\mathbf{F}$ as inertia force at all, and the interpretation of coefficient of proportionality between force and acceleration of M as measures of inertial properties isn't proved at all. (8)

On the other hand, the mechanic Newton it was limited to consideration of conservative systems, i.e. I neglected dissipation. In this regard she really demands adjustment as expression (8) assumes that acceleration $\boldsymbol{a}$ is the only consequence of action of active force of $\mathbf{F}$. In that case the proportionality coefficient between it and the speed of change of an impulse of $d\mathbf{P}/dt$ in (8) is equal to unit and could be lowered. However from positions of nonequilibrium thermodynamics of polyvariant systems any thermodynamic force of $\mathbf{X}_i$ generates all possible $\mathbf{J}_j$ streams in it. It is considered by record of phenomenological laws in the form of [7, 13, 15, 17]:

$$\mathbf{X}_i=\Sigma_j R_{ij}\mathbf{J}_j, \qquad (9)$$

where R_{ij} are the so-called phenomenological coefficients characterizing the resistance of any i-th force from the j-th stream side.

It is possible to show that for each of members of the sum (9) these coefficients are the efficiency functions η_j the corresponding process of transformation of energy which can be determined as power relation $N_j = \mathbf{F}_j\cdot\mathbf{J}_j$ at the converter exit to power $N_i = \mathbf{F}_i\cdot\mathbf{J}_i$ on his entrance:

$$\eta_j = N_j/N_i = \mathbf{F}_j\cdot\mathbf{J}_j/\mathbf{F}_i\cdot\mathbf{J}_i. \qquad (10)$$

If to accept according to Newton's law (8) $\mathbf{J}_j=d\mathbf{P}/dt = \mathbf{F}_j$ and $\mathbf{J}_i=\mathbf{F}_i$, then $\eta_j = (\mathbf{F}_j/\mathbf{F}_i)^2$, and the thermodynamic form of this law takes a form:

$$\mathbf{F}_i=\eta_j^{-½}d\mathbf{P}/dt. \qquad (11)$$

Expression (11) considers inevitable losses in the course of acceleration of a body (irreversibility of this process). It is fair for any converter of energy including for the accelerator of charged particles. Then becomes obvious that with approach by the speed limit of distribution of indignations in any environment (in this case to velocity of light c) when $d\mathbf{P}/dt\rightarrow 0$, coefficients $R_{ij}\rightarrow \infty$, and $\eta_j \rightarrow 0$.

The vanishing of the efficiency of the acceleration process is due to the fact that when the limiting speed of the material object is reached, no force $\mathbf{F}$ can lead to its further increase any more. In accelerators of charged particles this corresponds to the attainment by the particles of the limiting velocity, when all the power supplied to them is expended on replenishment of losses. This provision fully applies to Kaufman's experiments on electron acceleration [20], explaining the apparent increase in mass by a decrease in the efficiency of the acceleration process.

Thus, with growth of speed the acceleration process efficiency, but not accelerated masschanges. It is especially easy to be convinced of inadmissibility of relativistic change of mass with a speed υ from positions of conservation law of mass of the isolated system. Whatever processes happened in such system, including processes of relative acceleration or braking of components of system, their mass remains invariable. Therefore, dividing it into "rest mass" and "relativistic", "inertial" and "gravitational", "longitudinal" and "transverse", "electromagnetic" and any other is equivalent to substituting the law of conservation of energy with the law of "interconversion" of the masses.

V. Inconstancy of Light Speed

The postulate on constancy of velocity of light in emptiness returns us by Epicurus's times when existence of space, free from the material media was supposed. However this assumption doesn't maintain criticism from positions of modern knowledge. Really, if

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in space there are though any material objects exchanging among themselves radiant energy, then it isn't "empty" any more. Moreover, kind of we imagined the radiation carrier – the ether, a physical vacuum, the electromagnetic field, gas of photons, the hidden matter, etc. – he also fills this space. In any case, we can't exclude the intergalactic environment in which this light actually spreads from consideration. Besides the fact of a curvature of a trajectory of beams known since the time of D. Michel (1783), demonstrates change of the direction of a vector of speed. In that case and the movement of rays of light it would be necessary to consider accelerated, as well as any other curvilinear movement. From this point of view even the phenomenon of "gravitational lensing" recognized GRT testifies against a postulate on constancy of velocity of light.

At such formulation of the question the contradiction of the mentioned postulate to experimental data and theoretical representations whatever (wave or corpuscular) we adhered to the concept is found at once. Really, according to the theory of fluctuations [21] confirmed in huge number of cases, a square of speed of distribution of indignations (in this case velocity of light *c*) is determined private energy of elastic deformation of the environment of distribution of indignations, derivative of density, ρ_u by its density ρ:

$$c^2 = \partial\rho_u/\partial\rho. \qquad (12)$$

This derivative is equivalent to a private derivative ($\partial U/\partial M$) in identity (2) which is defined in the conditions of constancy of all other arguments of energy of *U*, including system *V* volume. Therefore expression (12), as well as identity (2), is fair for any material environments having elasticity. However, this partial derivative can't be considered "a priori" not depending on density and other parameters of the intergalactic media especially in conditions when the local density of this Wednesday changes on many orders. This speed and from positions of the corpuscular theory of light as in her she depends on the frequency of "collision" of these corpuscles, and taking into account existence in this environment of material bodies – and from duration of process of reradiation, i.e. eventually from environment density can't be considered as a constant. Thus, the assumption of constancy of velocity of light contradicts the representations which have developed for centuries and it can't be accepted without proofs.

Even more serious is the contradiction of a postulate of A. Einstein on limitation of speed of distribution of indignations in any environments of velocity of light in a page vacuum. This postulate obviously contradicted data of Laplace (1805) who on the basis of the fact of stability of solar system has for the first time shown that the speed of distribution of gravitational ("Newtonian") interaction can't be lower than $5 \cdot 10^7$ speeds of light [22].

In 1948 the Russian astrophysicist N. Kozyrev has found existence in the Universe of the radiation getting through the closed metal shutters of the telescope and the object advancing the optical image [23]. In the 90th years this result has been confirmed by group of researchers of RAS [24].

Other phenomenon illustrating a possibility of speeding of light was the so-called "tunnel effect" [25]. Moreover, in [26] it is reported about an experiment in which the laser beam went out of the camera with cesium vapors still before he has entirely entered it. This phenomenon is interpreted as a result of "saving of time" due to the choice of the shortest way.

Within the last decades the XX centuries in far space of radio - and x-ray telescopes many objects (quasars and galaxies) which throw out substance streams with a speed exceeding velocity of light several times are revealed. Now there are data confirming excess by gravitation of velocity of light on 11 orders and more. In a number of cases, the "superluminal" velocities could even be measured [27].

There is no lack of data and on inconstancy of velocity of light. In the 50th years the founder of astrospectroscopy A.A. Belopolsky has opened that the light spectrum is displaced near bright stars that demonstrated change of speed of electromagnetic waves depending on properties of the environment [28]. The interstellar dispersion of speed of electromagnetic waves found by him has also been repeatedly confirmed further. It turned out that EM-waves with a frequency below 100 KHZ have speed significantly below than size of $3 \cdot 10^8$ m/c.

In the 60th years inconstancy of velocity of light has been confirmed at a radar-location of Venus. In the conditions of an error of the radar of ±1,5 km and the maximum error of an experiment because of rotation of Earth in 260 km the actual variability of data of measurements of velocity of light on different sites of her orbit was 2000 km. [29].

In 2016 all scientific world has been shocked by opening of R. Santilli who has designed the telescope with concave lenses and has received with his help repeated images of the same star in different points of an orbit in the form of "a pearl necklace" because of distinction of speed of distribution of radiation [30].

It isn't less certificates and delay of light. In 1982 the Australian scientific B. Setterfield has paid attention to monotonous decrease of the measured light speeds within the last 300 years [31]. Other strange thing was found by means of the «MAGIC» telescope by the international group of researchers of the galaxy "Markarian 501". Astronomers "have sorted" the gamma photons arriving from there with each flash on low - and high-energy and have found out that at the simultaneous

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radiation high-energy particles arrive with lateness about 4 minutes [32].

In 1999, “Natura” published a scientific article detailing the experiment, in which the speed of light was reduced to 17 meters per second [32]. Nevertheless, the "scientific community" continues to persist in not recognizing an environment that is not reducible in its properties to ordinary (baryon) matter, preferring to it a "void" covered with a fig leaf of "physicality".

VI. The Nonequivalence of Mass and Energy

According to the relation (12), which follows from the theory of oscillations, the square of the propagation velocity of perturbations in elastic media is determined by the partial derivative of the energy density ρ_u of this medium with respect to the density of this medium ρ itself. This means that this derivative depends in principle on all other arguments for the energy of this medium, including its density ρ, temperature T, composition, and so on. Only for media in which the density ρ is the only state variable, the partial derivative $(\partial\rho_u/\partial\rho)$ goes over into the total $d\rho_u/d\rho$, the integration of which, taking $E = \int \rho_u dV$ and $M = \int \rho dV$, leads to expression

$$E = Mc^2. \tag{13}$$

Such a luminiferous medium in the representation of the physicists of the nineteenth century was the ether as an elastic medium possessing a nonzero density ρ whose oscillations propagate at the speed of light c. Therefore N. A. Umov back in 1874, on the basis of the law of conservation of energy and mass of the system consisting of a radiating body and ether, related the decrease in the total energy of the body dE and its mass dM in the process of radiation with increasing kinetic energy of the ether $dE_k = (½)c^2dM$, the relationship between them of the form [34]:

$$E = Mc^2/2. \tag{14}$$

W. Thomson in 1881 derived a similar expression $dE = (3/4)c^2dM$, taking into account the ideas of that time about the existence of an "electromagnetic mass" of electrons [5]. The expression currently used

$$E = Mc^2. \tag{15}$$

was obtained by O. Heaviside (1890) on the basis of the concept of the flux of radiant energy in ether as the product of the light pulse $P = Mc$ by its velocity c [35]. To the same conclusion came A. Poincaré (1900) and F. Hasenohrl(1904).

A. Einstein in 1905 extended this expression to any form of energy, postulating the constancy of the speed of light and calling expression (17) "the principle of equivalence" of mass and energy [36]. According to him, anybody with energy E (including a photon) has a mass $M = E/c^2$, which grows not only with increasing kinetic energy of the material system, but also with any form of its rest energy E_o. Conversely, an increase in any form of energy of the system E entails an increase in its mass M. In this connection, the concepts of the "relativistic mass" M_ρ, "rest mass" M_o, "inert", "electromagnetic", "gravitational" etc. masses.

This classification is based on the use of the Planck system of units (where $c = 1$), which makes each form of energy U_i equivalent to the mass M_i of its energy carrier Θ_i. Meanwhile, it is known that any form of energy has a quantitative and qualitative measure, i.e. is characterized not only by the value of Θ_i, but also by the corresponding potential ψ_i, so that the equivalence of the energy E to the mass M does not yet imply the equivalence of $U_{i½}$ to the mass M_i. This circumstance reveals the complete inconsistency of the substitution of the additivity of the partial energies U_i by the additivity of their masses M_i.

A different conclusion follows from the energy dynamics of isolated systems. It proceeds from the premise that all forms of the ordinary (baryonic) matter of the universe are the product of the "condensation" of non-baryonic (hidden, unobservable) matter, no matter what we call it - ether, electromagnetic field, physical vacuum, photon gas, etc. This immobile material medium has a single (gravitational) form of energy, which depends on its density ρ. For such a medium, the partial derivative $\psi_m = (\partial U/\partial M)$, which determines the gravitational potential of the system, goes over into the total derivative $\psi_m = dU/dM$, its integration leads to the expression

$$U = \psi_m M. \tag{16}$$

Since in the isolated system $U = E_o$ and $M = M_o$, under the conditions of volume constancy $(\partial U/\partial M) = (\partial \rho_u/\partial\rho) = c^2$, expression (16) can be written in the form

$$E_o = c^2 M_o. \tag{17}$$

To this expression, an increasing number of researchers are now inclined, believing, however, the speed of light with a constant [37]. The mass in this expression does not change with velocity, becoming Einstein's measure of the stored energy of the body. However, in the more general case of an intergalactic medium as a carrier of light, the rate of propagation of perturbations (oscillations) in it in accordance with experiment becomes different, which leads to a violation of the principle of equivalence of mass and energy.

VII. The Non-Geometric Nature of Gravity

According to the identity (2), not only gravitational forces, but also any other forces disappear

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under a uniform energy distribution in space. This is also true for velocity fields, as follows from (8). Let us show now that it does not contradict the law of Newton gravity $F_g = GmM/R^2$, according to which the gravitational potential ψ_g at a distance R from the center of the "field-forming" body of mass M is determined by the expression:

$$\psi_g = -GM/R, \quad (18)$$

where G is the gravitational constant.

Since in the intergalactic space with a continuously distributed mass there are neither "field-forming" M nor "test" masses $m \ll M$, we consider the sphere of unit volume V_o with radius R_o and mass $M_o = \rho V_o$. For it, the potential (15) at any point of its surface is equal to:

$$\psi_{go} = -(GV_o/R_o)\rho. \quad (19)$$

From (19), in view of the constancy of (GV_o/R_o), it follows that the acceleration of the gravitational field $\mathbf{g} = -\nabla\psi_g$ can be represented as a function of the density of the intergalactic medium:

$$\mathbf{g} = (GV_o/R_o)\nabla\rho = \psi_{go}\nabla\rho/\rho, \quad (20)$$

where $\psi_{go} = G\rho V_o/R_o$ is the Newtonian gravitational potential on the surface of a sphere of unit volume, equal in the system SI $\sim 10^{-34}$ m^2 s^{-2}.

A similar conclusion about the proportionality of the acceleration g to the relative density gradient of the medium $\nabla\rho/\rho$ follows from the energy dynamics. Indeed, in accordance with the identity (2) for $d\mathbf{R}_m = -d\mathbf{r}$, the gravitational force $\mathbf{F}_g$ is determined by the gradient $(\partial U/\partial \mathbf{r})$ of the energy $U = c^2\rho V_o$ and is equal to $c^2 V_o \nabla\rho$. In this case, $\mathbf{F}_g/V_o = \rho\mathbf{g} = c^2\nabla\rho$, and we arrive at the modified form of Newton's law [38]:

$$\mathbf{g} = c^2\nabla\rho/\rho. \quad (21)$$

Comparing expressions (20) and (21), we find that for an intergalactic medium with an average density $\rho \sim 10^{-24}$ kg m^{-3}, the acceleration of the gravitational field, determined by expression (21), is at least 40 orders of magnitude greater than that found from Newton's law in form (20). This is explained by the fact that Newton's law of gravitation takes into account only the pair interaction of gravitating bodies, while (21) takes into account the interaction of all structural elements of non-baryonic matter. Thus, the modified Newton's law (21) confirms the presence in the intergalactic space of a gravitational field that is not inferior in intensity to the field of internuclear forces. The latter testifies to the unity of the nature of "strong gravity" and "strong interaction".

The origin of gravity resulting from energy dynamics as a consequence of the uneven distribution of matter in space was confirmed by recent studies of 240 galaxies of various types, according to which the distribution of ordinary (baryonic) matter in them is closely correlated with gravitational acceleration [39]. Along with the discovery of "strong gravity," this explains many of the processes observed in the universe: amplification of in homogeneities in the gravitational field ($\nabla\rho \neq 0$) upon their spontaneous generation; the presence of baryon acoustic oscillations in the intergalactic medium [40]; the presence in the Universe of vast regions (voids) free of baryonic matter (which is due to "gravitational equilibrium" ($\nabla\rho = 0$), that is, the absence of conditions for densification of the intergalactic medium, the ordered distribution of clusters of galaxies in the form of concentric circles [41]; their expansion with predominance of repulsive forces ($\nabla\rho < 0$); condensation of regions with predominance of gravitational forces ($\nabla\rho > 0$); formation in areas of increased density of gas-dust clouds, nebulae, stars, galaxies and their clusters; formation of "black holes" from non-baryon (unobservable) matter in the centers of galaxies; the emergence of "jets" when baryon (radiating) matter appears in them; the presence of a non-visible halo at the periphery of galaxies; the nature of their rotational curves; gradual weighting of planets as accretion of interstellar matter accreted to them; flow in the depths of stars of thermonuclear reactions; gradual weakening of gravitational forces as the stars become denser; the explosion of "supernovae" when the internal pressure in the stars exceeds the gravitational forces and much more [42]. All this distinguishes the energodynamic theory of gravity from general relativity, which generates more riddles than answers.

VIII. Discussion of Results

It is known that the principle of relativity of Galilei (1632) claimed that the uniform and rectilinear motion of one system of material bodies is relative another doesn't affect the course of the mechanical processes happening in them at all. material systems. It is easy to notice that in essence this principle is reflection of indistinguishability of a condition of rest or the movement of system "by inertia" when she is affected by no forces, and her parameters $\mathbf{P}$ and $\mathbf{R}_m$ remain invariable.

Absolutely other business if to adhere to the principle of legibility of processes and to use motionless RS in which these states are obviously distinguishable ($\mathbf{P} = 0$). Newton also adhered to this position, claiming that "any body continues to keep at rest or the uniform and rectilinear motion, so far and as it isn't forced by the applied forces to change this state" [9].

Therefore, the main point in what task is set for himself by the researcher: to distinguish processes for the purpose of their subsequent studying, or to make them indiscernible to subordinate to the theory of groups. The mathematician A. Poincare has preferred

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the last option and in 1895 has extended the principle of relativity (i.e. indistinguishability) to the electromagnetic phenomena. It is quite natural that in inertial RS physical laws will have the same appearance. However, this does not follow at all that these laws have to be submitted so that the studied phenomena were indiscernible. On the contrary, all centuries-old experience prompts that these laws should be written down in such SR in which they look more simple and understandable.

Meanwhile A. Einstein in 1905 has preferred an opposite way and after A. Poincare has extended his postulate of relativity on all phenomena of nature.In so doing, he put in the basis of the special theory of relativity (STR) a postulate on independence of velocity of light of the direction of his distribution in space and from the movement of his sources, without having attached significance to the fact that it and is recognition of its absoluteness.

Soon he has formulated the principle of local indistinguishability of gravity and forces of inertia, having called it the principle of equivalence of inertial and gravitational masses and having put it in the basis of the general theory of relativity (GTR). Then the principle of indistinguishability of the accelerated and rotary movements which has allowed to approve indistinguishability of dynamic effects of acceleration and inclination in not inertial reference systems has joined him.

So the Galilean thesis about indistinguishability of rest and the uniform rectilinear motion in own reference system became the initial principle of theoretical creation of all physics and criterion of "scientific character" of a research. In electrodynamics this was expressed in principle indistinguishability of electrons in metal; in physics of elementary particles – in principle indistinguishability of identical particles; in KED – in indistinguishability of substance and the field; in the uniform theory of the field – in a statement about merges together (up to full indistinguishability) at least three of four known types of interaction. As a result, the known idea of Leibniz about absence in the nature of two absolutely identical things has been forced out by his antipode - the principle of indistinguishability. His postulation has made understanding of physical processes optional and considerably illusory that eventually has led to not distinction of the truth and delusions.

It would seem, along with Newton's mechanics which was really needing correction at least in view of prevalence of rotary motion, there was thermodynamics about which A. Einstein spoke as of the only theory of the general contents which investigations never and will be disproved by nobody. From it, on the basis of the principle "self-destructive of equilibrium" (its "zero start" [2]), there followed the existence of a single ("absolute") SR satisfying the law of conservation of energy when it was exchanged between the system and the environment. However, with the approval of A. Einstein, it was also subjected to revision in relativistic thermodynamics, which led to a number of paralogisms [16]. This became evident only from the standpoint of energodynamics as a "theory of absoluteness" and the successor of thermodynamics. In this regard energodynamic approach to a problem of gravitation is the alternative deserving attention TR marking return of physics on the classical way of development.

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Mende Parametric Electric Generator

By F. F. Mende

Abstract- From an energy point of view its transfer on the direct current is the most advantageous method of the transfer of the large volumes of electric power up to the great distances. However, up to now there does not exist such direct-current generators, which are capable of generating the necessary level of power with the lumped voltages. In this article this problem is solved. The law of capacitive parametric induction is assumed as the basis of the solution of problem.

Keywords: *current, voltage, capacity, capacitive parametric induction, direct-current generator, the transformer of constant voltage, water pump.*

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Mende Parametric Electric Generator

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Abstract- From an energy point of view its transfer on the direct current is the most advantageous method of the transfer of the large volumes of electric power up to the great distances. However, up to now there does not exist such direct-current generators, which are capable of generating the necessary level of power with the lumped voltages. In this article this problem is solved. The law of capacitive parametric induction is assumed as the basis of the solution of problem.

Keywords: current, voltage, capacity, capacitive parametric induction, direct-current generator, the transformer of constant voltage, water pump.

I. Introduction

Energy electrical systems include the generator of electrical energy (further generator) and electric power line (EPL). Since the electric transmission up to the great distances is accomplished with the aid of high-voltage EPL, and generators have low output voltage, the intermediate component between the generator and EPL is the high-voltage step-up transformer. All elements indicated have energy losses, and their calculation shows that into these losses they can reach 10% the percentages. Consequently, a question of reduction in these losses is very important.

In essence, EPL are used for the transfer of alternating current; however, the lines of direct current have smaller losses to capacitive and inductive components. Therefore EPL on the direct current build when necessary to betray the separately large volumes of electric power. IN the USSR were built several electric power lines of the direct current: High-voltage line of direct current Moscow- Kashira(project Elba); High-voltage line of direct current Volgograd- Donbass ; High-voltage line of direct current Ekibastuz- Center and other.

The absence of the high-voltage generators, which directly generate constant voltage of the assigned magnitude with the necessary level of power, is the essential problem of the creation of power systems on the direct current. Therefore it is necessary to at first manufacture electric power on alternating current with the low voltages, then, using high-voltage transformers, to increase voltage and with the aid of the high-voltage rectifiers to further manufacture direct current. All these intermediate components have energy losses, what is the basic problem of such systems. Moreover they are very complex from a design point of view.

From the aforesaid it follows that the creation of the high-voltage direct-current generators, which immediately can generate the voltage of the assigned magnitude with the necessary levels of power, is the key problem of contemporary electro-energetics. Up to now such generators are not created.

II. Operating Principle of Parametric Direct-Current Generator

If there is a capacitor, who'scapacity C, and this capacitor it is charged to a potential difference U, that the energy, accumulated in it, is determined by the relationship

$$W_C = \frac{1}{2} C U^2 \qquad (1.2)$$

But charge Q, accumulated in the capacity, is equal

$$Q_{C,U} = CU. \qquad (2.2)$$

From relationship (1.2) it is evident that if the charge, accumulated in the capacity, remains constant, then voltage on it can be changed by changing the capacity. In this case is fulfilled the relationship

$$Q_{C,U} = CU = C_0 U_0 = const,$$

where C, U- instantaneous values, and C_0, U_0- initial values of these parameters.

The voltage on the capacity and the energy, accumulated in it, will be in this case determined by the relationships:

$$U = \frac{C_0 U_0}{C} = K U_0, \qquad (2.3)$$

$$W_C = \frac{1}{2} \frac{(C_0 U_0)^2}{C}. \qquad (2.4)$$

Coefficient

$$K = \frac{C_0}{C}. \qquad (2.5)$$

It can be named the multiplication factor (transformation) of constant voltage.

The schematic of voltage transformer realizing the principle examined, is represented in Fig. 1.

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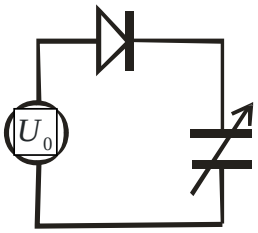

Fig. 1: Schematic of the transformer of constant voltage

In this diagram to the variable capacitor by means of the diode the dc power supply is connected U_0.

The incremental voltage, which can ensure this transformer, is determined from the relationship.

$$\Delta U_C = \left(\frac{C_0}{C} - 1\right) U_0 \ . \qquad (2.6)$$

As follows from the relationships (2.3) and (2.4) with the decrease of capacitance of capacitor on it increases not only voltage, but also the energy stored in it.

It should be noted that this transformer can work only in the regime of an increase in the voltage, since. With the attempt to obtain the decrease of voltage across capacitor this cannot be made for that reason that the diode ensures the straight connection of the voltage source to the capacitor and therefore voltage across capacitor decrease cannot.

An increase in the energy, accumulated in the capacitor, with a change in its capacity is determined from the relationship.

$$\Delta W_C = \frac{1}{2}\left(C_0 U_0\right)^2 \left(\frac{1}{C} - \frac{1}{C_0}\right) \qquad (2.7)$$

With a mechanical change in the capacitance of capacitor, the increase in the energy indicated ensures the spring mechanical energy source.

Properties of the transformer of constant voltage can be used for creating the high-voltage source of the direct current, whose diagram is given in Fig. 2.

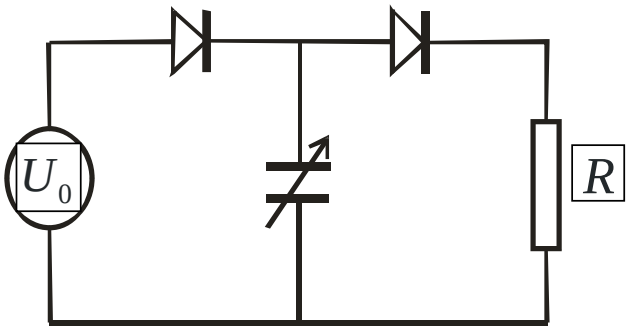

Fig. 2: Diagram of the high-voltage source of direct current

In this diagram is present still one diode and load resistance R.

In the initial state the capacitance of capacitor is equal C_0 and voltage on it equally U_0. At this time through the load resistance the current flows.

$$I_0 = \frac{U_0}{R} .$$

In this case the energy, obtained by capacitor from the voltage source, comprises.

$$W_0 = \frac{1}{2} C_0 U_0^2 \qquad (2.8)$$

As soon as capacitance of capacitor will begin to decrease, the secondary voltage, assigned by the relationship will appear on it (2.5). This secondary voltage through the right diode enters on the load resistance R. The additional energy, isolated in this case during the load resistance, is determined by the relationship (2.7). For computed efficiency's of this process, it is necessary to compare the energy, spent by the right voltage source on the charging of capacitor and the energy, isolated during the load resistance. In this case efficiency it is defined as the relation of relationships (2.8) and (2.7).

$$EF = \frac{\Delta W_C}{W_0} = \left(\frac{C_0}{C} - 1\right) 100\% \qquad (2.9)$$

In the following cycle proceeds an increase in the capacitance of capacitor from the values C to the values C_0. But voltage on it cannot be less than U_0 therefore the left voltage source begins to charge the being increased capacity. And up to the moment, when capacitance value reaches value C_0 voltage on it will be equal U_0. During this cycle the left voltage source will repeatedly consume the energy, determined by the relationship (2.8). In this case complete cycle to be completed and the system will return to the initial state.

The operating principle of the generator examined is such to the operating principle of the valve water pump, whose schematic is represented in Fig. 3.

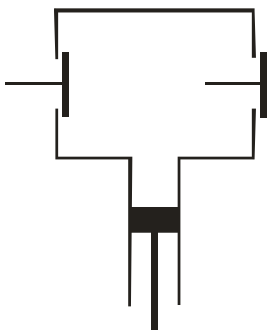

Fig. 3: Schematic of the valve water pump

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With the displacement of piston downward left release valve is opened, and water is sucked in into the cavity of pump. With the displacement of piston upward the water through the right release valve is ejected outside.

The role of valves in the schematic of the described generator diodes play, while the role of cylinder with the being moved piston performs variable capacitor.

Hence it follows that the basic problem of the creation of the proposed generator is the development of the capacitor, whose capacity changes with mechanical method. In this case the capacitor must have the great significances of initial and final capacity, also, with the large relation of these values. This question can be solved by the way of using the technology of the creation of the ceramic capacitors, when titanate of barium, which has very large dielectric constant, is used as the dielectric between the capacitor plates. The construction of the generator, in which is used the principle indicated, it is shown in Fig. 4.

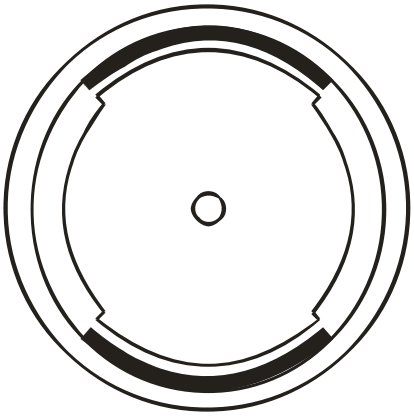

Fig. 4: The mechanical oscillator circuit, in which the inserts from titanate of barium are located on the internal surface of stator

In the given construction there is a figured rotor, and inserts from titanate of barium are located on the internal surface of cylindrical stator.

Let us calculate the practical construction of generator with the following parameters: the voltage of the voltage source $U_0 = 200 \ \ V$; the diameter of the rotor $D = 0.5 \ \ m$; clearance between the inserts of titanate of barium and the stator $d = 10\mu m$; the thickness of the inserts $25 \ \ mm$; the depth of turnings on the rotor $25 \ \ mm$; the speed of rotation of the rotor $n = 500 \ \ \frac{1}{s}$ (this rotational speed it is characteristic for the gas turbines); the length of the generator $L{=}1m$. The power, manufactured by generator will comprise

$$P = \frac{\pi\varepsilon nKDLU_0^2}{2d} \qquad (2.10)$$

During the record of this formula are taken into account the fact that in one revolution of rotor it occurs two cycles of a change in the capacity between the rotor and the stator.

The substitution of the assigned parameters into the formula (2.10) gives the power $34 \ \ kW$.

Efficiency generator, calculated according to the formula (2.9), comprises 50000%. This means that practically entire mechanical energy, spent on the rotation of the rotor of generator, is converted into the electrical energy.

The output voltage, which manufactures generator, calculated according to the formula (3.3) it will comprise $1 \ \ MV$. This voltage will be developed between the stator-rotor units, when the capacity between them is minimum. In order in this case to avoid electrical breakdown, the internal cavity of generator must be filled with air or another gas under the high pressure.

The optimal mode of operation of such a generator is the case where the RC time constant of the circuit, which is the load resistance and the maximum capacitance between the rotor and the stator, will be less than half the rotor rotation period. Then for the specified time the capacity will be discharged through the resistance, giving all its energy to the load.

None of the existing generators can ensure this high efficiency such high voltage without the use of the step-up transformers and rectifiers. Large simplicity of construction is the very great advantage of this generator.

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The type of generator in the section is shown in Fig. 5.

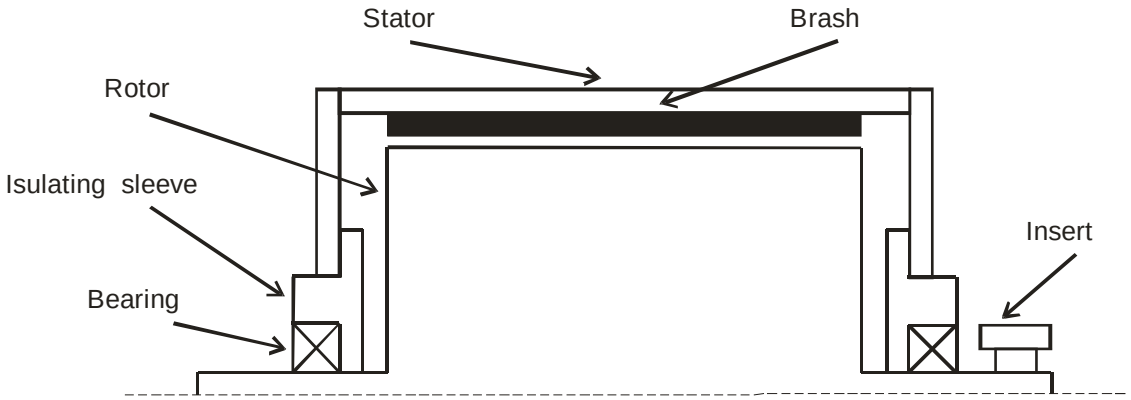

Fig. 5: Type of generator in the section

The insulating bush is located between the axis of rotor and the housing of stator. In this bushing the bearing is located. By lower its edge bushing slides along the axis of shaft, ensuring the vacuum seal between the internal cavity of generator and the atmosphere. The insert from titanate of barium is located on the internal part of the stator. The electrical contact between the axis of rotor and the external circuits brushes ensure.

III. Conclusion

In the article the operating principle is examined and is given the construction of the parametric electric generator, which gives the possibility to generate high constant voltage with the high level of power. The name of generator the production of constant voltage is connected with the fact that produced by the way of a mechanical change in the capacitance value of capacitor. The generator examined possesses large simplicity in comparison with the existing generators.

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Comparison of Density of States of Fermi Gas and Bose-Einstein Condensate in Single Valence Electron Bulk Metal Elements

By Gelana Chibsa & Appa Rao Vegi
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Abstract- The density of states of Fermi gas and density of states of Cooper pairs that form Boson Condensate have been compared. The derived density of states of Fermi gas is elucidated using literature in a cube of size L [1]. In this line, Cooper pairs are highly coherent and responsible for super conductivity[2]. The Cooper pairs form Boson-Einstein condensate of spin quantum number s-1[3], we obtained its density of states. The ratio of Cooper pair density of states to Fermi gas density of states has been derived. To obtain the relation between the two densities of states, the condition of high coherent Cooper pairs in Bose-Einstein condensate has been taken in to account. In addition, the fact that Fermions do not take same quantum states was employed while highly coherent Cooper pairs with s-1 do take same quantum states for they are Boson particles.

Keywords: *density of states, fermi gas, cooper pairs, bose-einstein condensate.*

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Gelana Chibsa [α] & Appa Rao Vegi [σ]

Abstract- The density of states of Fermi gas and density of states of Cooper pairs that form Boson Condensate have been compared. The derived density of states of Fermi gas is elucidated using literature in a cube of size L [1]. In this line, Cooper pairs are highly coherent and responsible for super conductivity[2]. The Cooper pairs form Boson-Einstein condensate of spin quantum number s-1[3], we obtained its density of states. The ratio of Cooper pair density of states to Fermi gas density of states has been derived. To obtain the relation between the two densities of states, the condition of high coherent Cooper pairs in Bose-Einstein condensate has been taken in to account. In addition, the fact that Fermions do not take same quantum states was employed while highly coherent Cooper pairs with s-1 do take same quantum states for they are Boson particles.

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I. Introduction

Under normal condition above transition temperature (*Tc)*electrons are Fermions and they are governed by Fermi-Dirac statistics. Fermions obey Paul's exclusion principle. To this end, no two electrons occupy same quantum state. At least two electrons possess different spin quantum numbers (s) even if their principal quantum number (n) and angular momentum quantum number (l) same. Spin quantum number of electron is½. Its degeneracy is given by: *2*s + 1 = 1; 2*½ + 1 = 2 or ½,-½.* In general each electron is described by distinct quantum numbers n, l, and s in an atom[4]. For an isolated atom these quantum numbers are obtained by solving the Schrodinger equation.

In Cartesian coordinates system the time independent Schrodinger equation is given by:

$$-\frac{\hbar^2}{2m}\nabla^2\,\Psi(x,y,z)+V(x,y,z))\Psi(x,y,z)=E\Psi(x,y,z) \qquad (1)$$

The case is different for bulk metal elements. In such case, the electrons are free to move inside the bulk metal elements up to the surface of the metal. Under this condition interaction potential energy is constant and it can be taken as a reference (V → 0). In other words the valence electrons are not interacting with the atoms in the bulk metal and become the Fermi gas. Using this assumption the Schrodinger equation that describes the Fermi gas is reduced to;

$$-\frac{\hbar^2}{2m}\nabla^2\,\Psi(x,y,z)=E_k\Psi(x,y,z\,) \qquad (2)$$

If we take the electrons as a Fermi gas in side cubic metal of size L the energy of an electron of mass m is only quantized kinetic that can be described by principal quantum number *n* or wave number *k*.

The normalized wave function over dimension of the cube of solution of eq.2 is given by;

$$\Psi_{k_xk_yk_z}(x,y,z)=\left(\frac{8}{L^3}\right)^{1/2}sin(k_xx)sin(k_yy)sin(k_zz) \qquad (3)$$

Where,

$$k_x\ =\frac{p_x}{\hbar},\ \ k_y=\frac{p_y}{\hbar}andk_z=\frac{p_z}{\hbar} \qquad (4)$$

Energy of the electron *En* can be put as function of wave number kas;

$$E_k=\frac{\hbar^2\boldsymbol{k}^2}{2m}=\frac{\hbar^2(k_x^2+k_y^2+k_z^2)}{2m} \qquad (5)$$

Valance energy of individual atom is discrete. However, when the number of metal atoms increases energy levels are getting overlap. In this regard, for macroscopic cubic box of size *L* the energy of electrons is continuous function of wave number *k* throughout the bulk metal.

Normally two valence electrons of distinct atoms in the metal repel each other. Under superconductive state electron and electron come together and form highly coherent pair. Attraction between electrons pair is resulting from the virtual exchange of phonons that dominates the columbic repulsive force[5]. This electrons pair is called Cooper pair after the theory of super conductivity of J. Bardeen, L.N. Cooper, and J.R. Schrieffer (BCS). The theory of BCS is regarded as one of the most land marking achievements in many body particle physics [6]. Cooper pair is highly coherent pair of delocalized electrons in superconducting state. The pairs are free to move as a unit in the superconductive material.

Mass of a Cooper pair m_c is twice mass of an electron. In bulk macroscopic cubic metal of size *L*and the motion of Cooper pair is described by (eq.2).Note that;

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$$m_c = 2m \tag{6}$$

Under this condition energy of Cooper pair is;

$$E_{kc} = \frac{\hbar^2 \boldsymbol{k}_c^2}{2m_c} = \frac{\hbar^2 (k_{xc}^2 + k_{yc}^2 + k_{zc}^2)}{2m_c} \tag{7}$$

The Cooper pair momentum is vector sum of momentum of individual anti symmetric electrons that exchange momentum of phonons in the bulk metal crystal.

$$\hbar k_c = \hbar k_1 + \hbar k_2 \tag{8}$$

Below the transition temperature (*Tc*) the Cooper pairs move in the bulk crystalas a single particle and cause superconductivity.

Superconductivity is property of some materials below the transition temperature[7]. Electrons form symmetric highly coherent pairs and results in integral[8] spin s-1 particle of double mass and double charge of electron. Columbic repulsion force between the pair of electrons is balance by phonon interactions with in the crystal. Under this condition there is no more rotation of the valance electrons around the nucleus. Hence in this case rotational angular momentum becomes zero. As the result angular momentum quantum number *l = 0* and principal quantum number *n = 1*.That is all electrons reside on the ground state. Under this circumstance only the degeneracy of spin quantum number s-1 gives magnetic spin quantum numbers *1, 0, -1; where* its degeneracy number given by *2*1 + 1 = 3*.

II. Density of States of Fermi Gas in Cube Metal Elements of Size L

In wave number space representation the total numbers N_s of individual electron is calculated as follows. Volume of single state (*Vss*) in cube of size L is given by;

$$V_{ss} = \frac{\pi^3}{L^3} \tag{9}$$

And volume of sphere (V_{sp})in k- space is;

$$V_{sp} = \frac{4\pi k^3}{3} \tag{10}$$

Then, the number of filled states *NsF* of Fermi gas in a sphere of radius *k* becomes;

$$N_{sF} = \frac{1}{8}(2 * ½ + 1)\frac{V_{sp}}{V_{ss}} = \frac{L^3 k^3}{3\pi^2} \tag{11}$$

The number of electron states *D(k)dk* of Fermi gas between wave number *k* and *k + dk* is defined as;

$$D(k) = \frac{dN_{sF}}{dk} = \frac{L^3 k^2}{\pi^2} \tag{12}$$

Since energy of an electron in the in wave number k representation is given by;

$$E = \frac{\hbar^2 k^2}{2m} \tag{13}$$

Now, combining eq. (11) and (13) the number of field states of Fermi gas as function of energy takes the form;

$$N_{sF} = \frac{1}{8}(2 * ½ + 1)\frac{V_{sp}}{V_{ss}} \tag{14a}$$

$$N_{sF} = \frac{L^3}{3\pi^2}\left(\frac{2mE}{\hbar^2}\right)^{3/2} \tag{14b}$$

Then, the number of electron states of Fermi gas between energy *E* and *E + dE* obtained from eq.(14b) as follows;

$$D_F(E) = \frac{dN_{sF}}{dE} = \frac{L^3}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2} E^{1/2} \tag{15}$$

III. Density of States of Bose-Einstein Condensate in Cube Metal Elements of Size L

Below *Tc* the highly coherent electrons pairs that are known as Cooper pairs form Bose-Einstein condensate. For Cooper pairs the number of filled states in the sphere of radius *k* are directly obtained using s = *1* and in eq. (13) and (14). Then, the number of Cooper pairs electrons filled states *Nsc* for Bose-Einstein condensate is given by;

$$N_{sc} = \frac{1}{8}(2 * 1 + 1)\frac{V_{sp}}{V_{ss}} \tag{16}$$

Using eq. (9) and (10) it follows;

$$N_{sc} = \frac{L^3 k^3}{2\pi^2} \tag{17}$$

In an analogous way, the number of Cooper pairs states D(k)dk of Bose-Einstein condensate between wave number k and k + dk becomes;

$$D_C(k) = \frac{dN_{sc}}{dk} = \frac{3L^3 k^2}{\pi^2} \tag{18}$$

Finally, the result of number of Cooper pairs states in eq. (16) as function of energy takes the form;

$$D_C(E) = \frac{dN_{sC}}{dE} = \frac{1}{2}\left(\frac{2m_C}{\hbar^2}\right)^{3/2} \frac{L^3 E^{1/2}}{\pi^2} \tag{19}$$

Comparison of density of states of Cooper pairs and density of states of Fermi gas states represented by eq.(15)&(19)gives the following result;

$$D_C(E) = 2^{3/2} D_F(E) \tag{20}$$

Eq. (19) shows density of Cooper pairs states are more than density of Fermi gas states in a cube of metal elements of same size. In this regard, within same volume of metal elements, we have gotten more charge carriers below *Tc* in the case of highly coherent Cooper pairs than Fermi gas. To this end, thermal contraction of the metal elements and highly coherence of Cooper

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pairs provides more density of states in the metal elements below *Tc.*

IV. Conclusion

The density of states of Fermi gas and density of states of highly coherent Cooper pairs in metal elements of size L have been analyzed. In this regard, the fact of s-½ and s-1 has been used for Fermi gas and Cooper pairs that form Bose-Einstein condensate, respectively.We solved the Schrödinger equation and obtained the expression of energy for both particles. At low temperature, in the absence of rotational motion of Fermi gas and Cooper pairs all particles are in the ground state and possess only translational momentum that exhibit continues energy in the metal elements. For the considered bulk metal elements density of states of both Fermi gas and highly coherent Cooper pairs are found to be continuous function of energy.

Comparison of density of states has been done. The ratio of density of states of highly coherent Cooper pairs to Boson condensate is obtained to be $2^{3/2}$. Cooper pairs are formed only below transition temperature. The derivation has been taking in to account this assumption. Therefore the dominating density of state is that of highly coherent Cooper pairs that form Boson Condensate.

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Lasers are Quantum by Generators?

By F. F. Mende

Abstract- It is customary to assume lasers as quantum generators. But this name does not correspond to the principle of their action. Such generators present the phased lattices and are subordinated to the known laws of radio engineering. Physics of the work of such generators describes the relationships of Manley-Rou.

Keywords: *laser, quantum generator, the phased antenna array, the relationship of manley-rou.*

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Keywords: laser, quantum generator, the phased antenna array, the relationship of manley-rou.

I. Introduction

It is customary to assume lasers as the quantum generators [1]. But this name does not correspond to the principle of their action. It is known that the laser emission possesses high coherence and directivity. The principle of the construction of radiating systems with such characteristics is well known in radio engineering, in them a large quantity of elementary phased emitters, located in the determined order, is used. Such systems are called the phased lattices (FL) [2,3]. Moreover, the greater the quantity of elementary sources it is used and the greater the dimensions of space, on which they are located, the greater the directivity and the radiated power can be obtained. For obtaining the high directivity the linear dimensions of system must be considerably more than the length of radiated wave.

In the work substance of laser also always is contained a huge quantity of elementary sources, which the atoms or the molecules of work substance are. If the discussion deals with the solid-state lasers, for example on the basis of ruby, then the radiating atoms, which are the atoms of chromium, it is also located in the crystal of work substance in the strictly defined order. If such atoms are synchronously excited by any means then so that their fluctuations would be phased as in FL, then from a radio-technical point of view this system can give the very narrowly-directed emission, since. A quantity of emitters is very great, and the length of radiated wave is much less than the linear dimensions of the field of emission. But as to excite atoms? One of such methods – the collision excitation, when the work substance of laser they irradiate by short pulse from the flashbulb, as is done in ruby laser. But with the aid of the flashbulb it is not possible to excite atoms so that the phase of their fluctuations would correspond to the conditions of FL. For this selection external macroscopic resonator serves. Selection indicated condition – agreement of one of the resonance modes of external resonator with the natural vibration frequency of the atoms of chromium. But this it is insufficient. The lattice of FL will compose only the atoms of chromium, located in the places, where their phase of fluctuations coincides with the phase of the fluctuations of macroscopic resonator. But in a total quantity of excited atoms of such it is not much, a total of several percentages of a total quantity. Therefore the efficiency of ruby laser is not high [4].

Consequently, this generator works according to all laws of electrodynamics and radio engineering, and there is nothing in it quantum, although the name in it very beautiful - two-level quantum generator.

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II. Physics of Work are Multilevel Quantum Generators and the Relationships of Manley -Rou

The multilevel quantum generators, in which allegedly it occurs by lowering quanta downward through several levels from the higher levels, work also according to the laws of nonlinear parametric systems. Occurs either parametric strengthening or parametric generation according to relationships to Manley–Rou– to the energy relationships, which characterize interaction of fluctuations or waves in the connected nonlinear systems with the concentrated or distributed parameters. Relationships to Mendi-Rou [5] take the form

$$\sum_{m=1}^{\infty}\sum_{n=-\infty}^{\infty}\frac{mP_{mn}}{m\omega_1+n\omega_2}=0;\quad \sum_{m=-\infty}^{\infty}\sum_{n=1}^{\infty}\frac{nP_{mn}}{m\omega_1+n\omega_2}=0.$$

In this relation P_{mn} – a change in the power at the combination frequency $m\omega_1+n\omega_2$, and ω_1 also ω_2 – the frequency of initial vibrations. Relation $\frac{\omega_2}{\omega_1}$ must be irrational, since otherwise, it is possible to express all frequencies as the harmonics of one fundamental frequency.

The relationships of Manley -Rou are valid for the system with the arbitrary reactive nonlinear coupling. In conjunction with the laws of conservation of energy and momentum, they determine the nature of nonlinear interaction of waves (fluctuations) and make it possible to calculate the maximum effectiveness of frequency converter on the reactive nonlinearity.

In the terms of quanta this diagram appears as follows. Let per unit time it appear or disappear A_{mn} the quanta of combination frequency. Then power at this frequency is equal.

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$$P_{mn}=A_{mn}\hbar(m\omega_1+n\omega_2) \qquad (1.2)$$

In view of conservation of energy in the system total power is equal to zero:

$$\sum_{m,n} P_{mn}=\sum_{m,n}\hbar A_{mn}(m\omega_1+n\omega_2)=0.$$

Since $\frac{\omega_2}{\omega_1}$ it is irrational; m, n, A_{mn} – integers, this equality is carried out, only if both terms are equal to zero:

$$\sum_{m,n} mA_{mn}=\sum_{m,n} nA_{mn}=0.$$

After expressing A_{mn} from (1.2) and after substituting into the last expression, we will obtain:

$$\sum_{m,n}\frac{mP_{mn}}{m\omega_1+n\omega_2}=\sum_{m,n}\frac{nP_{mn}}{m\omega_1+n\omega_2}.$$

Let us examine the relationships of Manley-Rou in the particular case interaction. Let, for example, combination the difference frequency is $\omega_0=\omega_1-\omega_2$. Then system has three frequencies:

$$\omega_0=(m=1,n=-1);\ \omega_1=(m=1,n=0);\ \omega_2=(m=0,n=1).$$

In this case the relationships of Manley -Rou take the form:

$$\frac{P_{0,1}}{\omega_2}=\frac{P_{1,-1}}{\omega_0}=\frac{P_{1,0}}{\omega_1}.$$

These relationships describe nonlinear medium with three interconnected resonances. Moreover if we excite one of the resonances, then I will be excited and rest. The energy, stored up in each of the resonances, is proportional to resonance frequency what quantum mechanics interprets as the presence on environment of the energy levels, proportional to frequency. But the processes of energy transfer of one resonance in another, which ensures the nonlinearity of medium, quantum mechanics interprets as skate from one energy level to another. This scholastic diagram hides the true physical sense of process.

The first, so-called, quantum generator, in which the electromagnetic vibrations OF SHF were generated with the aid of the molecules NH_3, was created in 1954 H.G. Basov, A. M. Prokhorov and independent of them Ch. Townes, J. Gordon and H. Zeiger [5]. Both versions of generators worked on the molecular beam of ammonia. Its work thus was explained from the point of view of quantum mechanics: molecules NH_3, possessing electrical dipole moment, flying through the heterogeneous electric field, are differently slanted by this field depending on their internal energy. In the first molecular generator the sorting system was the quadrupole capacitor, which consists of the parallel 4 rods, connected in pairs through one with the high-voltage rectifier. The electric field of this of capacitor is not homogeneous, it causes the bend of the trajectories of molecules, which fly along its longitudinal axis. Molecules, which are found in the upper energy state, are slanted to the condenser spindle and fall inside the cavity resonator, that are located in the lower – are rejected to the sides.

Falling inside the resonator, the excited moleculesemit photons under the action of the field of resonator. Photon energy strengthens field in the resonator, increasing the probability of the stimulated emission for the molecules, which fly later (the feedback). If the probability of the stimulated emission of photon is more than the probability of absorption in the walls of resonator and emission in its limits, then the intensity of the field of resonator at the transition frequency rapidly grows due to the internal energy of molecules. Growth ceases, when field in the resonator reaches the value, with which the probability of the stimulated emission becomes so large, that in the transit time of resonator manages to emit photon exactly half of the molecules of beam. In this case for the beam as a whole the probability of absorption the equal probability of the stimulated emission becomes (saturation). The power of molecular generator with molecular beam NH_3 is small and is equal strand 10^{-11} W.

But how in reality does work molecular generator with the molecular beam of ammonia? The molecule of ammonia actually has a dipole moment, and in the space this molecule can have two positions: one steady, but another – no. If with the thermal molecular excitation falls into the unsteady state, i.e. the electric dipole overturns and it begins to hesitate with the resonance frequency. Since the size of dipole, determined by molecular dimension, is considerably lower than the wavelength of emission, this resonance has very high quality. If we with the aid of the quadrupole capacitor filter out molecules in the unsteady state, to and then throw in them into the macroscopic resonator, whose resonance frequency coincides with the frequency of the vibrations of molecular dipole, then such molecules will excite in the resonator of fluctuation, and macroscopic resonator will independently select molecules with the phase of fluctuations, which coincides with the phase of fluctuations in the Ger. Only difference from the ruby laser – in the latter the vibration frequency lies at the

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region of light frequencies, and in ammonium – in HF range. Therefore the principle of work of molecular generator as ruby laser, is plotted in the radio-technical concepts without the attraction of quantum-mechanical concepts.

One should separately emphasize that in the existing constructions of lasers the selection of the atoms, which form the phased lattice, which forms the directed laser beam, achieves the macroscopic resonator, in which is located the active material. Macroscopic resonator is the separator, which selects only corresponding to the specified conditions oscillations of the atoms located in it. The excited by impact method atom, which presents dipole source, can be located in the resonator in any place, and its emission can have any polarization and direction. But only atoms with the frequency, which coincides with frequency of one of the modes of macroscopic resonator, have chances to give the contribution to the laser beam. For this it is necessary that the direction of the emission of these atoms would coincide with the axis of resonator, and so that the distance from the atoms to both lenses would be multiple to half of the wavelength of the emission of atom. Then the emissions of atom after multiple reflections from the mirrors of external resonator form exponentially the diminishing standing wave. If such atoms much, and they are excited in the different time, they all together form the not damped standing wave between the mirrors, which, after traversing the semi-transparent mirror, gives laser beam of light. This beam, in view of Huygens's principle, weakly disperses if the size of semi-transparent mirror much more than wavelength that also is observed in practice.

Atoms with the oscillations of those atoms, which do not satisfy these conditions, will consume their vibrational energy for the creation of the scattered incoherent radiation. Because we see the bright glow of the transparent tube of gas laser, through which this emission leaves.

With respect to the excitation of laser emission frequently is used the term stimulated radiation. This term indicate the additional synchronization of the being varied dipoles because they are connected with the electric field of external resonator. Actually, if we in the field of this resonator place the system of the being varied dipoles phases of which are not phased, then after a certain time the phases of such emitters will be phased by the field of external resonator that we have in the continuous laser.

The principle of the quantization of action, which lies at the basis of quantum generators, leads to the fundamental, actually, to insoluble problems in contemporary theoretical physics [6,7]. From this principle it turns out that the energy can change only spasmodically (by portions). Idea about the quanta of energy, which the physical systems are exchanged between themselves hence arose. The fault of this approach lies in the fact that the discontinuity of a change in the energy unavoidably leads to the local (at the level of microcosm) disturbance of the law of conservation of energy even for the conservative systems. Namely, is allowed this disturbance of the law of the conservation of energy of conservative system, with which the value of action does not exceed Planck's constant. Thus, is allowed even an infinitely large increase in the energy, but only during the infinitely small time interval (the greater the increase in the energy, the less the corresponding time interval).

III. Conclusion

It is customary to assume lasers as quantum generators. But this name does not correspond to the principle of their action. Such generators present the antenna phased arrays and are subordinated to the known laws of radio engineering. Physics of the work of such generators describes the relationships of Manley - Rou. The principle of the quantization of action, which lies at the basis of quantum generators, leads to the fundamental, actually, to insoluble problems in contemporary theoretical physics. From this principle it turns out that the energy can change only spasmodically (by portions). Idea about the quanta of energy, which the physical systems are exchanged between themselves hence arose. The fault of this approach lies in the fact that the discontinuity of a change in the energy unavoidably leads to the local (at the level of microcosm) disturbance of the law of conservation of energy even for the conservative systems. Namely, is allowed this disturbance of the law of the conservation of energy of conservative system, with which the value of action does not exceed Planck's constant. Thus, is allowed even an infinitely large increase in the energy, but only during the infinitely small time interval (the greater the increase in the energy, the less the corresponding time interval).

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Investigation of Classical Systems with Complex Energy in the Field of Quantum-Classical Correspondence

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Abstract- Classical mechanics and quantum mechanics contradict each other, and both are essential to explain the phenomena of the exclusively different realm of nature. On the other hand, Bohr's correspondence principle shows classical mechanics is the somewhat approximate version of quantum mechanics. Classically a particle with negative energy i. e. $E < V$ is not allowed go through a forbidden region or disappearing from one well to another well. This paper gives the numerical studies for the trajectory of the particle in a double-well potential and presents quantum mechanical behavior such as tunneling in the complex plane for different energies. Our findings provide a route to solve the classical system with complex energy.

Keywords: *double-well potential, complex energy, complex trajectory, PT-symmetry, tunneling.*

GJSFR-A Classification: *FOR Code: 020699p*

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Investigation of Classical Systems with Complex Energy in the Field of Quantum-Classical Correspondence

Shahadat Hossain [α], Syed Badiuzzaman Faruque [σ] & M. S. Hossain [ρ]

Abstract- **Classical mechanics and quantum mechanics contradict each other, and both are essential to explain the phenomena of the exclusively different realm of nature. On the other hand, Bohr's correspondence principle shows classical mechanics is the somewhat approximate version of quantum mechanics. Classically a particle with negative energy i. e. $E < V$ is not allowed go through a forbidden region or disappearing from one well to another well. This paper gives the numerical studies for the trajectory of the particle in a double-well potential and presents quantum mechanical behavior such as tunneling in the complex plane for different energies. Our findings provide a route to solve the classical system with complex energy.**

Keywords: double-well potential, complex energy, complex trajectory, PT-symmetry, tunneling.

I. Introduction

Quantum mechanical phenomena are completely different from classical mechanical in our physical world. The motion of a classical particle is deterministic and is described by Hamiltonian's equation. The position x(t) of a particle at any instant can be found by solving a local initial value problem for this differential equation. The energy of a particle which is numerically equal to the Hamiltonian is a constant and can have any values. Classically, the motion of the particle is confined or allowed to a region where energy E≥V(x) and forbidden where E<V(x). A classical particle may not travel through the barrier which separates two classical allowed regions.

Many researchers have astonished by extending both quantum mechanics and classical mechanics into the complex domain. In conventional quantum mechanics, all physical observable must be represented by Hermitian operators on Hilbert space so that the Hamiltonians have real energy eigen values and unitary time evolution[1]. But a class of physical allowable Hamiltonians may be extended to include non-Hermitian Hamiltonians that possess an unbroken PT(combined parity and time reversal) symmetry because these complex Hamiltonians also have real energy eigenvalues and generate unitary time evolution[2-12].In the recent years; some new surprising phenomena were revealed by PT symmetry quantum mechanics which observed in laboratory experiment[13-15]. Conventional classical mechanics is the study of the real solution to Hamiltonian's equation, and we find the exact trajectory of a particle. To understand PT-symmetric quantum mechanics, conventional classical mechanics is extended into the complex domain. In the complex classical mechanics, we study all solutions, real as well as complex of Hamiltonian's equation[16-18]i.e., the real and the complex trajectory for a system having real energy. Study of complex classical mechanics has provided an intuitive image of what is happening at the unbroken and broken PT-symmetric phase of PT-symmetric quantum mechanics, the classical trajectories are closed and periodic, but in the broken phase those are open[19].

A new area of research has been recently introduced which concerns the generalization of classical mechanics from real to complex energy[20]. Since the energy of a quantum particle cannot be determined precisely due to an infinite amount of time. According to the time-energy uncertainty principle in quantum mechanics $\Delta E\, \Delta t \geq \frac{h}{4\pi}$, the energy cannot be measured without an uncertainty of ΔE. As a consequence of this argument, the uncertainty exists in classical mechanics and further, it, can be assumed as complex. The generalization from real to complex energy reveals many features of quantum mechanics by the classical system having complex energy. Carl M Bender, Dorje C Brody and Daniel W Hook have performed numerical studies in the conjectural paper[20] and they found some well-known quantum effects by the deterministic equations of classical mechanics(Newton's law) when these equations are solved in the complex plane for the systems having complex energy.

In the discussion of the conjectural paper[20], it has been concluded that the analogies between quantum mechanics and complex energy classical mechanics make further investigation worthwhile. In [21-22] the authors investigated the analogies between quantum mechanics and complex classical mechanics and also provide a procedure to obtain the trajectory

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when the energy of a deterministic classical particle is allowed to be complex in the double well potential.

In this work, we allowed a classical particle to have a complex energy in the double well potential $x^4 - x^2$, the corresponding system appears with a phenomenon that completely a feature of quantum mechanics such as tunneling.

II. Methodology

In classical mechanics, the motion of a particle is modeled by the Hamiltonian of the for

$$H = \tfrac{1}{2}p^2 + V(x) \tag{2.1}$$

Such that the first derivative of the potential V(x) is a function of the position of the particle, x.The Hamilton's equations are

$$\dot{x} = \frac{\partial H}{\partial p} = p(= u) \tag{2a}$$

and

$$\dot{p} = -\frac{\partial H}{\partial x}(= a) \tag{2b}$$

u and a express the velocity and the acceleration of the particle at the point x.

If the energy E is a given numerical value of H, which is a constant of motion, then we get from equation (1)

$$E = \frac{1}{2}p^2 + V(x) \tag{2.3}$$

Using equation (2) in (3) we obtain,

$$u = \pm\sqrt{2E - 2V(x)} \tag{2.4}$$

It is obvious from above two that u is complex value when $E \le V(x)$, but u is real value when $E \ge V(x)$. The positive and negative of $\pm\sqrt{2E - 2V(x)}$ is denoted by u_+ and u_- respectively.

The particle starts its journey from x_{+0} at the time $t = 0$ and if the time interval Δt is infinitesimally small, we can consider a as a constant. Hence, at the position x_{+0}, the velocity of the particle is,

$$u_{+0} = \sqrt{2E - 2V(x_{+0})} \tag{2.5}$$

Where particle moves with positive value of u and the acceleration is

$$a_{+0} = -\frac{\partial H}{\partial x}(x_{+0}) \tag{2.6}$$

Now according to the well-known classical formula

$$x = x_0 + ut + \frac{1}{2}at^2, \tag{2.7}$$

we have

$$x_{+1} = x_{+0} + u_{+0}\Delta t + \frac{1}{2}a_{+0}(\Delta t)^2 \tag{2.8}$$

Because both the velocity and the acceleration depend on position of the particle, the velocity and acceleration at the position x_{+1} are

$$u_{+1} = \sqrt{2E - 2V(x_{+1})} \tag{2.9}$$

and

$$a_{+1} = -\frac{\partial H}{\partial x}(x_{+1}) \tag{2.10}$$

respectively. Now the position of the particle for time, $0 + \Delta t + \Delta t$, i.e. $2\Delta t$ is

$$x_{+2} = x_{+1} + u_{+1}\Delta t + \frac{1}{2}a_{+1}(\Delta t)^2 \tag{2.11}$$

Similarly, we can obtain the position of the particle after each interval, x_{+3}, x_{+4}, x_{+5}

Let us take the final position x_{+n} for the positive sign of u. Then the particle travels from x_{+n} with the negative sign of u. Therefore, the velocity of the particle at x_{+n} is

$$u_{-0} = \sqrt{2E - 2V(x_{+n})} \tag{2.12}$$

and

$$a_{-0} = -\frac{\partial H}{\partial x}(x_{+n}) \tag{2.13}$$

After the time interval Δt from the x_{+n} position of the particle is

$$x_{-1} = x_{+n} + u_{-0}\Delta t + \frac{1}{2}a_{-0}(\Delta t)^2 \tag{2.14}$$

Similarly using the above procedure we can obtain the positions of the particle $x_{-2}, x_{-3}, x_{-4}, \ldots\ldots\ldots x_{-n}$, for each interval Δt, where x_{-n} is the final position of the particle with the negative sign of u. Then at the point, x_{-n}, then the particle travels with the positive sign of u.

The alternatively taking positive sign of u and negative sign of u of the particle continue endlessly, and we have an endless trajectory of the classical particle. If after $n\Delta t$ time, the particle returns to its initial position, the trajectory of the particle is closed and periodic with $n\Delta t$, where n is a positive integer.

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III. Theoretical Calculation

a) Motion of a Particle Having Real Energy in the Potential $(x^4 - x^2)$ in the Complex Domain

Investigation of the classical trajectories of a particle having energy $E = 1$ with different initial conditions in the potential, $x^4 - x^2$, defined by the Hamiltonian $H = \frac{1}{2}p^2 + x^4 - x^2$ in the complex domain showed in figure 1. The solutions of the equation $V(x) = E$, i.e.$x^4 - x^2 = 1$ gives the classical turning points located at $x = \pm 1.2720, \pm 0.7862i$ and indicated by red dots. The so-called 'classical allowed region'(for which $E \geq V(x)$ i. e. $1 \geq x^4 - x^2$) is the portion of the real x between $x = -1.2720$ to $x = 1.2720$, and a classical particle initially on this line segment moves parallel to the real axis and oscillate between real turning points. The classical forbidden regions (represented by $E < V(x)$ i.e.,$1 < x^4 - x^2$) are the portions of the real axis for which $x > 1.2720$ and $x < -1.2720$, and a particle having initial position in either one moving perpendicularly to the real axis. The particle then enters into the complex-x and makes a sharp turn about the imaginary turning points and return to its initial position. All orbits in figure 1 have the same period which is exactly 3.998. It was observed that two different trajectories never cross each other.

The trajectories of a classical particle having real negative energy,$E = -1$, in the potential, $x^4 - x^2$ of the Hamiltonian $H = \frac{1}{2}p^2 + x^4 - x^2$ with different initial conditions were shown in figure 2. The turning points belong to the energy $E = -1$ are located at $x = \pm(0.8660 - 0.5000i), \pm(0.8660 + 0.5000i)$, which are indicated by red dots in figure 2.We observed that the all trajectories are closed and periodic. The classical trajectories are always confined to either the right-half or left-half of the complex-x plane and unable to go through imaginary axis, $x = 0$. Figure 2 shows the sixteen classical trajectories for energy $E = -1$. Eight trajectories lie in the right-half enclosing the turning points $x = 0.8660 + 0.5000i$ and $x = 0.8660 - 0.5000i$, and other eight trajectories lie in the left-half enclosing the turning points $x = -0.8660 + 0.5000i$ and $x = -0.8660 - 0.5000i$. No two trajectories cross each other. Thus for a particle having negative real energy the potential $x^4 - x^2$ act.

b) Classical Trajectory of a Particle of Energy $2 + 0.2i$in the Double-Well Potential

A single classical trajectory of a particle having energy $E = 2 + 0.2i$ in the potential, $x^4 - x^2$ defined by Hamiltonian $H = \frac{1}{2}p^2 + x^4 - x^2$ presnted in figure 3. The solution of the equation $V(x) = E$, i.e. $x^4 - x^2 = 2 + 0.2i$ gives classical turning points. Hence we have four turning points located at $x = 1.4149 + 0.0235i, -1.4149 - 0.0235i, 0.0333 - 1.0013i, -0.0333 + 1.0013i$ which are indicated by red dots. The turning points are different from figure 1 due to the amount of adding energy $(0.2i)$ to real energy(2). A particle whose initial position in any point in the complex- x plane have an initial motion having two components, along with real axis and perpendicular to the real axis and the particle moves in the complex-x plane. The trajectory spirals inward around the pair of turning points, $1.4149 + 0.0235i$ and $-1.4149 - 0.0235i$ and make a sharp turn about the other pair of turning points, $0.0333 - 1.0013i$ and$-0.0333 + 1.0013i$. The effect is that the trajectory still does not cross itself; the trajectory no longer needs to be closed and periodic. The trajectory, in this case, is open.

c) Classical Trajectory of a Particle of Energy $2 - 0.2i$

The single classical trajectory of a particle having energy $E = 2 - 0.2i$ in the potential, $x^4 - x^2$ defined by Hamiltonian $H = \frac{1}{2}p^2 + x^4 - x^2$ depicted in figure 4. The solution of the equation $V(x) = E$, i.e. $x^4 - x^2 = 2 - 0.2i$ gives classical turning points. Hence we have four turning points located at $x = 1.4149 - 0.0235i, -1.4149 + 0.0235i, 0.0333 + 1.0013i, -0.0333 - 1.0013i$ which are indicated by red dots. The turning points are different from figure 1 due to the amount of subtracting energy $(0.2i)$ to real energy(2). A particle whose initial position in any point in the complex- x plane have an initial motion having two components, along real axis and perpendicular to the real axis and the particle moves in the complex-x plane. The trajectory spirals inward around the pair of turning points, $1.4149 - 0.0235i$ and $-1.4149 + 0.0235i$ and make a sharp turn about the other pair of turning points, $0.0333 + 1.0013i$ and $-0.0333 - 1.0013i$. The effect is that the trajectory still does not cross itself, the trajectory no longer need be closed and periodic. The trajectory, in this case, is open. The direction of motion of the particle, in this case, becomes reverse compared to figure 3 due to change of sign in the imaginary part of the energy.

d) Classical Trajectory of a Particle of Energy $-1 - 2i$

For the classical particle with complex energy $E = -1 - 2\mathrm{i}$ in the double well potential, turning points are 1.2503 - 0.4804i, 0.6760 + 0.8885i, -1.2503 + 0.4804i, -0.6760 - 0.8885i which are indicated by red dots. A single classical trajectory of classical particle having energy $E = -1 - 2\mathrm{i}$ in the complex-x plane sketched in figure 5. In figure 5 the trajectory begins at $x = 1$, and it spirals around the right pair of turning points of the right-half of double-well potential then it crosses imaginary axis $x = 0$ and enters into left-half of double well potential and spirals around the left pair of turning points. In figure 6 the trajectory begins at $x = -1$ and it spirals around the left pair of turning points of the left-half of double-well potential then it crosses imaginary axis $x = 0$ and enters into right-half

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of double well potential and spirals around the right pair of turning points. Both trajectories are not periodic because they are open. According to classical mechanics this type of motion is forbidden, but allowing the energy of a classical particle to be complex, we get a quantum mechanical phenomenon.

e) Classical Trajectory of a Particle of Energy $-1+2i$

The single classical trajectory of a classical particle having energy $\mathrm{E}=-1+2\mathrm{i}$ in the double-well potential in the complex domain pictured in figure 7. The four classical turning points are associated with this energy are 1.3077 + 0.4956i, 0.6754 - 0.9595i, -1.3077 - 0.4956i, -0.6754 + 0.9595i, which are indicated by red dots in the figure 7. The particle begins its motion from position x=1, and it shows classical tunneling through imaginary plane $x=0$. Although we changed the sign of imaginary part of energy, it does not change tunneling of the classical particle. The classical particle first spirals around the right pair of turning points then leaps to left-half of the complex-x plane. Then the particle spirals around the left pair of turning points.

f) Classical Trajectory of a Particle of Energy $-1-2.5i$

A single classical trajectory of a particle with energy $\mathrm{E}=-1-2.5\mathrm{i}$ in the double-well potential in the complex-x plane pictured in figure 8. The four turning points associated with energy $\mathrm{E}=-1-2.5\mathrm{i}$ are 1.3077 - 0.4956i, 0.6754 + 0.9595i, -1.3077 + 0.4956i, -0.6754 - 0.9595i which are indicated by red dots. The particle begins its journey from x=8 and enters into left-half of the complex-x plane crossing imaginary axis x=0. Then spirals around the left pair of turning points, and then it returns to right-half of the complex-x plane. So, in this case, we have two times tunneling through imaginary axis x=0. The trajectory is not periodic because it is open.

g) Classical Trajectory of a Particle of Energy $-1+2.5i$

Let us investigate what happens if we take a classical particle having complex conjugate of energy $\mathrm{E}=-1-2.5\mathrm{i}$, i.e.$-1+2.5\mathrm{i}$in the double-well potential. A single classical trajectory of a particle with energy $\mathrm{E}=-1+2.5\mathrm{i}$ in the double-well potential in the complex-x plane presented in figure 9. The four turning points associated with energy $\mathrm{E}=-1+2.5\mathrm{i}$ are 1.3077 + 0.4956i, 0.6754 - 0.9595i, -1.3077 - 0.4956i, -0.6754 + 0.9595i which are indicated by red dots. The particle begins its journey from x=8 and enters into left-half of the complex-x plane crossing imaginary axis x=0. Then spirals around left pair of turning points, and then it returns to right-half of the complex-x plane. So, in this case, we have two times tunneling through imaginary axis x=0. Although we take energy $\mathrm{E}=-1+2.5\mathrm{i}$, the complex conjugate of $\mathrm{E}=-1-2.5\mathrm{i}$, we get same result i.e., tunneling. The trajectory is not periodic because it is open.

IV. Results and Discussion

We investigated the motion of a classical particle in the classical system using potential $V(x)=x^4-x^2$, in the complex domain by numerically. We found that the trajectories of the particle in the potential, x^4-x^2 are always confined to either right-half or left-half of complex-x plane for a negative real value of energy. Thus, the potential acts like a double-well potential, one well is left-half and another well is right-half of complex-x plane, separated by the imaginary axis x=0, leads to no effect analogous to quantum tunneling. Butthe energy of a deterministic particle being complex in the double-well potential, x^4-x^2, the corresponding system presents an effect analogous to quantum tunneling. We examine the analog to the quantum tunneling in the complex classical system for different four energies $-1-2i, -1+2i, -1+2.5i$ and $-1-2.5i$. The classical 'tunneling' process is less abstract and hence easier to understand than quantum-mechanical analog. During quantum tunneling the particle disappears from one classical region and reappears almost immediately in another region giving no idea about the path. For a classical particle, it is clear how the particle travels from one classically allowed region to the other i.e., it follows a well-defined path in the complex-x plane.

V. Conclusion

Investigation of the trajectories of particle having real but negative energy in the potential x^4-x^2 gives x^4-x^2 acts like double-well potential. Particle exhibits periodic motion for real energy and confined to either right-half or left-half of the complex-x plane separated by imaginary axis $x=0$ for negative energy. The open classical trajectories that result from complex energy are particularly interesting because of their behavior reminiscent of the phenomenon of quantum tunneling-a negative energy quantum particle in such potential tunnels back and forth from one-well to another-well.

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Figures

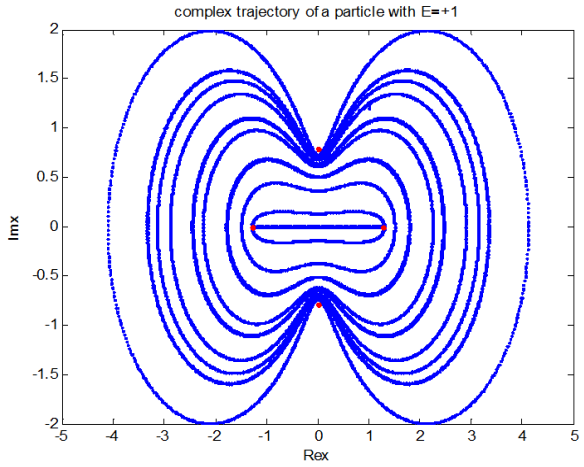

Figure 1

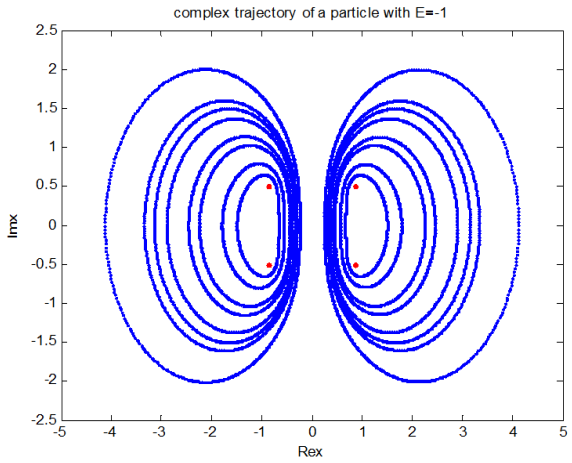

Figure 2

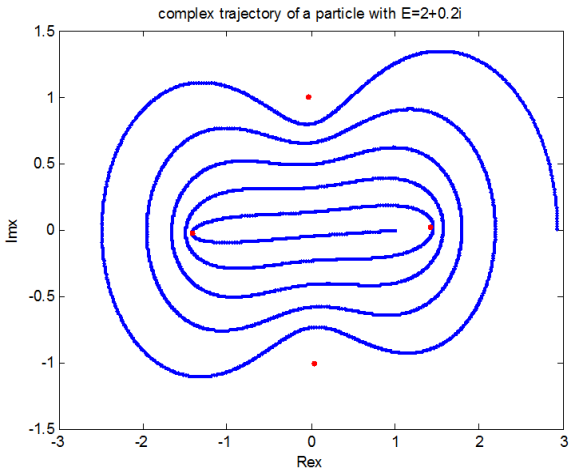

Figure 3

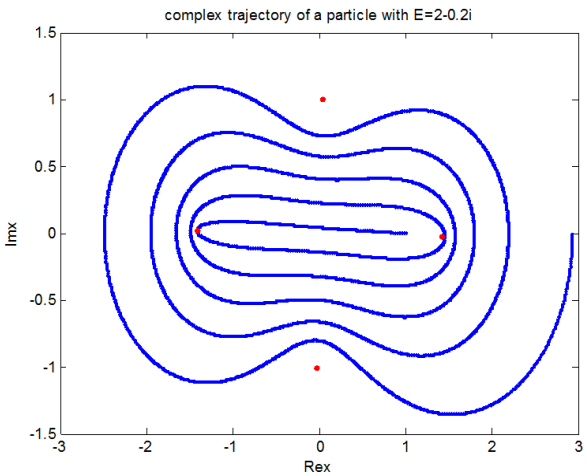

Figure 4

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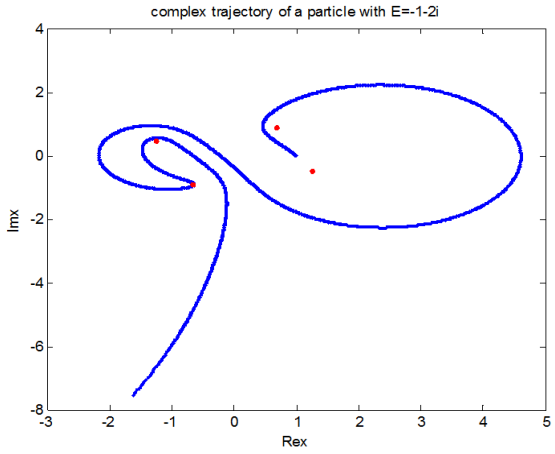

Figure 5

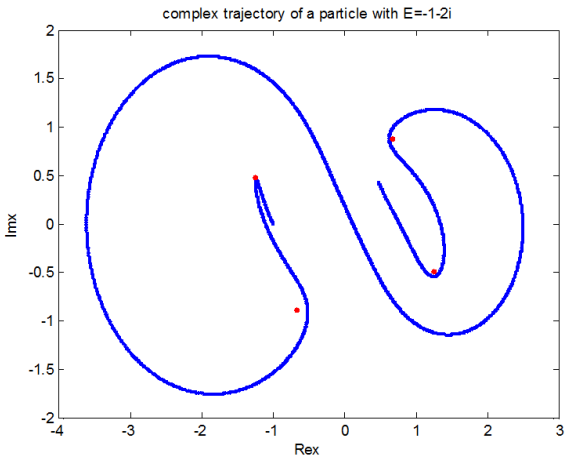

Figure 6

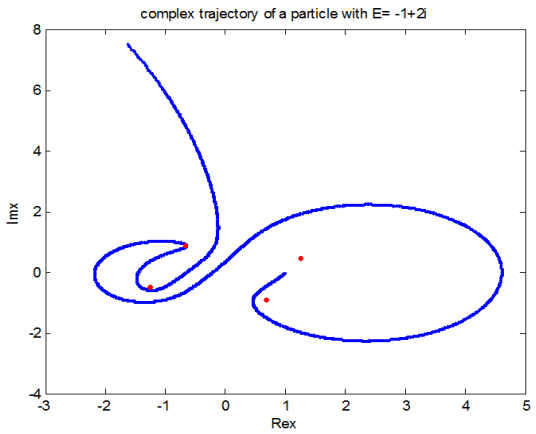

Figure 7

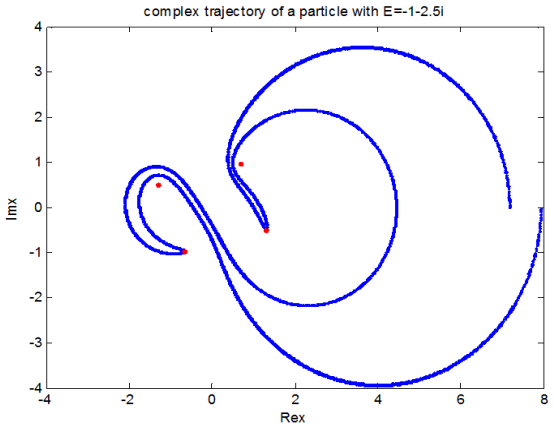

Figure 8

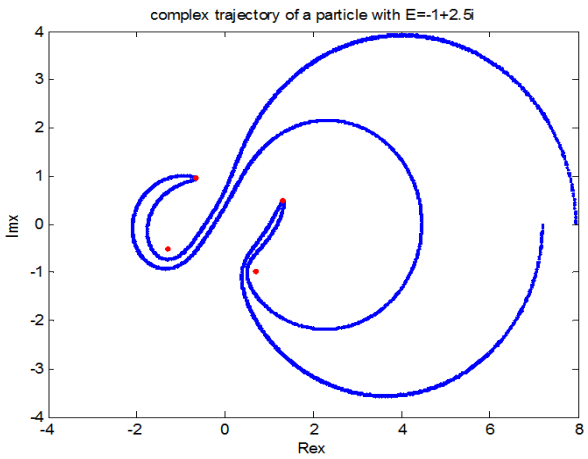

Figure 9

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Exact Solution to the Schrodinger Equation with Manning-Rosen Potential Via WKB Approximation Method

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Abstract- In quantum mechanics, exact solutions to equations play an important role because they contain a wealth of important information regarding the system under consideration. Here, we present the use of Wentzel-Kramers-Brillouin (WKB) approach toobtain the exact energy spectrum for Manning-Rosen potential and also, eigen energy solutions of special potential considered were also obtained.

Keywords: *schrodinger equation, manning-rosen potential, WKB approximation.*

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Exact Solution to the Schrodinger Equation with Manning-Rosen Potential Via WKB Approximation Method

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Abstract- **In quantum mechanics, exact solutions to equations play an important role because they contain a wealth of important information regarding the system under consideration. Here, we present the use of Wentzel-Kramers-Brillouin (WKB) approach toobtain the exact energy spectrum for Manning-Rosen potential and also, eigen energy solutions of special potential considered were also obtained.**

Keywords: schrodinger equation, manning-rosen potential, WKB approximation.

I. Introduction

Vital information regarding quantum mechanical systems are readily obtained from exact solutions to equations for the system under consideration. For instance, the exact solution of the Schrodinger equation for the hydrogen atom and simple harmonic oscillator provided strong evidence supporting the validity of the quantum theory. However, many quantum systems are treated as approximations because exact solutions are few [1-4]. The bound state energy equation and the unnormalized radial wave functions have been approximately obtained for the Manning-Rosen potential by using the super symmetric WKB approach and the function analysis method [5]. The analytical bound state solutions of the Dirac equation with the Manning–Rosen potential for an arbitrary spin-orbit coupling quantum have been solved [6].

One of the earliest and simplest methods of obtaining approximate eigenvalues of a one-dimensional Schrodinger equation in the limiting case of large quantum numbers was originally proposed by Wentzel, Kramers, and Brillouin which isknown as the WKB approximation method [6-10]. In the lowest- order approximation, the WKB quantization condition is:

$$\int_{r_1}^{r_2}\sqrt{2m\big(E-V(r)\big)}\,dr=\pi\hbar\left(n+\frac{1}{2}\right),\ n=0,1,2\ldots \quad (1)$$

In general, Eq. (1) yields moderately accurate eigenvalues as analytic functions of the parameters contained in the potential.

To properly use the WKB approximation for three-dimensional problems with spherical symmetry, it is necessary to apply the one-dimensional WKB formalism to the radial Schrodinger equation

$$\frac{\partial^2\Psi}{\partial r^2}+\frac{2m}{\hbar^2}\left[E-V_{eff}\,(r)\right]\Psi=0 \quad (2)$$

where the effective potential $V_{eff}\,(r)$ is

$$V_{eff}\,(r)=V(r)+\frac{l(l+1)\hbar^2}{2mr^2}$$

Such a straightforward application leads to an important difficulty in obtaining exact energy eigenvalue solution because the WKB reduced radial wave function at the origin has a behavior which is different from that of the true wave function [11]. For this reason, Langer [12] suggested that the strength of the angular momentum $l(l+1)$ should be treated as an adjustable parameter K, not as a fixed quantity. Langer pointed out that K should be replaced with the term $\left(l+\frac{1}{2}\right)^2$ in the lowest order quantization formula which have great physical meaning. The replacement of $l(l+1)\rightarrow\left(l+\frac{1}{2}\right)^2$ regularizes the radial WKB wave function at the origin and ensure correct asymptotic behaviour at large quantum numbers [9-16].

In this work, our aim is to solve the Schrodinger equation for the Manning-Rosen potential via the WKB approximation method. The Manning-Rosen potential takes the form:

$$V(r)=-\left[\frac{Ce^{-\propto r}+De^{-2\propto r}}{(1-e^{-\propto r})^2}\right] \quad (3)$$

where α is the screening parameter and C & D are the depths of the potential. Not much has been done in solving the Manning-Rosen potential via the WKB method.

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This paper is organized as follows: Section 1 has the introduction, a brief description of the semiclassical quantization and the WKB approximation for the radial solution is reviewed in section 2. In section 3, the radial Schrodinger equation with Manning-Rosen potential is solved. Finally, we give a brief discussion in section 4 before the conclusion in section 5

a) Semiclassical quantization and the WKB approximation

In this section, we consider the quasi-classical solution of the Schrodinger's equation for the spherically symmetric potentials. Given the Schrodinger equation for a spherically symmetric potentials $V(r)$ of eq. (3) as

$$(-i\hbar)^2\left(\frac{\partial^2}{\partial r^2}+\frac{1}{r^2}\frac{\partial^2}{\partial\theta^2}+\frac{1}{r^2\sin^2\theta}\frac{\partial^2}{\partial\phi^2}\right)\psi(r,\theta,\phi)=\left[2m\left(E-V(r)\right)\right]\psi(r,\theta,\phi) \quad (4)$$

The total wave function in Eq. (3) can be defined as

$$\psi(r,\theta,\phi)=[rR(r)]\left[\sqrt{sin\theta}\Theta(\theta)\Phi(\phi)\right] \quad (5)$$

And by decomposing the spherical wave function in Eq. (4) using Eq. (5) we obtain the following equations:

$$\left(-i\hbar\frac{\mathrm{d}}{\mathrm{d}r}\right)^2 R(r)=\left[2m\left(E-V(r)\right)-\frac{\vec{M}^2}{r^2}\right]R(r), \quad (6)$$

$$\left(-i\hbar\frac{\mathrm{d}}{\mathrm{d}\theta}\right)^2 \Theta(\theta)=\left[\vec{M}^2-\frac{M_z^2}{\sin^2\theta}\right]\Theta(\theta), \quad (7)$$

$$\left(-i\hbar\frac{\mathrm{d}}{\mathrm{d}\phi}\right)^2 \Phi(\phi)=M_z^2\Phi(\phi) \quad (8)$$

where $\vec{M}^2$, M_z^2 are te constants of separation and, at the same time, integrals of motion. the squared angular momentum $\vec{M}^2=\left(l+\frac{1}{2}\right)^2\hbar^2$.

Considering Eq. (6), the leading order WKB quantization condition appropriate to Eq. (3) is

$$\int_{r_1}^{r_2}\sqrt{P^2(r)}\,dr=\pi\hbar\left(n+\frac{1}{2}\right), \text{ n=0, 1, 2 . . .} \quad (9)$$

where r_2 & r_1 are the classical turning point known as the roots of the equation

$$P^2(r)=2m\left(E-V(r)\right)-\frac{\left(l+\frac{1}{2}\right)^2\hbar^2}{r^2}=0 \quad (10)$$

eq. (9) is the WKB quantization condition which is subject to discussion in the preceding section. Consider Eq. (6)-(8) in the framework of the quasiclassical method, the solution of each of these equations in the leading $\hbar$ approximation can be written in the form

$$\Psi^{WKB}(r)=\frac{A}{\sqrt{P(r,\lambda)}}exp\left[\pm\frac{i}{\hbar}\int\sqrt{P^2(r)}\,dr\right] \quad (11)$$

b) Solutions to the radial Schrödinger equation

The radial Schrodinger equation for the Manning-Rosen potential can be solved approximately using the WKB quantization condition Eq. (9). Since the potential of interest slowly varies, we assume that the wave function remains sinusoidal. Hence, we use the effective potential and plug it into the WKB approximation of Eq. (10) and to obtain the exact solution, we consider two turning points.

Given the effective potential of the centrifugal term as:

$$V_{eff}(r)=-\left[\frac{Ce^{-\propto r}+De^{-2\propto r}}{(1-e^{-\propto r})^2}\right]+\frac{\left(l+\frac{1}{2}\right)^2\hbar^2}{2mr^2} \quad (12)$$

The wave equation (12) is not an exactly solvable problem even for $l=0$ because of the centrifugal barrier term. Therefore, to solve eq. (12) analytically, we use an approximation scheme of the exponential-type proposed by Greene and Aldrich [12,13] to deal with the centrifugal term:

$$\frac{1}{r^2}=\frac{\alpha^2e^{-\alpha r}}{(1-e^{-\alpha r})^2} \quad (13)$$

the potential in Eq. (12) can also be written in the form

$$V_{eff}(r)=-\frac{Ce^{-\propto r}}{(1-e^{-\propto r})^2}-\frac{De^{-2\propto r}}{(1-e^{-\propto r})^2}+\frac{\alpha^2\hbar^2\left(l+\frac{1}{2}\right)^2e^{-\alpha r}}{2m(1-e^{-\alpha r})^2} \quad (14)$$

Subs. Eq. (14) into Eq. (9), we have

$$\int_{r_1}^{r_2}\sqrt{P^2(r)}\,dr=\int_{r_1}^{r_2}\sqrt{2m\left(E_{nl}+\frac{Ce^{-\propto r}}{(1-e^{-\propto r})^2}+\frac{De^{-2\propto r}}{(1-e^{-\propto r})^2}-\frac{\alpha^2\hbar^2\left(l+\frac{1}{2}\right)^2e^{-\alpha r}}{2m(1-e^{-\alpha r})^2}\right)}dr=\pi\left(n+\frac{1}{2}\right) \quad (15)$$

Let

$$\vec{M}^2=\frac{\alpha^2\hbar^2\left(l+\frac{1}{2}\right)^2}{2m} \quad (16)$$

$$\int_{r_1}^{r_2}\sqrt{2m\left(E_{nl}+\frac{Ce^{-\propto r}}{(1-e^{-\propto r})^2}+\frac{De^{-2\propto r}}{(1-e^{-\propto r})^2}-\frac{\vec{M}^2e^{-\alpha r}}{(1-e^{-\alpha r})^2}\right)}dr=\pi\hbar\left(n+\frac{1}{2}\right) \quad (17)$$

making the transformation $z=\frac{e^{-\alpha r}}{1-e^{-\alpha r}}$, we obtain (18)

$$\frac{-\sqrt{2m}}{\alpha\hbar}\int_{z_1}^{z_2}\frac{1}{z(1+z)}\sqrt{E_{nl}+Cz(1+z)+Dz^2-\vec{M}^2z(1+z)}dz=\pi\left(n+\frac{1}{2}\right) \quad (19)$$

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$$\frac{-\sqrt{2m}}{\alpha\hbar}\int_{z_1}^{z_2}\frac{1}{z(1+z)}\sqrt{-(\vec{M}^2-C-D)z^2+(C-\vec{M}^2)z+E_{nl}}\,dz=\pi\left(n+\frac{1}{2}\right) \tag{20}$$

$$\frac{-\sqrt{2m(\vec{M}^2-C-D)}}{\alpha\hbar}\int_{z_1}^{z_2}\frac{1}{z(1+z)}\sqrt{-z^2+\frac{C-\vec{M}^2}{(\vec{M}^2-C-D)}z+\frac{E_{nl}}{(\vec{M}^2-C-D)}}\,dz=\pi\left(n+\frac{1}{2}\right) \tag{21}$$

Let $\frac{C-\vec{M}^2}{(\vec{M}^2-C-D)}=b$, and $\frac{E}{(\vec{M}^2-C-D)}=-c$, we have (22)

$$\frac{-\sqrt{2m(\vec{M}^2-C-D)}}{\alpha\hbar}\int_{z_1}^{z_2}\frac{1}{z(1+z)}\sqrt{-z^2+bz-c}\,dz=\pi\left(n+\frac{1}{2}\right) \tag{23}$$

$$\frac{-\sqrt{2m(\vec{M}^2-C-D)}}{\alpha}\int_{z_1}^{z_2}\frac{1}{z(1+z)}\sqrt{(z-z_1)(z_2-z)}dz=\pi\hbar\left(n+\frac{1}{2}\right) \tag{24}$$

where we obtain the turning points z_2 & z_1 from the terms inside the square roots as

$$z_1=\frac{-b-\sqrt{b^2-4C}}{2}$$

$$z_2=\frac{-b+\sqrt{b-4C}}{2}$$

let $2z+1=y; dz=\frac{dy}{2}$ (25)

subs. Eq. (25) into Eq. (24), we obtain

$$\int_{y_1}^{y_2}\frac{1}{y^2-1}\sqrt{(y-y_1)(y_2-y)}dy=\frac{-\alpha\pi\hbar\left(n+\frac{1}{2}\right)}{\sqrt{2m(\vec{M}^2-C-D)}} \tag{26}$$

For computing the integral in equation (26), we use the integral expression [13,14]

$$\int_{y_1}^{y_2}\frac{1}{y^2-1}\sqrt{(y-y_1)(y_2-y)}dy=\frac{\pi}{2}\left[\sqrt{(y_1+1)(y_2+1)}-\sqrt{(y_1-1)(y_2-1)}+2\right] \tag{27}$$

where the limits y_1, y_2 are real numbers, with $y_1<y_2$. Comparing equation (27) with equation (26), and solving for E_{nl} gives

$$E_{nl}=-\frac{\alpha^2\hbar^2}{2\mu}\left[\frac{\left(l+\frac{1}{2}\right)^2-\frac{2\mu C}{\alpha^2\hbar^2}+\left(n+\frac{1}{2}\right)^2+(2n+1)\sqrt{\left(l+\frac{1}{2}\right)^2-\frac{2\mu C}{\alpha^2\hbar^2}-\frac{2\mu D}{\alpha^2\hbar^2}}}{2n+1+2\sqrt{\left(l+\frac{1}{2}\right)^2-\frac{2\mu D}{\alpha^2\hbar^2}-\frac{2\mu C}{\alpha^2\hbar^2}}}\right]^2 \tag{28}$$

II. Conclusion

In this paper, we present the exact energy spectrum for present for Manning-Rosen potential using the Wentzel-Kramers-Brillouin WKB approach. The energy eigen values and the corresponding total normalized wave functions expressed in terms of the hyper geometric functions for the system are also obtained.

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- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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

"

Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

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Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

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3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
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Declaration of Conflicts of Interest

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- Printed material
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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

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Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

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Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

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

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.

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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.

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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.

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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.

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

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