The new physical theory about gravitational time dilation

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Abstract.
Time, a fundamental concept in modern physics, is integral to classical mechanics, relativity theory, quantum field theory, the standard model of elementary particle physics, superstring theory, and other contemporary theories. Understanding the properties of time in the spatial and temporal processes of both the microcosm and macrocosm is particularly important. Consequently, there is a need to understand how time depends on gravitation, as established through various experiments. This paper briefly analyzes the results of these experiments within the contexts of classical physics and the General Theory of Relativity (GTR), presenting the main principles of the new "Physical Theory of Gravity." These principles provide a scientific explanation of the nature and properties of time. The findings of this research not only elucidate the influence of gravitation on time but also offer a physical explanation of the nature of gravitation itself, and the effects of the gravitational field on material bodies. This work could form the foundation for developing a general theory of gravity in the future.

Keywords: gravity, time, gravitational time dilation, physical theory of gravitation, electromagnetic field, pulsating electric and magnetic fields.

1. Introduction

1.1 Time as a Physical Quantity.

Time is one of the fundamental concepts in natural sciences and, as a physical quantity, is determined by periodic processes within a chosen reference frame. This enables us to measure changes in the states of objects across various processes and to determine the duration of their existence using a time scale [1,2,3].

1.2 Concepts of Time in Modern Science.

Classical Physics. In classical physics, time is considered an absolute, continuous, and invariant quantity. All natural processes are viewed within a three-dimensional Euclidean space, described by three orthogonal coordinate vectors X, Y, and Z (a variant of flat Minkowski space). Time governs the progression of all processes equally as a flow of duration. Processes in nature do not influence the passage of time [4].

Time is regarded as an independent, continuous, one-dimensional quantity that measures the duration of events in three-dimensional space. The flow of time is uniform and identical at any location where material bodies exist. The relationship between time and space is expressed through the interrelation of momentum and energy properties. The laws of conservation of energy and momentum are unambiguously fulfilled in three-dimensional space [5].

A periodic sequence of events is employed to measure time, which is recognized as a standard interval. The unit of time is one second in the International System of Units (SI), defined by the period of electromagnetic radiation corresponding to the transition between the hyperfine levels of the ground state of the Cesium-133 atom (one second equals 9,192,631,770 such periods) [6,7].

General Theory of Relativity (GTR). In GTR, time is considered one of the coordinates of the unified space-time and can change under the influence of gravitation. Gravitation is perceived not as a force interaction among material bodies but as a manifestation of the "curvature" of the four-dimensional space-time continuum induced by mass. This curvature of four-dimensional space forms gravitation, which is identified with the metric tensor of Riemannian space. This understanding negates the concept of a gravitational field as a physical field, transitioning to a geometry of space with curved geodesic lines [8,9,10,11].

The metric properties of space-time vary at each point under the influence of the gravitational field, making time a relative quantity that changes as a coordinate of the unified spacetime. Specifically, time slows down when approaching a massive body according to GTR. For instance, one second (the time for 9,192,631,770 quantum transitions of the cesium isotope) has different values depending on whether the cesium isotope atom is on Earth or in space [12,13,14].

1.3 Experiments on Time Dilation under the influence of gravitational forces.

Gravitational time dilation is confirmed by several experimental studies aimed at testing the effect of decreased gravitational potential with increasing altitude above Earth, which causes clocks to run slower at the Earth's surface than at higher altitudes.

Experiments:

(i) **Hafele-Keating Experiment**. This experiment demonstrated a time difference between the average values of clocks on two airplanes flying in opposite directions and those on the Earth's surface [15].

For small changes in the gravitational field associated with altitude changes, the approximate time dilation expression is used to compare a clock on the Earth's surface (T_E) with one at height h above the surface (T). Hafele and Keating correctly predicted a time difference of 144 ns for an eastward flight around the world, lasting 41.2 hours at an average altitude of 8900 m. For a westward flight lasting 48.6 hours at an average altitude of 9400 meters, the correctly predicted value was 179 ns.:

$$T - T_E = \frac{gR}{c^2} T_E \qquad (1)$$

where: T_E - clock on the Earth's surface, T- clock above Earth's surface at distance h,

$g = 9.8\ m/s^2$, $R = 6.38 \times 10^6$ m (mean radius), $c = 3 \times 10^8 m/s$.

(ii) **Gravity Probe A Experiment**. This experiment measured the difference in clock rates between a satellite at an altitude of 10,000 kilometers and the Earth's surface, with data showing a time delay with an error margin of 0.007%. Subsequent observations of Galileo satellites reduced this error by a factor of 5.6, refining gravitational redshift test results from 1976 [16].

(iii) **Hidetoshi Katori Experiment**. This experiment observed a lag of 4.3 nanoseconds per day between synchronized optical atomic "bottom clocks" on the first floor of the Tokyo Sky Tree skyscraper and "top clocks" 450 meters above the Earth's surface [17].

(iv) **GPS Satellites**. Time corrections are applied to clocks on GPS satellites at an altitude of about 20,000 km, which run faster than clocks on Earth. The time delay for Earth clocks is 38 microseconds per day [18,19,20,21].

(v) **Holger Muller's Experiment at UCLA**. This experiment demonstrated time dilation due to Earth's gravity. Cesium atoms, moving upward relative to Earth's surface under two laser beams, entered a superposition of states with different impulses. The gravitational influence varied with height, causing phase overlaps of the wave function to differ when returning to the starting point. These variations caused atomic interference within the cloud, showing alternating densification and rarefaction measured by laser beams. This confirmed the effect of time dilation under Earth's gravity with high accuracy (of the order of $7 \cdot 10^{-9}$) in 2011 [22,23].

1.4 Explanation of the Experimental Results.

Experiments have demonstrated that gravity affects time, causing it to slow down when approaching a massive body like Earth. This implies that increasing the level of gravity decelerates the passage of time. The explanation of these results, according to the two main variants of time concepts, is as follows:

Classical Physics (Mechanics). Classical physics interprets the results of experiments (i)-(iv) and similar experiments confirming gravitational time dilation as the direct effect of gravity on the clock mechanism. In classical physics, time and space are immaterial entities; they possess neither energy nor mass, nor any other physical properties detectable in an experiment. Gravity is viewed as an influence on a material medium. For instance, the speed of electromagnetic wave propagation depends on the medium's properties, causing electromagnetic waves to travel different distances in the same time when the medium's properties change. These changes result from interactions between electromagnetic waves and the material medium, not from alterations in the properties of space itself.

The measurement of different processes' durations depends on the time standard. Clocks may run slower under the influence of gravity, possibly due to changes in the medium's properties where they

are situated or the direct effect of gravity on the clock's mechanism. In classical physics (mechanics), these changes pertain not to time itself but to changes in the properties of material bodies.

General Theory of Relativity (GTR). In GTR, space-time is characterized by the properties of non-Euclidean space with a pseudo-Riemannian metric. Space-time exhibits varying properties at different points, described by the metric tensor and its differential properties. These differential properties correlate with the parameters of matter's structure, mass, and motion within a spatial region, explaining the phenomenon of gravitation. Gravitation, as a manifestation of space-time curvature, accounts for the change in time under the influence of gravity in GTR. The only reason for the observed clock slowing in experiments (i)-(iv) and the laser beam interference in experiment (v) is the curvature of space-time itself.

For example, gravitational time dilation at a height r from the Earth's center can be estimated by the following formula:

$$1-\sqrt{1-\frac{a}{r}}\approx\frac{a}{2r}, \qquad (2)$$

where: a - is the Schwarzschild radius of the Earth (a = 1sm),

r - is the height from the center of the Earth.

GTR shows that clocks on the Earth (r = 6400 km) lag behind clocks on distant navigation satellites by about tens of microseconds per day (1.5 μs/hour).

1.5 Comments.

- **Lack of Scientific Explanation in Classical Physics.** Classical physics does not provide a scientific explanation for the change in time due to gravity. It explains the effects of gravity through the action and alteration of the properties of the material medium. The current issue is the unknown structure of the gravitational field and its effect on matter; there is no comprehensive theory of gravitation that fully describes this fundamental interaction.
- **GTR and Mathematical Methods.** The General Theory of Relativity (GTR) describes the influence of the gravitational field on time as a change in the time scale in a specific region of space using mathematical methods. GTR explains the curvature of geophysical lines due to the properties of space-time. However, GTR does not offer a physical explanation of how gravitation affects time. The theory employs a geometrical approach, linking the emergence of gravitation to the curvature of pseudo-Euclidean spacetime. Consequently, GTR can be seen as a mathematical model.

2. Problems of Modern Theories of Gravitation.

2.1 Newtonian Gravitation.

Within classical physics, gravitational interaction is described by Newton's law of universal gravitation. According to this law, gravitation is a force in nature directly proportional to the mass of the interacting bodies. This theory posits that every particle possessing mass has an intrinsic property enabling it to generate a force field in the surrounding space, known as the gravitational field. However, this law, and subsequent works, do not reveal the physical basis of gravitation or explain the mechanism of gravitational interaction between material bodies. This limitation prevents a complete explanation of the effect of gravitation on time [24].

2.2 Modern Theories of Gravitation.

Modern theories of gravitation can be categorized into two main groups:

(a) Geometrical Interpretation: This group interprets gravitation as a geometrical effect based on the properties of "space-time," as demonstrated in the General Theory of Relativity (GTR) and other complementary theories [25, 26].

(b) Alternative Gravitational Theories: These include relativistic (RTG), quantum, covariant, and other theories [27-37].

Group (a): Geometrical Interpretation.

Theories in this group do not view gravitation as a force interaction between material bodies but as a manifestation of the "curvature" of the four-dimensional spacetime continuum under the influence of masses. Gravitation is identified with the metric tensor of Riemannian space, leading to the rejection of the gravitational field as a physical field in favor of the geometry of space with curved geodesic lines. This approach leads to partial inconsistencies with quantum mechanics, as GTR does not explain how the mass of matter curves space, an explanation that conflicts with quantum mechanics. Attempts to present space as discrete in various complementary theories also lack physical explanation.

Group (b): Alternative Gravitational Theories.

Theories in this group describe gravitation as a real physical field, explaining its nature through mechanisms such as the emission and interaction of unknown particles ("gravitons" in RTG), the "pushing" of bodies by other particles, Coulomb interaction of charges, photon emission, or the properties of space filled with unknown matter like cosmic particles or one-dimensional energy "strings." Gravitational phenomena are considered within the framework of flat Minkowski space, where the laws of conservation of energy-momentum and momentum are unambiguously fulfilled.

2.3 Inconsistencies and Approximations.

Despite inconsistencies in initial positions, interpretations of phenomena, and separate experiments on gravitation, known theories (a) and (b) yield similar results within permissible approximations. All theories tend to explain one unknown phenomenon of gravitation by invoking perplexing and unknown elements, such as the "curvature of space-time" in GTR or the "repulsion" and interaction of elusive particles that have yet to be discovered, or the presence of a material medium ("world ether"), whose existence remains unconfirmed by scientific observations.

Despite the diversity of scientific theories, the physical mechanism of gravitation formation, gravitational interaction between material bodies, the influence of gravitation on time, and the structure of the gravitational field remain unexplained. There is also no description of gravitational interaction at the quantum level or scientific explanations for various gravitational anomalies at micro and macro levels, including the phenomenon of the expanding Universe. It can be stated that there is currently no consistent theory of gravitation that fully describes this fundamental interaction based on known and objectively shown scientific facts, observations, and experiments. All known theories describe the manifestations of gravitation through various mathematical methods and can be considered as mathematical models.

3. Results.

3.1 Main Points of the New "Physical Theory of Gravity".

Today, there are ample objective scientific observations and experimental data on the structure of matter, its properties, and various interactions at both macro- and microscopic levels to explain the physical nature of gravitation. We propose that rather than seeking fundamentally new properties of matter that form and react to the gravitational field through mutual attraction, it is sufficient to study the known properties of matter and its constituents (particles, molecules, and atoms) that create and respond to physical fields.

The proposed "Physical Theory of Gravity" provides a physical explanation of the nature of gravitation and the action of the gravitational field on material bodies, integrating modern understandings of the structure of matter. This theory could form the basis for a general theory of gravitation in the future. Our research addresses critical gaps in understanding gravitation, laying the groundwork for a physical theory that explains the genesis of gravitational fields and the dynamics of gravitational interactions among material bodies, while incorporating established scientific concepts about the structure of matter [38].

Key insights of the theory include:

- **Electromagnetic Nature of the Gravitational Field:** The gravitational field is presented as a physical field of electromagnetic nature, resulting from the interaction of electrons with atomic nuclei and the motion or rotation of charged particles, including those in a plasma state.
- **Generation of electromagnetic fields by Atoms and Charged Particles:** Each atom and charged particle (objects with a magnetic moment - atomic and nuclear systems, electrons, protons, other fermions) generates a gravitational field characterized by the superposition of pulsating, vortex-free electric and magnetic fields („E"- and „H"- fields) with discrete frequencies and quantized energy levels.
- **Multimodal Gravitational Field:** The gravitational field radiated by matter in the radial direction acquires a multimodal character due to the superposition of pulsating vortex-free „E"- and „H"- fields originating from all atoms and particles comprising the matter.

The our theory posits that matter generates gravitational fields, which are longitudinal pulsating electric and magnetic fields („E"- and „H"- fields) resonating within the frequency range of 10^{19}-10^{23} Hz, akin to X-rays and gamma rays. These fields are named "electric" and "magnetic" based on the type of charge and current systems that emit the corresponding longitudinal fields. Pulsating „E"-fields are emitted by oscillating electric dipoles, and pulsating „H"-. fields are emitted by oscillating magnetic dipoles. The Umov-Poeting vector of such waves is zero identically, since their vector product is zero and the electromagnetic momentum of the wave is absent (**Figure 1, A**).

A specific property of longitudinal pulsating E-waves and H-waves is their high penetrating ability.

The high-frequency pulsations of „E"- and „H"-fields, ranging from 10^{19}-10^{23} Hz, exhibit surprising penetrating abilities characteristic of gravitational fields.

This penetration is due to the high frequency of the pulsations, from 10^{19}-10^{23} Hz. At this frequency, it is impossible to compensate for their effect by external antiphase-induced fields.

These waves do not create recharging currents and no Foucault currents on the conducting surface, so this radiation passes without attenuation through ordinary screens.

The interaction of pulsating multimode „E"- and „H"- fields with matter significantly differs from the interaction of electromagnetic fields with matter. When passing through matter, the „E"- and „H"-fields interact with electrons and atomic nuclei or individual particles, resulting in an attraction force in

the direction of the gravitational field source. This interaction is very weak, hence the strong penetrating power of „E"- and „H"- fields.

Gravitational Field Mechanism: Objects with a magnetic moment - electrons, protons, other fermions, and many atomic and nuclear systems have angular momentum and effective internal electric current proportional to their angular momentum. The external magnetic field exerts force on these objects, driving the Larmor precession. In this case, the force of the external field induces the impulse of attraction of these objects towards the source of the external field. The phenomenon is conceptually similar to the precession of a tilted classical gyroscope in an external torque-exerting gravitational field (**Figure 1, B**).

Atoms or particles in external multimode "E'- and "H"- fields acquire additional energy. The pulsating "E"- field polarizes electric systems, for example, in an atom it shifting electron clouds relative to the nucleus, while the pulsating "H" - field orients the magnetic moments of particles associated with their rotation. This leads to impulsive precession of the rotating particles and a tilt of the rotation axis, causing the gravitational attraction of the entire body towards the gravitational field source.

It is noteworthy, that during resonance phenomena, i.e. the ratio of the pulsation frequencies of the external "E"- and "H"- fields and the internal frequency of rotation of the particles and their highest kinetic energy, repulsion of these particles from the field source will occur. In this case, instead of gravitational attraction, gravitational repulsion will take place, the so-called "antigravity". Such interaction is possible between objects from high-temperature plasma, for example, stars.

Quantum Mechanics Perspective: From the standpoint of quantum mechanics, the effect of multimode longitudinal pulsating „E"- and „H"- fields on the atom of an external body alters the wave function of the atomic electron due to the non-central symmetry of the external gravitational force. The type of wave function changes with the polarization of the external electromagnetic wave, leading to induced anisotropy in the probability density distribution of the atomic electron's spatial localization. This anisotropy, due to its non-stationarity, causes the precession of the magnetic moment and the attraction of the center of mass to the external gravitational source [39].

The energy of these pulsations is quantized, formed due to the quantum levels of atoms. These pulsating „E" and „H" fields act on external bodies, causing precession of their magnetic moments, similar to the mechanical effect on a gyroscope. Conceptually, these pulsations can be considered gravitational particles (gravitons) that provide attraction between bodies. The gravitational field, representing radially pulsating „E" and „H" fields can thus be considered as a flow of particles („**gravitons**") (**Figure 1, C**).

The minimum pulsation duration of the „E" and „H" fields is on the order of 10^{-23} seconds, implying that time consists of minimal discrete intervals similar to the energy of quanta. This discreteness of time indicates the existence of a minimal indivisible unit of time, equal to 10^{-23} seconds, termed „**chronons**".

3.2 Possibilities of the New Theory of Gravity.

The "Physical Theory of Gravity" offers several possibilities:

- **Mechanism of Gravitational Field Origin and Action:** Provides a description of the mechanism of gravitational field origin and its action on matter.
- **Physical Nature of the Graviton:** Reveals the physical nature of the gravity carrier (graviton).

- **Physical Nature of the Chronon:** Unveils the physical nature of the quantum of time (chronon).
- **Quantum Level Gravitational Interaction:** Demonstrates the possibility of describing gravitational interaction at the quantum level.
- **Unification with Quantum Mechanics:** Shows how quantum mechanics can be unified with gravitational interaction.
- **Theoretical Unification of Fundamental Interactions:** Allows for the theoretical unification of all four fundamental interactions.
- **Explanation of Gravitational Phenomena and Anomalies:** Explains observable phenomena, anomalies, and experimental results related to gravity (e.g., gravitational anomalies on Earth and other planets, spacecraft missions, expansion of outer space on the scale of the entire Universe due to the gravitational repulsion of stars. etc.).
- **Experimental Testing:** Proposes experiments to test the nature of gravity (e.g., dependence of gravitational forces on body shape and matter composition, dependence of body mass on motion direction).

3.3 The Incorrectness of the "Observer" Method in Relativity Theory.

The "Physical Theory of Gravity" critiques the use of "observers" in the thought experiments of relativity. Einstein and his followers employed visualized thought experiments as a fundamental tool for understanding physical phenomena and explaining the "Special Theory of Relativity" (STR) and the "General Theory of Relativity" (GTR). In these theories, an "observer" typically refers to a person mentally transported to a specific point in space to measure physical processes.

For example, paradoxes of distance and time are represented using "observers" following the passage of light signals between moving and stationary bodies. Observers are imaginatively placed on different objects and endowed with identical properties, emphasizing their perception of time intervals in the given process. A key focus is on the equivalence of inertial reference systems, such as stationary and moving "observers."

An illustrative example is a long train moving past an equally long platform, where an observer in the center of the car emits a light flash. Observers in the train and on the platform perceive the arrival of the light at different times due to their relative motion, despite the same speed of light.

However, the method of using identical "observers" is flawed because it does not account for the physical changes in the properties of observers when placed in different points of space. For instance, a stationary observer and one in a moving train cannot remain identical due to the necessary acceleration and resulting changes in the observer's clock speed and gravity level.

Thus, the proofs of physical phenomena in STR and GTR based on these thought experiments with "observers" are incorrect. The fundamental error is the assumption that observers in different physical positions remain identical, ignoring the physical changes induced by motion and gravity.

By analogy, as Einstein humorously noted, an "observer" in a train differs from one on the platform in having a travel ticket.

4. Time Depends on Gravity in Three-Dimensional Space.

4.1 Mechanisms Underlying Gravitational Attraction and Their Effect on Time.

Our theory elucidates the mechanisms underlying gravitational attraction through the action of pulsating "E" and "H" - fields on matter and, consequently, their effect on the duration of any processes. This discovery has profound implications for understanding gravity's effect on time. The first results of our theory were disseminated in 2020, and the present paper provides the main points and a general qualitative assessment of gravity [38].

4.2 Known Experimental Evidence and Contradictory Explanations.

Known experiments show that time, as a measure of duration, depends on gravity. Increasing the level of gravity in space slows down time. The concepts of time provide contradictory explanations for the results of these experiments:

- **Classical Physics:** In classical physics, gravity affects only material bodies in space. The mechanism of gravity's effect on time is not considered in this concept due to the lack of understanding of the gravitational field's nature.
- **General Theory of Relativity (GTR):** GTR postulates that the change of time under the action of gravitation is caused by the deformation of four-dimensional space-time, rather than by a force interaction between gravitation and material objects. In this framework, the value of time depends on the presence of mass-energy in a given region of space-time, making time a relative quantity.

4.3 Explanation by the New "Physical Theory of Gravity"

The new "Physical Theory of Gravity" explains the dependence of time on the level of gravity in three-dimensional Euclidean space as a result of the action of the physical field of gravity on all material objects in space. According to this theory, time is a measure of change in the surrounding world and is determined by processes in the spatial field. Conversely, the duration of existence and change of all material objects in nature can be considered as time. The gravitational slowing down of time in space is essentially the increase in this duration under the influence of gravity.

Cause-and-Effect Relationship: Gravity, as a physical field, acts on all material objects in three-dimensional space and affects the duration of all processes in nature. An increase in the level of gravity, i.e., the force exerted on all material objects, leads to the slowing down of the duration of these processes and, consequently, to the slowing down of time.

The reason for gravity's influence on time is that the duration of physical and chemical phenomena in nature, which determine the duration of existence and the change of states of all material objects, depends on the magnitude of gravity. The stronger the gravitational field, the longer the duration of all phenomena, i.e., time.

In conclusion, our theory provides a comprehensive framework for understanding the intricate relationship between gravity and time, grounded in the physical interactions of gravitational fields with matter. This framework not only aligns with experimental observations but also offers a consistent explanation that bridges classical physics and general relativity with quantum mechanics

4.4 Explanation of the Increase in Duration of Physical and Chemical Phenomena Due to Gravity.

The "Physical Theory of Gravity" provides an explanation for the increase in the duration of physical and chemical phenomena and related processes under the influence of gravity near the Earth's surface. This explanation is based on well-known scientific observations of physical, chemical, and nuclear kinetics [40…47]:

(a) Chemical and Nuclear Reactions:

- **Chemical Reactions:** Homogeneous and heterogeneous chemical reactions occur when atoms and molecules collide. In these reactions, new substances with different properties from the reactants are formed, with changes occurring in the electron shells of the substances, while the atomic nuclei remain unchanged.
- **Nuclear Reactions:** These involve changes in the atomic nuclei of the reacting elements, resulting in the formation of atoms of new elements. The rate of nuclear reactions depends on the collisions of the nuclei of the reacting substances.

The rate of these reactions is determined by two main factors:

- **Number of Collisions:** This depends on the concentrations of the reacting substances and their mobility.
- **Probability of Transformation:** This depends on the energy of the colliding substances.

The rate of reactions quantitatively characterizes their speed, i.e., their duration. As the level of gravity increases, the duration of chemical and nuclear reactions increases. This is because the rate of reactions involving nuclei, atoms, or molecules depends on their activation energy and inert mass. An increase in gravity reduces the mobility of particles and increases the activation energy required for reactions, resulting in slower chemical and nuclear reactions due to fewer collisions of reacting substances.

From a quantum perspective, the physical field of gravitation, represented by longitudinal pulsating electric and magnetic fields ("E"- and "H"- fields with frequencies ranging from 10^19 to 10^23 Hz), leads to partial polarization of the wave functions of the atoms of reacting substances. This increases their stability due to the precession of the magnetic moments of nuclei and electrons. Under the influence of a gravitational field in the form of longitudinal pulsating "E"- and "H"- fields, the wave function of the electron in atoms changes. The state of the electron is determined by the forces acting on it from the atomic nucleus and the external gravitational force. This change in the wave function of the atomic electron leads to an increase in the duration of chemical reactions.

Analysis of Chemical and Nuclear Reactions.

Analysis of known chemical and nuclear reactions indicates that their duration depends on the level of gravity. An increase in gravity generally slows down the reaction time.

In summary, the "Physical Theory of Gravity" explains how the physical field of gravity affects the duration of physical and chemical processes. The increase in gravitational levels reduces particle mobility and increases activation energy, leading to slower reaction rates and longer durations for chemical and nuclear reactions. This explanation aligns with observed phenomena and provides a comprehensive understanding of gravity's impact on the duration of various processes.

(b) Physical Phenomena in Nature:

Physical phenomena in nature are characterized by changes in the shapes, sizes, or aggregate states of material bodies. The rate of these reactions depends on the mobility, structural stability, and masses of the material bodies involved in the interaction process. An increase in the gravitational field level leads to an increase in the inert mass of matter and a decrease in the mobility of material bodies, which explains the increase in the duration of physical reactions in nature.

A special group of physical phenomena stages, however, shows that an increase in the level of gravity can lead to an increase in their speed. Examples include:

- The frequency of pendulum oscillations

- The pressure exerted by a body on its base under gravity
- Acceleration of certain stages of earth cataclysms

In these stages, gravity acts as a dominant force that accelerates the physical process. Despite this, the overall duration of physical phenomena increases with increasing gravity levels.

(c) Plant Growth:

Plant growth, which involves both chemical (photosynthesis and respiration) and physical (transpiration) changes, slows down as gravity increases. The chemical reactions in plant growth convert light, water, and carbon dioxide into oxygen and glucose, which are used as energy. Transpiration involves the movement of water from the soil to the plant roots and leaves, where it is released as water vapor. An increase in gravity slows the rate of these reactions, thereby slowing plant growth.

(d) Processes in Living Organisms:

An increase in the level of gravity slows down the processes in living organisms that sustain their life. Despite the diversity of life forms, all organisms share common features in their life activities, which are based on physical and chemical processes. These processes include metabolism, protein synthesis, and regulation of genetic information, all of which occur at the molecular level within cells.

The effect of gravity on living organisms is similar to its effect on all material bodies in nature, leading to a slowdown in their development.

(e) Nervous System and Human Thought:

An increase in gravity leads to slower reactions of the nervous system and the human development process. The brain is a complex neural network that produces and processes a vast number of electrochemical impulses. These impulses are responsible for human thought, which is based on the properties of neurotransmitters forming functional chains for information transmission and processing.

Neurons communicate through synapses, where electrical signals are transmitted by neurotransmitters. The speed of thought is determined by the speed at which nerve impulses are transmitted through synaptic connections. The chemical and electrical activity of the brain is crucial for the formation of consciousness and memory. An increase in the gravitational field slows down the rate of these activities, leading to a slowdown in all thought processes and the perception of the surrounding world.

In summary, the "Physical Theory of Gravity" explains how the physical field of gravity affects the duration of various physical and chemical processes. As gravity increases, it reduces particle mobility, increases activation energy, and slows down reaction rates, resulting in longer durations for these processes. This comprehensive understanding aligns with observed phenomena in nature and living organisms.

4.5 Peculiarities of Gravitational Time Dilation.

A qualitative assessment of the influence of Earth's gravity on matter, based on scientific observations of physical, chemical, and nuclear kinetics, reveals the following:

Chemical and Nuclear Reactions:

- **Earth's Gravity and Matter Stability:** The gravitational field of Earth affects matter by increasing the stability of nuclei, atoms, and molecules. This stability is enhanced due to the precession of their magnetic moments within the physical gravitational field and the resultant increase in inert mass.

- **Activation Energy and Reaction Duration:** Earth's gravity raises the activation energy of nuclei, atoms, molecules, and other particles by polarizing the wave functions of electrons in the direction of the gravitational field. This polarization decreases the activity of particle interactions and slows down the duration of reactions. However, this slowing down effect is minimal under Earth's gravity because the gravitational force here is much weaker compared to the dominant electrostatic forces and kinetic energy of molecules that primarily determine the rate of chemical reactions.
- **Significant Gravitational Increase:** If the gravitational field level were significantly increased beyond Earth's gravity, the rate of chemical reactions would substantially decrease. This is due to the increased activation energy in molecules and changes in their average orientation, leading to fewer collisions necessary for reactions. Consequently, the duration of all reactions and chemical processes in both living and non-living nature would increase.

Physical Reactions:

- **Dominance of Gravity in Physical Processes:** Earth's gravity is the dominant force in many physical processes. The speed of these reactions depends on the mobility, structural stability, and masses of material bodies involved in interactions. An increased gravitational field level leads to an increase in the mass of matter and a decrease in the mobility of material bodies, which explains the lengthening duration of physical phenomena as gravity increases.
- **Phenomena Duration Under Earth's Gravity:** The duration of all phenomena occurring under Earth's gravity has been studied and conforms to the established laws of physics and chemistry.

Experimental Observations

- **Atomic Clocks and Gravitational Potential:** Well-known experiments with atomic clocks have demonstrated that they show different times at different altitudes, which have varying gravitational potentials on Earth. These time differences are extremely small, measured in nanoseconds, indicating a minimal but measurable impact of gravitational potential on time.
- **Nonlinear Dependence on Gravity:** The duration of all phenomena in nature depends nonlinearly on the level of gravity.
- **Disproportionate Changes in Phenomena Duration:** Changes in gravity levels lead to disproportionate changes in the duration of various reactions and phenomena in nature. Any significant increase or decrease in gravity compared to Earth's conditions results in distortions in the natural world, affecting plant and animal life, the nervous systems of living organisms, and the cognitive processes of intelligent beings.
- **Expansion of the Universe due to the repulsion of stars:** Expansion of the Universe due to repulsion of stars: At resonance of frequencies of pulsations of external "E"- and "H"-fields emitted by one mass, for example, a star, and frequencies of rotation of particles with huge kinetic energy in the state of plasma of another mass, these particles are repelled from the source of the field. In this case there is no precession of particles in the other mass and instead of gravitational attraction between these two masses there is gravitational repulsion, the so-called "antigravity". Such interaction is possible between objects from high-temperature plasma, such as stars. This explains the expansion of space on the scale of the entire Universe due to gravitational repulsion of stars.

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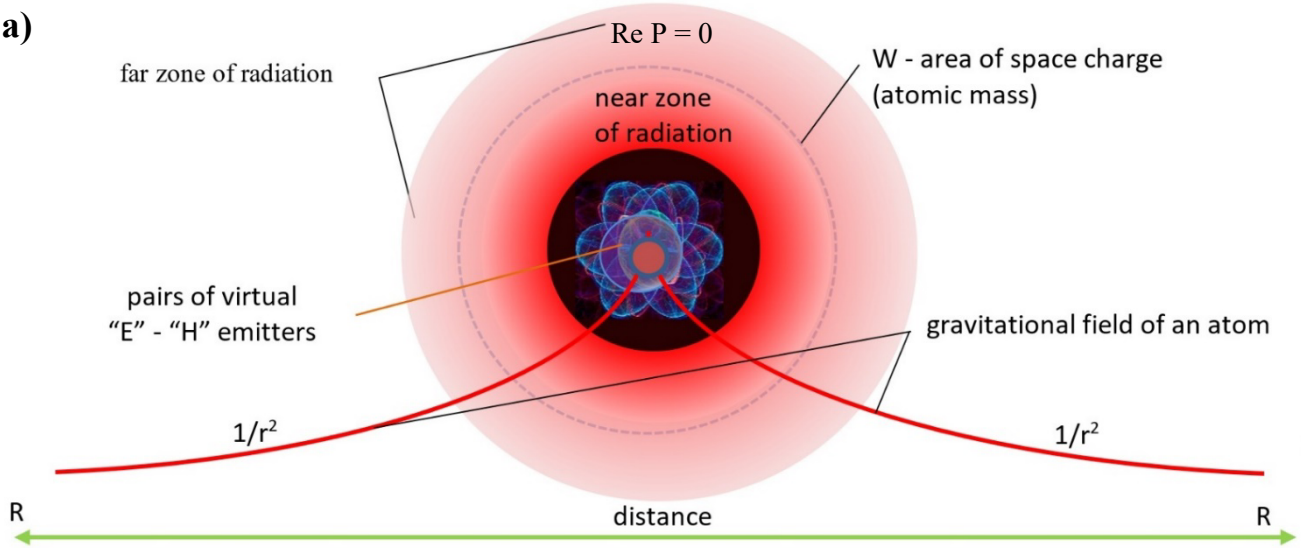
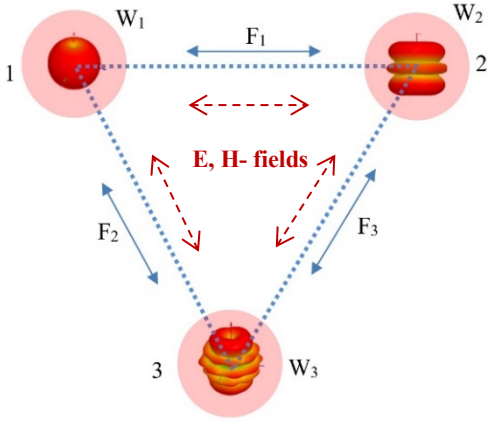
a)



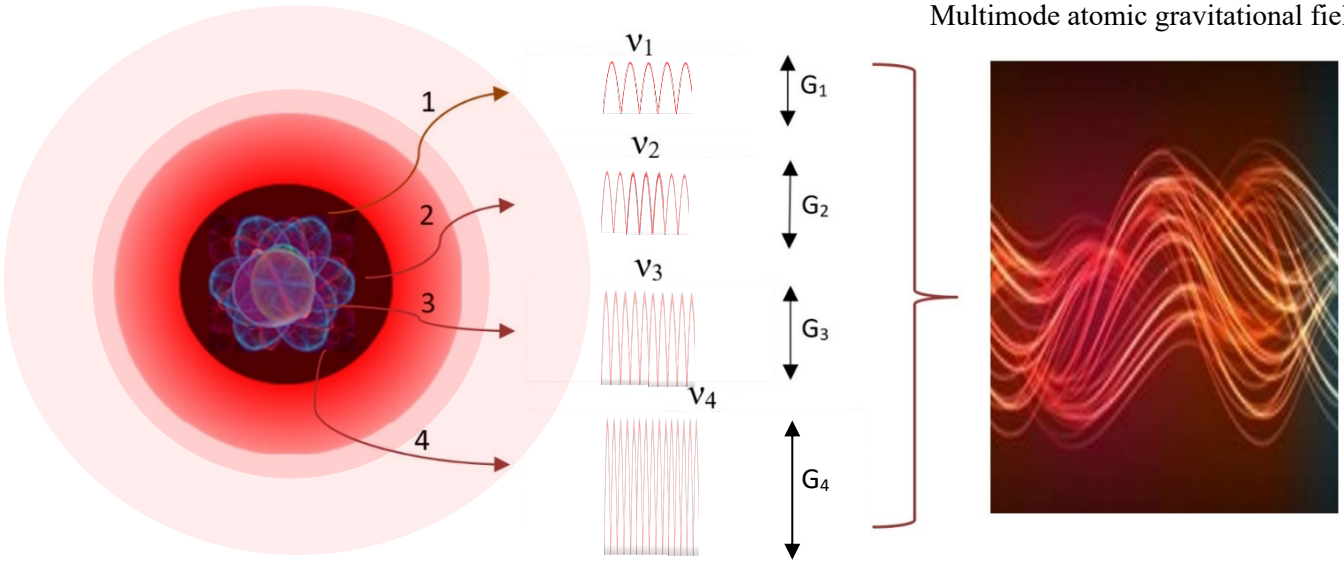
The gravitational field of an atom is formed from longitudinally scalar „E“ and „H“ fields emitted by virtual atom emitters

b)



c)

Multimode atomic gravitational field



The atomic structure (Z = 4) ensures the formation of the longitudinal pulsating "E"- and "H"-fields within the frequency range of 10^{19} to 10^{23} Hz.

Atom (Z = 4) emits longitudinally scalar electromagnetic "E" - "H" - fields with discrete frequencys ν1…ν4 and quantized amplitudes G1…G4

Figure 1