

Density/Curvature of Quantum Space Generates Gravitational Motion

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Abstract

Clocks measure a frequency, velocity and numerical order of change. Experimental data confirms that changes and clocks do not run time; they run in quantum space only. Time is not a part of quantum space. Quantum space itself is timeless. In the universe as a whole amount of matter energy and amount of quantum space energy is constant. Density of mass and density of quantum space in a given volume of quantum space tends to be constant. Mass here is considered as a compressed energy of quantum space. Presence of mass in a given volume of quantum space diminishes its density. Massive objects move always into direction of lower density of quantum space. Gravitational motion of massive objects is result of change of density of quantum space. In space with no change of density massive object will not have gravitational motion as in centre of stellar objects or in a flat quantum space where massive objects are far away. Change of density of quantum space corresponds in General Theory of Relativity to the change of the curvature of space. Lower is density of quantum space bigger is its curvature. Here is introduced density/curvature of quantum space.

Key words: quantum space, space-time, gravity, density/curvature of quantum space

Introduction

Quantum gravity describes cosmic space as granular. Space is made out of quanta of space QS volume of Planck (1). Experimental data confirms that with clocks we measure a frequency $\gamma(s^{-1})$, velocity $v(ms^{-1})$ and numerical order $n...n+1...n+2...$ of material changes that occur in a quantum space.

Experimental data confirms that change runs in cosmic space not in space-time. We experience stream of changes in a linear concept of the inner space-time that is based in neuronal activity of the brain. Research done in 2003 introduces idea that part of the brain is creating time: "The brain is the "local" creator of time, space, and space-time as our special maps of the reality we "observe" and participate in" (2).

Research done in 2005 shows that consequent experience of changes in a "past-present-future" perspective is a result of neuronal dynamics in certain areas of the brain (3).

Physical time that is run of clocks ("thick" of clocks) is not a part of quantum space in which change occurs. The fundamental arena in which changes occur is the quantum space. With clocks we do not measure time as a fourth dimension of space. With clocks we measure frequency, velocity and numerical order of change in timeless quantum space. Space-time is mathematical model merely were fourth coordinate X_4 is a product of imaginary number i , light speed and number t that represents "thick" of clock: $X_4 = i \times c \times t$.

Numerical order of change that runs in timeless quantum space is represented by a straight infinite line composed of real numbers. Transformation of the change n into $n+1$, $n+1$ into $n+2$ is an unbroken continuous process that is represented by the continuum of real numbers. Number zero represents the present moment in which we measure changes. Changes that have happened are represented by the real numbers to the left from zero and changes that will happen are represented by real numbers to the right from zero.

Discussion

With discovery that physical time is run of clocks in timeless quantum space, a new interpretation of relativity emerges. In a faster inertial system that moves in the timeless space the speed of change is slower than in a slower inertial system. With stronger gravity the speed of change is slower than with weaker gravity. The so-called “relativity of time” and “time-dilatation” means the speed of change slows down, including the speed of clocks.

A growing number of modern researchers are challenging the view that space-time is the fundamental arena of the universe. They point out that the mathematical model of space-time does not correspond to the physical reality, and propose a “timeless space” as the arena instead. One recent paper on the subject is: “A New Geometric Framework for the Foundations of Quantum Theory and the Role Played by Gravity”: Since quantum theory is inherently blind to the existence of such state-space geometries, the analysis here suggests that attempts to formulate unified theories of physics within a conventional quantum-theoretic framework are misguided, and that a successful quantum theory of gravity should unify the causal non-Euclidean geometry of space time with the atemporal fractal geometry of state space (4).

Another recent paper says: “We illustrate our proposal using a toy model where we show how the Lorentzian signature and Nordstroem gravity (a diffeomorphisms invariant scalar gravity theory) can emerge from a timeless non-dynamical space” (5).

Julian Barbour says in *The Nature of Time*: “I will not claim that time can be definitely banished from physics; the universe might be infinite, and black holes present some problems for the time picture. Nevertheless, I think it is entirely possible, indeed likely, that time as such plays no role in the universe”(6).

Physical time that is run of clocks definitely does not play any role in the universe. There is no linear time as a part of space in which change run. Space itself is timeless. The only linear time that exists is inner time that is based on neuronal dynamics of the brain.

Ernst Mach said: “It is utterly beyond our power to measure the changes of things by time. Quite the contrary, time is an abstraction, at which we arrive by means of the changes of things”. Mach is right. Clocks are man-made inventions and linear time is an abstraction of the mind. In physical equations symbol “t” means “thick of clock”. Clocks “thick” in timeless quantum space not in space-time.

Recent research indicates that some change happens and thick of clock is zero. Timeless quantum communication is a real phenomenon: “We show how continuous-variable systems can allow the direct communication of messages with an acceptable degree of privacy. This is possible by combining a suitable phase-space encoding of the plain message with real-time checks of the quantum communication channel”(7). What is meant here is that quantum information does not move through space-time. Timeless quantum space is an immediate medium for identifiable quanta.

The Einstein-Podolsky-Rosen (EPR) experiment similarly reminds us that quantum space is a timeless environment. There is no discernible signal in the form of a photon travelling between A and B. The thick of clock by information transfer between A and B is essentially zero. We might infer that A and B are extended entities. The timeless quantum space represents an immediate communication medium between the quanta A and B (8).

The timeless quantum space as an “immediate information medium” resolves the causality problem of the Fermi two-atom system: “Let A and B be two atoms or, more generally, a ‘source’ and a ‘detector’ separated by some distance R. At $t=0$ A is in an excited state, B in its ground state, and no photons are present. A theorem is proved that in contrast to Einstein causality and finite signal velocity, the excitation probability of B is non-zero immediately after $t=0$. Implications are discussed”(9). The excitation probability of B is non-zero because the quantum space in which atoms exist is an “immediate medium of excitation”.

It can be said that certain physical phenomena are timeless, since no measurable time (no tick of clocks) elapses for them to happen. For example in the article entitled Attosecond Ionization and Tunneling Delay Time Measurements in Helium by Eckle et al, a conclusion is drawn that "an electron can tunnel through the potential barrier of a He atom in practically no time" (10).

In similar vein, a recent arxiv paper depicts a system of diagrams to represent various elements of a quantum circuit, in a form which makes no reference to physical time as a run of clocks (11).

What is meant here is that the timeless quantum space is an immediate medium for information (I) and energy (E) transfer. At Planck size (IE), transfers are immediate; at photon size, they move at the light speed; at larger scales they move at the speed lower than the light speed.

Physical time as run of clocks in timeless quantum space confirms a vision of Einstein and Gödel who considered the universe to be a timeless phenomenon (12). "Back in time" and "forward in time" exists only as a numerical order of changes that run in timeless quantum space. Hypothetical "travelling in time" in spaceships is out of question; one can travel in timeless quantum space only. With clocks we measure velocity and numerical order of motion of a spaceship in quantum space.

Gravitational Motion of Massive Objects in Quantum Space

First law of thermodynamics considers energy cannot be created and not destroyed. In the universe as a whole amount of matter energy E_m and amount of timeless quantum space energy E_s is constant.

$$\sum E_m + \sum E_s = K$$

Elementary particle that diminishes density of quantum space has a mass. Elementary particle that does not diminish density of quantum space is mass-less. More mass is in a given volume of quantum space less dense is space and more space is curved. Change of density of quantum space corresponds in General Theory of Relativity to change of curvature of space. One can imagine density/curvature of quantum space as a density of material on which is an iron ball that represents stellar object. Under the ball material is curved, stretched and so less dense. Here is introduced relation between curvature and density of quantum space. Einstein curvature tensor in General Relativity $G_{\mu\nu}$ is in relation with density tensor $D_{\mu\nu}$ of quantum space by equation:

$$D_{\mu\nu} = \frac{1}{G_{\mu\nu}} = \frac{c^4}{8\pi G * T_{\mu\nu}} \quad \text{wich becomes in geometrized units} \quad D_{\mu\nu} = \frac{1}{8\pi T_{\mu\nu}}$$

According to second law of thermodynamics distribution of energy in the universe tends to be homogeneous. Massive objects that are compressed energy of quantum space move always in direction of lower density of quantum space. Earth has tendency to move to the centre of the sun because density of quantum space is lowest at the centre of the sun. "Gravitational motion" of massive objects is result of change of density/curvature of timeless quantum space. In the area where there is no change of density/curvature material object will not move as for example a centre of stellar objects or in intergalactic quantum space.

presence of mass → change of density/curvature of quantum space → gravitational motion

In a centre of black holes and centre of galaxies called Active Galactic Nucleus (AGN) density of quantum space is extremely low, curvature is extremely big, gravity is extremely strong, density of mass is extremely high. In centre of neutron stars, black holes and AGN old mass made out of heavy atoms is transforming back into fresh elementary particles.

Hawking proposes a spontaneous creation of elementary particles in gravitational field of nonstationary black holes (13).

Astronomical observations show that the centre AGN of our galaxy “eats” near stars and galaxies and from time to time throws out huge amounts of fresh gas (14). AGN, black holes and neutron stars are rejuvenating the universe. Mass made out of heavy atoms is sucked in and out is thrown fresh gas of elementary particles. Transformation of old mass in fresh elementary particles is permanent, has no beginning and no end. Universe is in a permanent dynamic equilibrium.

Mass does not emit or absorb some hypothetical gravitational waves in a similar way as electromagnetic waves. Gravitational waves emitted from mass seem to be fictitious entities (15). Gravity does not work between stellar objects on distance. Gravity is result of change of density of quantum space generated with presence of mass.

Conclusion

In today's physics the conviction still prevails that gravity works directly between massive bodies. Research here shows that mass changes density of timeless quantum space and this change generates gravitational motion. Hypothetical gravitational waves emitted and absorbed by the mass seem to be fictitious entities. Gravity motion is result of dynamics between mass and density/curvature of timeless quantum space.

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