

Implications of Time-Invariant Superfluid Quantum Space Model in Fundamental Physics and Cosmology

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Abstract

Time is what we measure with clocks. We measure the duration of material change running in superfluid quantum space with clocks. Material change runs in space only; time, as duration, enters existence when measured. Time is an emergent physical reality that enters existence when measured by the observer. No measurement means no time. The motion does not require time. Motion requires only space and the physical object that moves in superfluid quantum space, which is time-invariant. There is no physical past; there is no physical future. Past and future exist only in the human mind. Humans experience time-invariant superfluid quantum space as NOW. The entire universe exists and develops into NOW.

Keywords: superfluid quantum space, time, matter, energy, gravity, cosmology

1. Introduction

Let us consider an example of uniform motion. We have a physical object moving from point A to point B in superfluid quantum space. The distance between A and B is 1 meter. Duration of motion is 10 seconds. Consequently, the velocity of motion is 0,1 m/s. We imagine that superfluid quantum space is the fundamental arena of the universe with several elements. The fundamental arena is a set S . Observer OB, a moving object O , distance d , time t , and velocity v are different elements existing in set S , as follows in Eq. (1) below:

$$S: \{OB, O, d, t, v\} \quad (1)$$

Time t is an element of the set S as expressed in Eq. (2).

$$t \in S \quad (2)$$

Out of Eq. (1) and Eq. (2), the distance of motion, duration of motion, and velocity of motion exist only in superfluid quantum space and not in some physical time that is a constitutive part of the space. Since the beginning of physics, it has been misunderstood that motion occurs in some physical time. Motion occurs only in superfluid quantum space. Time becomes a duration of motion only when being measured by the observer. No measurement means no time. A belief that time is 4th dimension of space is a persistent scientific illusion. We can define time as an element of space; time is not a physical part of superfluid quantum space and cannot influence the physical properties of space in any manner. Technically, we can say that the universal superfluid quantum space is time-invariant (Sorli, Celan, 2020).

In physics, we experience that motion happens in time because we experience motion in the frame of linear time, which originates in the brain's neuronal activity (Sorli, Celan, 2022). There is no "cosmological time" running in the universe, and no "arrow of time" exists. The universe does not exist in time, and time does not run in the universe. When change is measured, we get time as an emergent physical reality, which is the result of the measurement done by the observer (Fiscaletti, Sorli, 2015). Rovelli also suggested that time has no physical existence and should be abandoned as a fundamental physical reality (Rovelli 2009, 2021). Barbour also suggested that time has no physical existence (Barbour 2009). Despite undeniable proof that time has no physical existence, it is still thought that motion requires time. A profound scientific discovery is that motion does not require time. Motion's existence necessitates space and a physical object that moves through space. When we track movement using clocks, we obtain duration, which is the only time that exists. This has crucial consequences in cosmology, namely, there is no physical past and no physical future, there is no cosmological

time, there is no flow of time, and there is no arrow of time; change in the universe runs in time-invariant space that we humans experience as NOW.

Fundamental time is the numerical order of material changes that run in time-invariant space. The basic unit of fundamental time is Planck time. Events in the universe run one after the other, only in the sense of numerical order, not in the sense of one after the other in some physical time. Emergent time as duration enters existence when measured by the observer. Every emergent time is the sum of Planck times (Fiscaletti, Sorli, 2015). Physical events run in time-invariant space and have no intrinsic duration. Duration enters existence when measured. This needs to be understood profoundly to progress fundamental physics and cosmology.

The model of time reversal symmetry (T-symmetry) has no physical correspondence in the physical world. The equation of time symmetry (3) below has no physical meaning:

$$T : t \rightarrow -t \quad (3)$$

The model of space-time, where the past is represented as the negative time $-t$ and the future is represented as the positive time $+t$, has no support in human observation and experimental results. In physics, we do not have proof that negative time exists, and time is ready, we abandon this idea. The same applies to the symmetry in time. There is no symmetry in time because there is no negative time, and no positive time; there is no past and no future.

Son, father, and grandfather are born in the same time-invariant space. Sure, the grandfather is born before the father, and the father is born before the son. But “before” and “after” have only mathematical reality in numerical order. For example, grandfather died in 1944, father died in 1980, and son died in 2024. All three have been born and have lived in the same time-invariant space. Between their deaths, there is no distance in some physical time. Dinosaurs lived in the same time-invariant space in which we live now.

Time-invariant superfluid quantum space is the medium of entanglement EPR-type (Sorli, Celan, 2020). Every elementary particle in the universe is entangled with every other particle via time-invariant space. Information transfer in time-invariant space is immediate. When a photon moves through a time-invariant space, the velocity of information transfer with the speed of light.

With clocks, we do not measure the time that is supposed to run in space. We measure the velocity of material changes that run in time-invariant space. Clocks are tuned with the rotation of the Earth. One rotation of the Earth around its axis is 1440 minutes, which is 86400 seconds. A wristwatch second-hand makes one revolution in 60 seconds, and the Earth in 86400 seconds. Angular velocity of the second-hand equals $\omega = 2\pi/t$. The rotational velocity of the end of the second-hand equals $v = \omega r$, where r is the length of the second-hand. If the diameter of the wristwatch is 4 cm, the rotational velocity of the second-hand will be around 0,002 m/s. The rotational velocity of the point on the Earth’s surface is 4651,1 m/s. The velocity of clocks is the basis for measuring the velocity of all kinds of material changes, i.e. motions.

The velocity of clocks is relative and is valid for all observers. A wristwatch runs on the Moon’s surface faster than Earth’s, which is valid for all observers. In technical terms, we say that the rate of clocks is observer-invariant. In physics, symbol t as duration is always related to velocity and has no independent existence. For example, when you walk, you have a certain velocity. Your motion has no duration but it has its proper velocity. If you want to know the velocity of your motion from A to B, divide the path of your motion by time $v = s/t$. By measuring your velocity, you compare your velocity with the velocity of the end of the second-hand of your wristwatch, which peripheral velocity equals $v = 2\pi r/60s$. The angular velocity of the second-hand of an ordinary clock is $0.105s^{-1}$. The angular velocity of Earth rotation is $7,27 \cdot 10^{-5}s^{-1}$. A clock will tick a second 86000 times in one Earth’s full rotation. Clocks are tuned with the rotation of the Earth. Time as duration is an emergent physical quantity that enters into existence in the process of measurement when we compare the velocity of material changes i.e. motion with the angular velocity of clocks.

The fundamental physical property of motion of a given object is its velocity, and an emergent physical property of motion is time. This is a paradigm shift with important consequences for fundamental physics and cosmology; motion does not require time, motion happens in time-invariant space, there is no physical past, and there is no physical future. There is no symmetry in time, as time is not a fundamental physical reality. The motion does not need an observer, time is the outcome of the observer’s measurement.

2. Implications of Time-Invariant Space Model on Gravitational Physics, Black Hole Physics, and Cosmology

The idea that space and time are warping and causing gravity was never been experimentally proved. Gravity is a pushing force of time-invariant superfluid quantum space. Light is bending because of the variable energy density of superfluid space. Extension of the principle of equivalence of mass and energy on time-invariant superfluid quantum space shows that gravity is a pushing force of superfluid space; see equation (4) below (Sorli et. al. 2023 a):

$$E = mc^2 = (\rho_{PE} - \rho_{CE})V \quad (4)$$

where ρ_{PE} is Planck energy density of superfluid space in intergalactic areas, ρ_{CE} is the energy density of superfluid space in the centre of a given object and V is the volume of the object. The difference between energy densities $(\rho_{PE} - \rho_{CE})$ generates gravity force. Gravitational mass m_g and inertial mass m_i can be expressed as follows in equation (5) below (Sorli et. al. 2023 a):

$$m_g = m_i = \frac{(\rho_{PE} - \rho_{CE})V}{c^2} \quad (5)$$

When in interstellar space, a spaceship accelerates with 9.8 m s^{-2} , the astronaut has the same experience as he would standing on the Earth's surface. This is because protons in the composite spaceship interact with the superfluid space, which additionally diminishes the energy density of space in the spaceship, so it becomes of the same value as on the Earth's surface. Sbitnev developed a model where protons are vortexes of superfluid space (Sbitnev 2016). When accelerated close to the speed of light, the proton's relativistic energy is 7460 times bigger than its energy when the proton is at rest. The relativistic proton integrates the energy of superfluid space into its vortex.

Relativistic mass is given by the following equation (6) below:

$$m = \gamma m_0 \quad (6)$$

where γ is the Lorentz factor, and m_0 is the rest mass. Combining equations (4) and (6) we can express the Lorentz factor as follows in the following equation (7) below:

$$\gamma = \frac{(\rho_{PE} - \rho_{CE})V}{m_0 c^2} \quad (7)$$

The higher the velocity of the physical object, the bigger the relativistic delta energy density and the bigger the value of the Lorentz factor. Equation (7) shows that the Lorentz factor depends on the relativistic delta energy density $(\rho_{PE} - \rho_{CE})$ of the moving object. The mathematical formalism above is observer-invariant. It is valid for all observers, regardless of their position or velocity. Relativistic mass is the result of a moving object's interaction with the superfluid quantum space (Sorli et. al. 2022 a). The kinetic energy of every moving physical object is the energy of the superfluid space that is integrated into protons. For example, the protons of a falling stone integrate the superfluid space energy. When a stone crashes on the ground, this energy is released as electromagnetic energy in the form of heat and light.

The gravitational force between two objects is generated by their gravitational masses. Gravitational mass m_g is the result of an interaction of a given mass m with the superfluid quantum space. A given mass is diminishing the energy density of the superfluid space in its center exactly by its mass. This is the so-called extension of the mass energy equivalence principle to superfluid quantum space. Two physical objects create an area of superfluid space with lower energy density. This is expressed as follows in equation (8) below:

$$F_g = \frac{m_{1g} m_{2g} G}{r^2} \quad (8)$$

Outer space, which has a higher energy density, pushes toward the lower energy density where physical objects are situated. This pushing force of space is the gravitational force. Physical objects are three-dimensional;

superfluid space is four-dimensional. Three-dimensional physical objects are somehow trapped in four-dimensional space.

Physical objects do not emit or receive gravitational force via hypothetical particles, gravitons. The idea that physical objects emit or receive gravitational force is flawed. Also, the idea that physical objects curve space is flawed (Sorli et. al. 2023 a). Gravity originates from the fundamental symmetry between the mass of a given object and the diminished energy density of timeless superfluid space at its center; see Figure 1 below: 2014 that the universal time-invariant superfluid space has a Euclidean shape, which means that the universal space is flat and infinite in its spatial dimension (NASA, 2014). The geometrization of gravity in GR has no physical meaning (Sorli et. al. 2024). The gravitational singularity in the center of black holes proposed by Penrose (Penrose 1965) is a flawed model that contradicts fundamental postulates of physics and mathematics. Gravity inside the event horizon follows Newton's shell theorem, as it is valid in all stellar objects (Sorli et. al. 2024).

In AGN, the energy density of superfluid space is so low that atoms that compose matter become unstable and fall apart into elementary particles that form stellar jets. Active galactic nuclei are rejuvenating systems of the universe, which is eternal, non-created system in a permanent dynamic equilibrium. The only universe that exists is the one we can perceive NOW; the idea about some initial explosion in some distant physical past in which the universe started is human imagination (Sorli et. al., 2023b).

When the James Webb Space Telescope (JWST) discovered six galaxies that were too massive to fit into Big Bang cosmology (Labbé et. al., 2023), there was a good point to recognize the Big Bang as a history of physics. The article was published on 22 February 2023. On 7 July 2023, the article was published in MNRAS, where the new age of the universe was calculated: 26.7 billion years (Rajendra, 2023). Five months after the discovery of the JWST rocked Big Bang cosmology to its core, a paper appeared that seemingly saved the Big Bang cosmology model. Since 1931, hundreds of articles have been published in renowned journals about Big Bang cosmology. Today's cosmology science has no courage to admit that for almost a hundred years, cosmology has been wrong. Admitting this error, one needs courage and scientific integrity.

Frankly, Big Bang cosmology has no necessary attributes to be considered science. An initial explosion of the mathematical point out of nothing, where density, pressure, and temperature were infinite, is not falsifiable and does not deserve to be called a scientific theory. The idea that the CMBR is proving Big Bang cosmology is false. A given signal can move only through time-invariant space; it cannot come from some remote, non-existent physical time. CMBR is the radiation of the existing universal time-invariant superfluid space (Sorli et. al., 2023b).

The official paradigm is that the universal space is expanding, and so distances between galaxies are increasing. The radius of our galaxy Milky Way is $9,5 \cdot 10^{17} km$. The volume of universal space is an enormous portion of space that also should expand. If the space of the Milky Way expands, the gravitational forces between the stars inside the galaxy would weaken, and the galaxy would fall apart. This is not the case with our galaxy, and the same we observe in all observable galaxies, they are stable.

The official age of the Milky Way galaxy is about 13,7 billion years. The age of the universe is declared to be 13,8 billion years. The Milky Way could not be developed in an expanding space because distances between stars would increase constantly, so galaxies could not be formed. Formation of a galaxy requires a stationary space where gravity forces between stellar objects are stable, and the universal space is stationary. This confirms undoubtedly that the universal space is not expanding. Research carried out in 2014 suggests that the universe is not expanding: "We find that the UV surface brightness of luminous disk galaxies are constant over a very wide redshift range (from $z = 0.03$ to $z \sim 5$). From this analysis we conclude that the Tolman test for surface brightness dimming is consistent with a non-expanding, Euclidean Universe with distance proportional to redshift. This result is also consistent with previously published datasets that were obtained to perform the Tolman test for a smaller redshift baseline when analysis of such data is done in a consistent system" (Lerner et. al., 2014).

Expansion of the universal space can be measured on the Earth's surface: Today, precise measurements of distances measure 113 km on one nanometre (1nm) precisely. This precision allows us to measure universal space expansion directly and accurately on Earth's surface. The method of measuring the redshift of distant galaxies and calculating out from these data the expansion is indirect. We can measure universal space expansion directly by measuring the daily increase of distance between two points on the Earth's surface. It is clear that at bigger distances the expansion of space is bigger and at smaller distances expansion is smaller, but it exists. If universal space expands, this means that distances on Earth are expanding. The only question is if these small dilations are measurable. At a distance of 113 km, the velocity of space expansion is $2.665975305E-13$ m/s. In

one year, this yields 0.0000084132 m. The distance of 0.0000084132 m is 8413 nm. If the universe expands at the declared rate of 72,8 km per Mps [15], the distance of 113 km will increase by 23 nm per day” (Sorli, 2025).

3. Discussion

In 1999, Barbour announced the next revolution of physics in his book “The End of Time – The Next Revolution of Physics” (Barbour, 1999). 25 years have passed, and fundamental physics and cosmology are still stuck in the old paradigm. In the last 25 years, numerous articles have proved that time is not the 4th dimension of space and has no physical reality. The scientific community still did not accept this indisputable fact. Still, articles are published in high-ranked journals of physics where time is meant to be the 4th dimension of space. Top physicists are not willing to admit that the common interpretation of relativity theory is wrong: time is not the 4th dimension of space. In today's physics, we still live in space and time, although time is non-existent. Here is the main barrier to physics development.

Physicists are still experiencing physical reality through the linear psychological time that exists only in the scientific mind. They think time is running on its own in physical reality, although time is running only in their minds. The step out of the mind and so out of the time requires an awakening of the observer. Advances in fundamental physics and cosmology require the exploration of consciousness. The awakened observer is consciousness itself. Consciousness is aware that events in the universe run in time-invariant (timeless) space, where there is always and only NOW (Sorli, Celan, 2020). Erwin Schrödinger's famous quote is a herald of the coming paradigm shift in physics: “Eternally and forever there is only now, one and the same now; the present is the only thing that has no end”.

Adlam and Rovelli's developed “relational quantum mechanics” (RQM) which predicts that different observers can experience the same sequence of events in distinct ways: “According to ref [1], the founding principle of RQM is the idea that ‘in quantum mechanics different observers may give different accounts of the same sequence of events.’ RQM has undergone significant development since this original proposal, but the basic idea remains the same: different observers may assign different quantum states to a given system and moreover in such cases all of the different assignments are equally correct, because the quantum state assigned to a system describes not only the system itself but also the relation between the system and the observer assigning the state. There exist other interpretations of quantum mechanics which take a similar view on the relational nature of quantum states [2–6] but typically these accounts regard (conscious) observers as playing some sort of privileged role. On the other hand RQM is built on strong naturalistic intuitions, and therefore in RQM the term ‘observer’ is understood in a broad sense which allows that any physical system can be an ‘observer,’ so we don’t have to accept that consciousness plays any fundamental role” (Adlam, Rovelli, 2022). The idea that different observers can experience an event differently is already present in Special Relativity. The idea is flawed; the fact is that all observers in all different inertial systems experience a given event identically. In the famous experiment, when the train is passing the station, the clock on the train has a slower rate than the clock in the station. And this is valid for both observers. The relative rate of clocks is “observer invariant”; it depends only on the variable energy density of superfluid space. The GPS is proving this without any doubt. Clocks on the satellites run at the same rate for all observers. If not so, the GPS could not work properly. The Theory of Relativity requires updating. The curvature of space can be substituted by the relative energy density of a time-invariant superfluid space (Sorli, et.al. 2022 b).

The well-known equation (9) below confirms that the 4th dimension of SR is not temporal, it is spatial:

$$X_4 = ict \quad (9)$$

The product of time, velocity, and the imaginary number i is an imaginary spatial distance. This was the original version of Albert Einstein. The development of this equation (9) that followed should not happen, namely, removing i , and considering that the velocity of light c is constant and can be written as 1. With this over-simplification, time has become 4th dimension of space. Further on, Einstein’s Relativity Theory speculates on the existence of “proper time” and “coordinate time” for each inertial system. In physical reality, there is no proper time and no coordinate time. The only phenomena that exist are different “proper velocities”, clocks run in “time-invariant” space, and their relative rate is valid for all observers. The relative rate of clocks depends on the variable energy density of superfluid space and is observer-invariant (Sorli, et.al. 2022 b).

4. Conclusions

The main progress of science was and will be forever the doubt. Today, we teach physics students worldwide that time is the 4th dimension of space. University teachers are not willing to ask themselves about the actual existence of time as the 4th dimension of space. In the 21st century, we are still stuck in the old paradigm of

20th-century belief in the existence of some hypothetical physical past and future, and consequently, there is no progress. The progress of physics is in the minds of those who can doubt. Time as the 4th dimension of space is a simplification that should be abolished from physics.

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