Gravity as a Result of Symmetry between Matter Energy and Space Energy

Amrit Sorli [*] and Štefan Čelan [*]

Article

Gravity as a Result of Symmetry between Matter Energy and Space Energy

Amrit Srečko Šorli [1,*] **and Štefan Čelan** [2,*]

[1]   Bijective Physics Institute, Slovenia; orcid.org/0000-0001-6711-4844
[2]   Scientific Research Centre Bistra, Slovenija; https://orcid.org/0000-0003-3646-1469
[*]   Correspondence: sorli.bijective.physics@gmail.com (A.S.Š.); stefan.celan@bistra.si (Š.Č.)

Abstract: In physics, symmetry is mostly about the symmetry between elementary particles, between matter and antimatter. In the universe, we have two fundamental types of energy: energy of matter and energy of space. These two energies have a symmetry that is not geometry type, not electric charge type, it is energy type. Every physical object with mass m symmetrically diminishes the energy density of space in its center exactly for the amount of its mass. This symmetry of matter and space energies is the physical source of gravity that is also valid in the centre of black holes.

Keywords: space; matter; symmetry; gravity; gravitational singularities

1. Introduction

The last ten years are an intense period where different researchers suggest that universal space is a type of energy, they call it "superfluid quantum space", "physical space", "physical vacuum" and other names [1–3]. Einstein's idea that universal space is empty and devoid of physical properties has shown weak points, especially in describing the physical origin of gravity. The idea, that the curvature of space could carry gravity, is becoming less popular because NASA measured back in 2014 that universal space has a Euclidean shape: "Recent measurements (c. 2001) by a number of ground-based and balloon-based experiments, including MAT/TOCO, Boomerang, Maxima, and DASI, have shown that the brightest spots are about 1 degree across. Thus the universe was known to be flat to within about 15% accuracy prior to the WMAP results. WMAP has confirmed this result with very high accuracy and precision. We now know (as of 2013) that the universe is flat with only a 0.4% margin of error. This suggests that the Universe is infinite in extent" [4].

Every physical system has a tendency for homogeneous distribution of energy. Also in the universe, the distribution of energy is homogenous. In a given volume of the universal space, the amount of matter-energy and space energy is always constant, see Eq. (1) below:

$$E_m + E_s = K \tag{1}$$

In intergalactic space, the value of the energy of matter is close to zero which means that the energy density of space ρ_{SE} has a value of Planck energy density $\rho_{PE} = 4.641266 \cdot 10^{113} Jm^{-3}$:

$$E_m = 0 \ \to E_s = K \ \to \rho_{SE} = \ \rho_{PE} \tag{2}$$

In the centre of every physical object with the mass m, energy density of space is diminished exactly for the amount of the energy that is incorporated in its mass:

$$\rho_{cE} = \ 4.641266 \cdot 10^{113} Jm^{-3} - \frac{mc^2}{V} \tag{3}$$

where ρ_{cE} is the energy density of space in the centre of the stellar object, and V is the volume of the stellar object. With the use of algebra, we get the following Eq. (4):

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

Every stellar object is diminishing the Planck energy density ρ_{EP} of intergalactic space in its center exactly for the amount of its mass/energy. This law is called "The extension of the mass-energy equivalence principle on the universal space". It shows that there is a symmetry of energies between a given mass and the space in which this mass exists. This symmetry is the physical origin of gravity force. Equation (4) is also developed for the relativistic domain.

2. Gravity is a pushing force of space

Gravity is governed by the Planck energy density ρ_{PE} of superfluid space, and gravitational constant G can be expressed by the Planck energy density:

$$G = \frac{c^2}{\rho_{PE}t_P^2} \qquad (5)$$

where Planck time t_P is the fundamental unit of the numerical order of material change that runs in time-invariant universal space. In time-invariant superfluid space time as duration is an emergent physical quantity that enters existence when measured by the observer [5]. Rovelli and Barbour independently came to the same conclusion that time has no physical existence [6,7]. Space-time model is developed into the time-invariant superfluid space model, where time is only the duration of material change. Time-invariant superfluid space is a four-dimensional type of energy, matter is a three-dimensional type of energy. Physical objects are diminishing the energy density of space and diminished energy density of space generates gravity force. Gravity force is embedded in the time-invariant superfluid space and is immediate, it is a pushing force of superfluid space from higher energy density towards the lower energy density, see Figure 1 below. Gravitation is not propagating through space as electromagnetism does. 3D physical objects somehow are trapped in a 4D superfluid space. They always move towards the lover energy density of space that is in the center of a given stellar object.
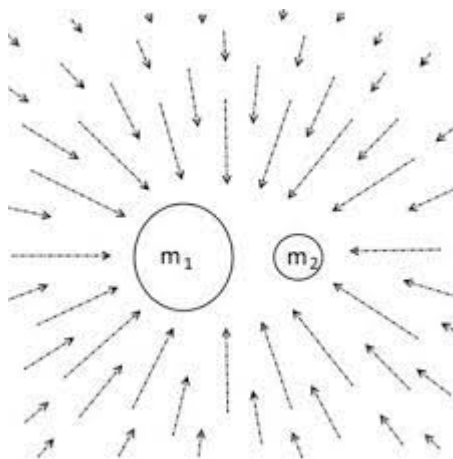

Figure 1. Two physical objects are pushed together by the outer superfluid space.

When a given physical object is moving with a high velocity it interacts stronger with the superfluid space and gains its relativistic energy E_R. This situation is expressed by the equation below:

$$E_R = \gamma mc^2 = (\rho_{PE} - \rho_{cER})V \qquad (6)$$

where γ is Lorentz factor. We can express the Lorentz factor as follows:

$$\gamma = \frac{m}{(\rho_{PE}-\rho_{cER})Vc^2} \qquad (7)$$

where m is the rest mass of the physical object, V is the volume of the object and ρ_{cER} is the minimal energy density in the centre of a fast-moving physical object [3]. Equation (7) is confirming that the Lorentz factor depends on the energy density of superfluid space ρ_{cER} in the center of a fast-moving physical object and it is the bridge between the special theory of relativity and the general theory of relativity. Imagine that a one-kilogram iron ball on the Earth's surface has a given energy density of superfluid space ρ_{cE} in its centre. Imagine that the same iron ball is moving the intergalactic space and that the value of ρ_{cER} is the same as the value ρ_{cE} on the Earth surface. This would mean that ball is moving with an acceleration of $9.8\ ms^{-2}$. An observer that would be on the surface of the ball would not experience any difference when the ball is on the Earth or moving in intergalactic space. The inertial mass and the gravitational mass of a given physical object both have the same physical origin which is the minimal energy density of superfluid space in the centre of the physical object.

$$m_0 \approx m_i = m_g = \frac{(\rho_{PE} - \rho_{cE})V}{c^2} \qquad (8)$$

Rest mass m_0 and inertial mass m_i are two different phenomena. Rest mass is the amount of energy that is incorporated in a given physical object, inertial mass, and gravitational mass have an origin in the pressure of superfluid space towards the centre of the physical object.

3. Discussion

Hawking and Guth have used another model of symmetry between the energy of matter and the energy of space. Their idea is that in the first moment of the Big Bang and later on in the inflation period, the energy of matter and the energy of space (gravitational energy) are multiplying. The energy of matter is positive, gravitational energy is negative, and their sum is always zero, and they multiply [8,9]. From a phenomenological point of view, their model is unacceptable. Let's go into details; in mathematics 1 + (-1) = 0, 2 + (-2) = 0, 3 + (-3) = 0, n + (-n) = 0, but this does not mean that the energy of matter and energy of space could multiply out of nothing. Hawking and Guth used mathematical laws to explain the origin of the energy of space and the energy of matter, which is inadmissible also from the methodological point of view. Moreover, their model is not falsifiable, and from this point of view, it does not belong to the core science. In today's physics, the scientific community finds it difficult to accept constructive criticism of the unproven working hypothesis of famous physicists.

Verlinde has proposed that gravity is an entropic force caused by changes in the information associated with the positions of material bodies: "Starting from first principles and general assumptions Newton's law of gravitation is shown to arise naturally and unavoidably in a theory in which space is emergent through a holographic scenario. Gravity is explained as an entropic force caused by changes in the information associated with the positions of material bodies" [10]. The problem with Verlinde's model is that in the principle, "information" cannot carry any type of force. Gravity force is keeping together for example Laniakea supercluster and it is unimaginable how this could be done by changes in the information associated with the positions of material bodies.

Xiao-Liang Qi published an article in Natura back in 2018 about the idea that gravity has to do with quantum information [11]. In physics, we experience gravity as a force, and phenomenologically force is different from information. For example, in the EPR-type experiment, two elementary particles are entangled via quantum information, but there is no physical force between them. The current tendency in physics is to see gravity as a phenomenon that has deep similarities with entanglement: "In this essay, we will argue, based on widely accepted examples of gauge theory/gravity duality, that the emergence of spacetime in the gravity picture is intimately related to the quantum entanglement of degrees of freedom in the corresponding conventional quantum system" [12]. In our model gravity and entanglement are both carried by time-invariant superfluid space. Gravity is carried by the variable energy density of superfluid space and at the same time-invariant superfluid space is the medium of immediate information transfer by EPR-type entanglement [2].

T-Symmetry (time-reversal symmetry) should be re-examined because we do not have any experimental data that physical change run in some physical time. Physical objects from the micro to the macro scale move only in space and time is the duration of their motion. We suggest that any type of symmetry can only exist in time-invariant space [2]. The symmetry in time-invariant space between the amount of mass and energy density of space is also valid in the center of a black hole: "Every physical object in universal space is diminishing Planck energy density accordingly to the amount of its energy. The diminished energy density of space is the source of the gravity vector $\vec{g}$ at the given point T. At the centre of the given physical object, the value of the gravity vector is zero ($\vec{g} = 0$). At the point T, on the distance R from the centre of the physical object value of gravity vector $\vec{g}$ we calculate as followed:

$$\overrightarrow{g_T} = \frac{(\rho_{PE} - \rho_{cE})VG}{c^2 r^2} \qquad (9)$$

where ρ_{cE} is the energy density of the space at the centre of the physical object, V is the volume of the object, r is the radius of the object. Inside the physical object we calculate gravity vector $\overrightarrow{g_T}$ at a given point T according the Newton shell theorem, see Figure 2 below
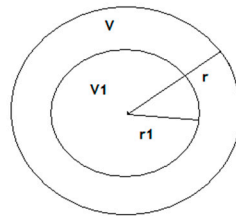

Figure 2. Newton shell theorem.

$$\overrightarrow{g_T} = \frac{(\rho_{PE} - \rho_{cE})V_1 G}{c^2 r_1^2} \qquad (10)$$

The gravity vector at the given point of space is equal to the gravitational acceleration and this is generally valid for every point of the universal space, areas inside the event horizon are included" [13].

Penrose's model of gravitational singularities [14] is mathematically correct but it has no correspondence with the physical world. We do not have a single astronomical observation that would prove the existence of gravitational singularities in the center of black holes: "In principle, only a black hole with infinite mass could produce the infinite gravitational acceleration and consequently infinite gravity force on its surface:

$$a_\infty = \frac{m_\infty G}{r^2} \qquad (11)$$

In physics, gravity is directly defined by the amount of mass of a given stellar object, not by the curvature of space. The curvature of space is only a mathematical description that describes gravity" [15]. The idea that gravity is not a force but rather the effect of space curvature is not correct. The model of the variable energy density of space explains the physical origin of gravity force and is correct inside the Schwarzschild radius, where the curvature of space has given wrong assumptions. The main problem with Penrose's model is that, like Hawking's and Guth's, it is not falsifiable.

4. Conclusions

Seeing gravity as a phenomenon occurring in some physical time seems not appropriate as it is clear that time has no physical existence. Gravity exists in time-invariant space. The symmetry between matter-energy and space-energy is a novel approach that has given a new model of gravity where gravity is an immediate force acting via variable energy density of time-invariant superfluid space.

References

1.   Sbitnev, V.I. Hydrodynamics of superfluid quantum space: de Broglie interpretation of the quantum mechanics. *Quantum Stud.: Math. Found.* **5,** 257–271 (2018). https://doi.org/10.1007/s40509-017-0116-z

2.   Šorli, A.S. & Čelan Š., Time-Invariant Superfluid Quantum Space as the Unified Field Theory, RAPS, Vol. 4, No. 3 (2020) 2050007, https://doi.org/10.1142/S2424942420500073

3.   Amrit Sorli, Niko Gorjup, Rado Gorjup, Replacement of space-time with superfluid space and restoration of Newton's dynamic ether, RAPS, World Scientific, Vol. 07, 2350005 (2023) https://doi.org/10.1142/S2424942423500056

4.   NASA https://map.gsfc.nasa.gov/universe/uni_shape.html (2014)

5.   Fiscaletti, D., Sorli, A. Perspectives of the Numerical Order of Material Changes in Timeless Approaches in Physics. *Found Phys* **45**, 105–133 (2015). https://doi.org/10.1007/s10701-014-9840-y

6.   Rovelli, C. Relational quantum mechanics. *Int J Theor Phys* **35**, 1637–1678 (1996). https://doi.org/10.1007/BF02302261

7.   Barbour, J. The Nature of Time (2009)   https://doi.org/10.48550/arXiv.0903.3489

8.   Hawking S., A Brief History of Time, Bantam Books, New York, 2017

9.   Guth A., The Inflatory universe, Beamline 27, 14 (1997) https://ned.ipac.caltech.edu/level5/Guth/Guth3.html

10. Verlinde, E. On the origin of gravity and the laws of Newton. *J. High Energ. Phys.* **2011**, 29 (2011). https://doi.org/10.1007/JHEP04(2011)029

11. Qi, XL. Does gravity come from quantum information?, *Nature Phys* **14**, 984–987 (2018). https://doi.org/10.1038/s41567-018-0297-3

12. Van Raamsdonk, M. Building up spacetime with quantum entanglement. *Gen Relativ Gravit* **42**, 2323–2329 (2010). https://doi.org/10.1007/s10714-010-1034-0

13. Gorjup Niko, Sorli Amrit, Vector Model of Gravity (2022), Advanced Studies in Theoretical Physics Vol. 16, 2022, no. 4, 281 – 289 https://doi.org/10.12988/astp.2022.91938

14. Penrose, Roger (1965), Gravitational Collapse and Space-Time Singularities, Phys. Rev. Lett., 14, 57. https://doi.org/10.1103/PhysRevLett.14.57

15. Šorli, A. (2023). Irrefutable Proof of The Non-Existence of a Gravitational Singularity at The Centre of a Black Hole: Gravity and Black Holes . *International Journal of Fundamental Physical Sciences*, *13*(1), 1-4. https://doi.org/10.14331/ijfps.2023.330156