

Advanced Studies in Theoretical Physics  
Vol. 16, 2022, no. 4, 281 - 289  
HIKARI Ltd, [www.m-hikari.com](http://www.m-hikari.com)  
<https://doi.org/10.12988/astp.2022.91938>

## Vector Model of Gravity

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### Abstract

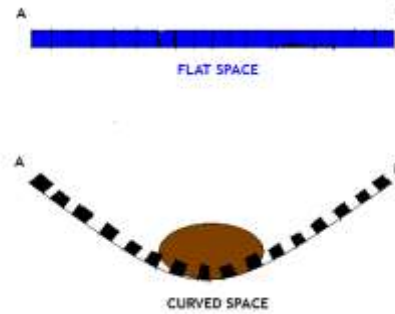
General Relativity has geometrized gravity. Matter curves space and space tells matter where to move. NASA has measured back in 2014 that universal space has a Euclidean shape. NASA's discovery suggests that the curvature of space is a mathematical description of its actual variable energy density. Gravity force can be described as the vector in the four-dimensional Euclidean space which depends on the variable energy density of space at a given point in space on the distance from the center of a given stellar object.

**Keywords:** gravity, variable energy density of space, gravitational vector, black holes

### 1. Introduction

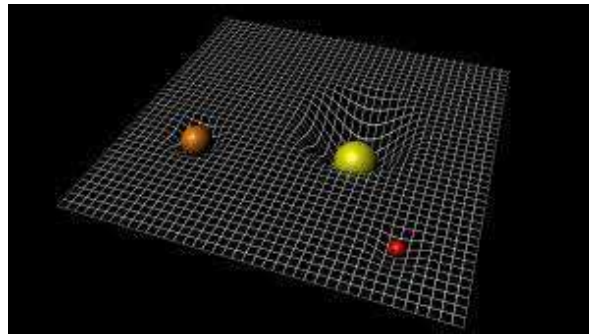
Geometrization of gravity is a more than the century-old achievement of physics that has revolutionized our understanding of gravity. In GR universal space has a geometry of Riemann and this geometry carries gravity. How this happens on the physical level was never well understood is one of the aims of this article. Max Planck's work in quantum mechanics has revolutionized our understanding of universal space that seems to be made out of infinitely small units that have a size of  $4,2217 \cdot 10^{-105} m^3$ . Combining curvature of space and granular structure of space suggests that space has variable energy density. Let's imagine a flat intergalactic empty space that is flat. On the distance A to B in this space, we have

a certain number of Planck volume units. Now we imagine that in this space is placed a stellar object that has curved space. Distance between A and B will have the same number of Planck volume units, but they will be less dense, see figure (1):



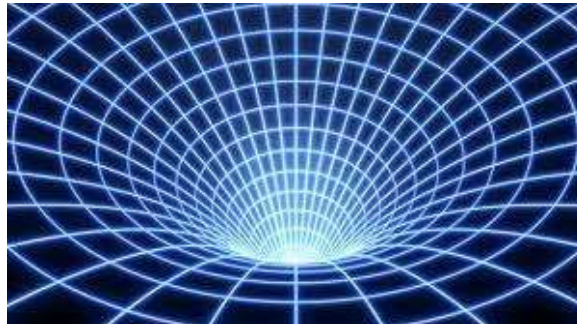
**Figure 1:** Curved space has lower density of Planck volume units

When space is more curved space is less dense, we can see this on ESA home page, the curvature is diminishing density of space [1], see figure (2) below:



**Figure 2:** ESA picture of the diminished density of space

Imagine that yellow stellar object is turning into a black hole. The density of the surface around such a black hole will hugely diminish because the square footage of the surface around the black hole will highly increase. We have to imagine this in four-dimensional space because universal space is four-dimensional. We see in the textbooks physics often figure below that represents the curvature of space, see figure (3) below:



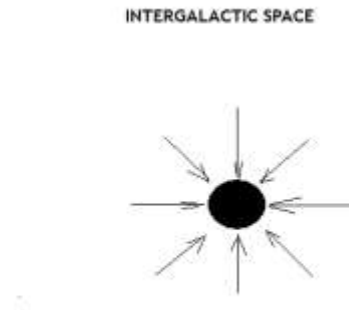
**Figure 3:** Common presentation of space curvature increasing in black holes

This picture is wrong because the energy density of space inside the black hole is decreasing. Decreasing the energy density of space is also valid inside the Schwarzschild radius [2].

The weak point of the geometrization of gravity is that it does not explain the physical origin of gravity. The vector model of gravity does it. In intergalactic space where there are no physical objects, the energy density of space has a value of Planck energy density. The value of the gravity vector in intergalactic space is zero. Now we imagine that we have a physical object in intergalactic space with the mass  $m$ . This object will diminish the energy density of space exactly for the amount of its energy:

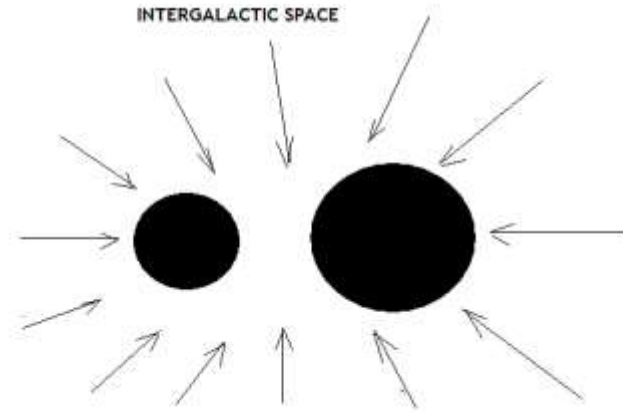
$$\rho_{cE} = \rho_{PE} - \frac{mc^2}{V} \quad (1) [2],$$

where  $V$  is volume of the object. With the appearance of the physical object in intergalactic space gravity vector of space has also appeared. The gravity force of the physical object is embedded in space and is not acting because no other physical object is there, see figure (4):



**Figure 4:** Gravity vector of a physical object in intergalactic space

Going away from the physical object gravity vector will diminish and will become zero at the infinite distance. So, gravity force has no origin in a given physical object, it has an origin in the variable energy density of space that is caused by the presence of the physical object. When the second physical object is introduced in intergalactic space close to the first physical object also this object will create gravity vectors of space and objects will have a tendency to move closer because of the gravity vectors of space that have been created by them.



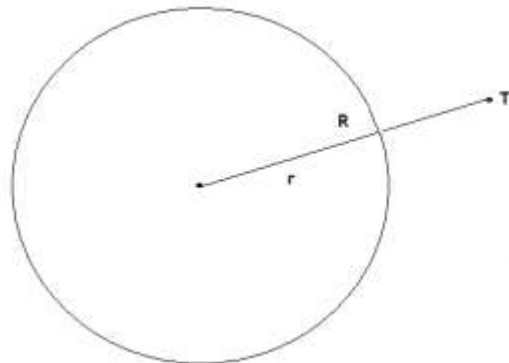
**Figure 5:** Matter creates a gravity vector of space which tells matter how to move

Gravity vector is four-dimensional and physical objects are three-dimensional. They will always move in the direction of the lower energy density of space. The idea that gravity force is produced by physical objects in a similar way to electromagnetic radiation seems wrong. There is no such phenomenon as gravitational radiation.

We can measure the energy density of space very precisely with clocks. The rate of a clock will decrease if we put the clock from the table on the floor. Clocks have a maximum rate in interstellar space and a minimum rate in the centre of black holes. The rate of clocks is the indirect measure of space energy density [3]. We can calculate the energy density of the space at the given point T from the centre of a given stellar object by the following equation:

$$\rho_{TE} = \rho_{PE} - \frac{3mc^2}{4\pi(r+R)^3} \quad (2) [2].$$

where  $\rho_{PE}$  is Planck energy density of the space in the interstellar space,  $m$  is the mass of the stellar object,  $r$  is the radius of the stellar object, and  $R$  is the distance from the centre of the stellar object to the point where we calculate the energy density of space. When  $R$  tends to infinity,  $\rho_{TE}$  tends to become equal to  $\rho_{PE}$ . When  $R$  tends to zero,  $\rho_{TE}$  tends to become equal to the energy density in the centre of the stellar object  $\rho_{cE}$ , see figure (6) below:

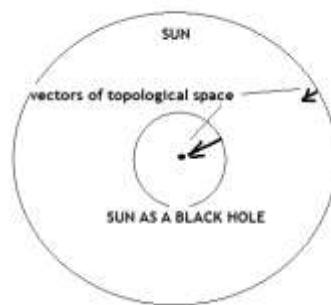


**Figure 6:** Energy density of space at the point T from the centre

In the centre of the stellar object equation (2) turns into the equation (1). Gravity vector at the point T depends on the difference in energy densities  $\Delta\rho_E = \rho_{TE} - \rho_{CE}$ . Gravity force at the point T that is on the distance R from the centre of a given stellar object can be mathematically described as the vector in the four-dimensional Euclidean space vector Gravity vector depends on two parameters:

- on the delta energy density  $\Delta\rho_E = \rho_{TE} - \rho_{CE}$
- on the distance R.

With equations (1) and (2) we can calculate  $\rho_{TE}$  and  $\rho_{CE}$ . Gravity vector the point T is bigger when the difference between energy density is bigger and distance T is shorter. For example, the gravity vector on the Sun's surface will highly increase when Sun would be compressed in a black hole, see figure (7):



**Figure 7:** Gravity vector on the Sun's surface

A black hole with the mass of the Sun has a much smaller energy density of space in its centre than it is in the centre of the Sun because the radius of a black hole is much smaller.

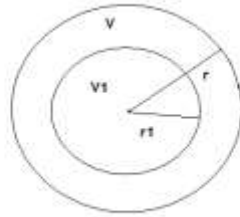
## 2. Mathematical model of the vector gravity

Universal space is a type of superfluid energy that is four-dimensional in its physical actuality. Taking in account Planck units, the energy density of the inter-

galactic areas is  $4,641266 \cdot 10^{113} Jm^{-3}$ . We use units  $Jm^{-3}$  because we cannot imagine  $Jm^{-4}$ . This is a puzzle that we cannot avoid. Back in 2014 NASA has measured that universal space has a Euclidean space [5], so we describe universal space as the four-dimensional Euclidean space  $\mathbb{R}^4$  that when void of physical objects has Planck energy density  $\rho_{PE}$ . 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:

$$\vec{g}_T = \frac{(\rho_{PE} - \rho_{CE})VG}{c^2 r^2} \quad (3),$$

where  $\rho_{CE}$  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  $\vec{g}_T$  at a given point  $T$  according the Newton shell theorem.



**Figure 8:** Newton shell theorem

$$\vec{g}_T = \frac{(\rho_{PE} - \rho_{CE})V_1 G}{c^2 r_1^2} \quad (4).$$

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.

### 3. Discussion

At the null point  $T$  between the Earth and the Moon each stellar object mass causes the same value of gravity vector  $\vec{g}_T$ :

$$\frac{\vec{g}_T M}{x^2} = \frac{\vec{g}_T m}{(d-x)^2} \quad (5),$$

where  $M$  is the mass of the Earth,  $m$  is the mass of the Moon,  $d$  is the distance between Earth and Moon, and  $x$  is the distance from the Earth to the null point  $T$ . With algebra, we get the following equation:

$$x = \frac{d}{1 + \sqrt{\frac{m}{M}}} \quad (6).$$

In the centre of SMBHs energy density of space is so low that atoms become unstable. In the centre of SMBH, the highly diminished energy density of space is weakening the electromagnetic force that keeps the nucleus and orbiting electrons in place. Consequently, atoms fall apart into elementary particles that form huge jets [6] composed of electrons, and atoms nuclei [7].

The electromagnetic force inside the atom depends on the electric permittivity  $\varepsilon_0$  and magnetic permeability  $\mu_0$  of the free space. In free space energy density of space has the value of Planck energy density, on the surface black holes energy density of space diminishes drastically which increases the value of permittivity and permeability as follows [8]:

$$\begin{aligned} \varepsilon &= K\varepsilon_0 \\ \mu &= K\mu_0 \end{aligned} \quad (7),$$

where  $K$  is the dielectric constant.

$$K = 1 + \frac{2GM}{rc^2} + \frac{1}{2} \left( \frac{2GM}{rc^2} \right)^2 \quad (8),$$

where  $G$  is the gravitational constant,  $M$  is the mass of the stellar object and  $r$  is the distance from centre of the black hole to the event horizon. Our proposal is that in the centre of black holes electric permittivity  $\varepsilon$  and magnetic permeability  $\mu$  of space are highly increased because of the highly diminished energy density of space. The speed of electromagnetic radiation (of the electromagnetic force that keeps together nucleus and electrons) in the centre of black holes diminishes accordingly to the equation:

$$c = \frac{1}{\sqrt{\varepsilon\mu}} \quad (9).$$

Therefore, atoms become unstable and fall apart into elementary particles that form huge jets.

In intergalactic space energy density of space is  $4,6412 \cdot 10^{113} Jm^{-3}$ . In the centre of SMBHs energy density of space diminishes hugely and consequently diminishes the amount of energy expressed by electron-volts. The mass of SMBH called Cygnus X-1 is  $4,2169 \cdot 10^{31} kg$  [9], its radius is 63000 m [10]. Calculating the diminished energy density of space in the centre of Cygnus X-1 using Eq. (2) yields:

$$\rho_{cE} = 4,6412 \cdot 10^{113} Jm^{-3} - \frac{3 \cdot 4,2169 \cdot 10^{31} kg \cdot c^2}{4\pi \cdot 63000^3}$$

$$\rho_{cE} = 4,6412 \cdot 10^{113} Jm^{-3} - 3,5762 \cdot 10^{34} Jm^{-3}.$$

In centre of Cygnus X-1 energy density of space is less for  $3,5762 \cdot 10^{34} Jm^{-3}$  than in the intergalactic space. We suggest that this diminishing of energy density is the physical cause of the diminishing of the electromagnetic forces that keep atoms together.

Sbitnev has developed a model of a physical vacuum where elementary particles are different vortexes of the physical vacuum that is the physical origin of universal space [11]. The stability of these vortexes depends on the variable energy density of space. We suggest that in the centre of SMBHs, vortexes become unstable because of the low values of space energy density.

Newton has figured out the mathematics of how gravity works, but the mechanism of gravity has remained unknown. Einstein has described gravity as the curvature of space that still did not resolve the question of “spooky action on distance”. With the geometrization of gravity, it has become clear that there is no physical force acting between two stellar objects, gravity is the result of space geometry. This has not satisfied physicists that were more oriented toward the physical way of thinking. They exposed the “spooky action on distance” question. For mathematical-oriented physicists, Einstein’s proposal was satisfying. The model of vector gravity shows clearly that Einstein was right: matter is curving space, and space tells matter how to move. Our model has developed this understanding: diminished energy density of space is the physical source of gravity vector that tells matter how to move. The gravity vector is embedded in the quantum structure of space. Gravity is in space, where no physical object is there, gravity already is there. Our model gives a deeper understanding of gravity, where outer space with higher energy density is pushing towards the space with lower energy density (see Figure 5). Gravity is not the “attraction force” between physical objects, gravity is the “pushing force” of the universal space in the sense that every area of space with a diminished energy density has a tendency to move in the direction of the lower energy density of space. In this perspective, an antigravity device should increase the energy density of space, so it would move in the direction of higher energy density, which always means away from the stellar object.

#### 4. Conclusions

At the beginning of the 20th century, mathematics overruled physics. Physicists started thinking using mathematical symbols rather than physical phenomena. This has led to models that are mathematical in the first place and secondarily physical. Relativity Theory is a classical model where mathematics has prevailed over physics. In this article, we have shown the weak part of this model. Thinking in terms of physical phenomena and using mathematics as a tool for their description is giving promising results.



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**Received: October 9, 2022; Published: October 28, 2022**