Can special relativity, general relativity, and quantum physics unify into one theory?

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Abstract

Can special relativity, general relativity, and quantum physics unify into one theory? I claim that unification is possible if the correct physical structure of the entire universe is used.

General

Special relativity and general relativity are two of the most successful and well-tested theories in physics. They have been experimentally verified to high precision and have revolutionized our understanding of space, time, and gravity. However, there are some reasons to believe that these theories may not be complete.

Special relativity is limited to situations where gravity does not exist. It does not provide a complete explanation of gravity, which is why Einstein developed the theory of general relativity.

General relativity is a more comprehensive theory that incorporates gravity, but it is still incomplete in some ways. For example, it does not provide a complete understanding of quantum mechanics, which is the theory of how the universe works at the smallest scales.

In addition, some observations cannot be explained by either special relativity or general relativity. For example, the existence of dark matter and dark energy, which make up about 95% of the universe, cannot be explained by either theory.

As a result of these limitations, physicists are continuing to search for a more complete theory of gravity. This theory is often called a "theory of everything" (TOE), and it would be able to unify special relativity, general relativity, and quantum mechanics. However, a TOE has not yet been found.

In the following paragraph, I describe a hypothesis on how the problems of the two relativistic theories can be resolved. I claim that these issues can be resolved if the correct structure of the universe is taken into account. The entire universe is composed of an infinite vacuum space. The vacuum space is endowed with fluctuating fields of energy. From these fluctuating fields of energy pairs of matter and antimatter particles (also designated virtual) pop out and immediately after that annihilate each other.

The matter universe is an isolated island located in this infinite vacuum space. It is composed of two parts: a massive spinning neutron star designated the Pivot and a ring-shaped visible Universe that orbits this Pivot. The Pivot, from the quantum physics point of view, is composed of neutrons and antineutrons packed at the highest possible density in the Universe. From GR's point of view, the Pivot is described as a Kerr black hole. Therefore, the ring-shaped visible

universe must reside outside the event horizon of the Pivot. An observer located in the visible universe cannot observe the Pivot. I will not elaborate here on how the Pivot was created in the vacuum space except to note that the Pivot started as a spinning primeval nucleus. This primeval nucleus accumulated gradually mass from the vacuum space energy. The growth of this primeval nucleus stopped when it reached a size such that the acceleration on its surface reached the maximum possible acceleration and then it exploded into two distinct parts: The Pivot and a ring of the visible Universe. More details in my article The structure of the Pivot Universe

Fig.1 describes the structure of the entire universe. It includes an infinite stationary vacuum space. The vacuum space existed forever. Our matter universe is located in this vacuum space. Vacuum space permeates everywhere, including our matter universe, and is also inside the Pivot. A question that arises here is how the spinning neutron was built. I hypothesize that the virtual particles that exist always in the vacuum space are the source of matter. The hypothesis is based on quantum physics and is described in The_origin_of_matter_docx

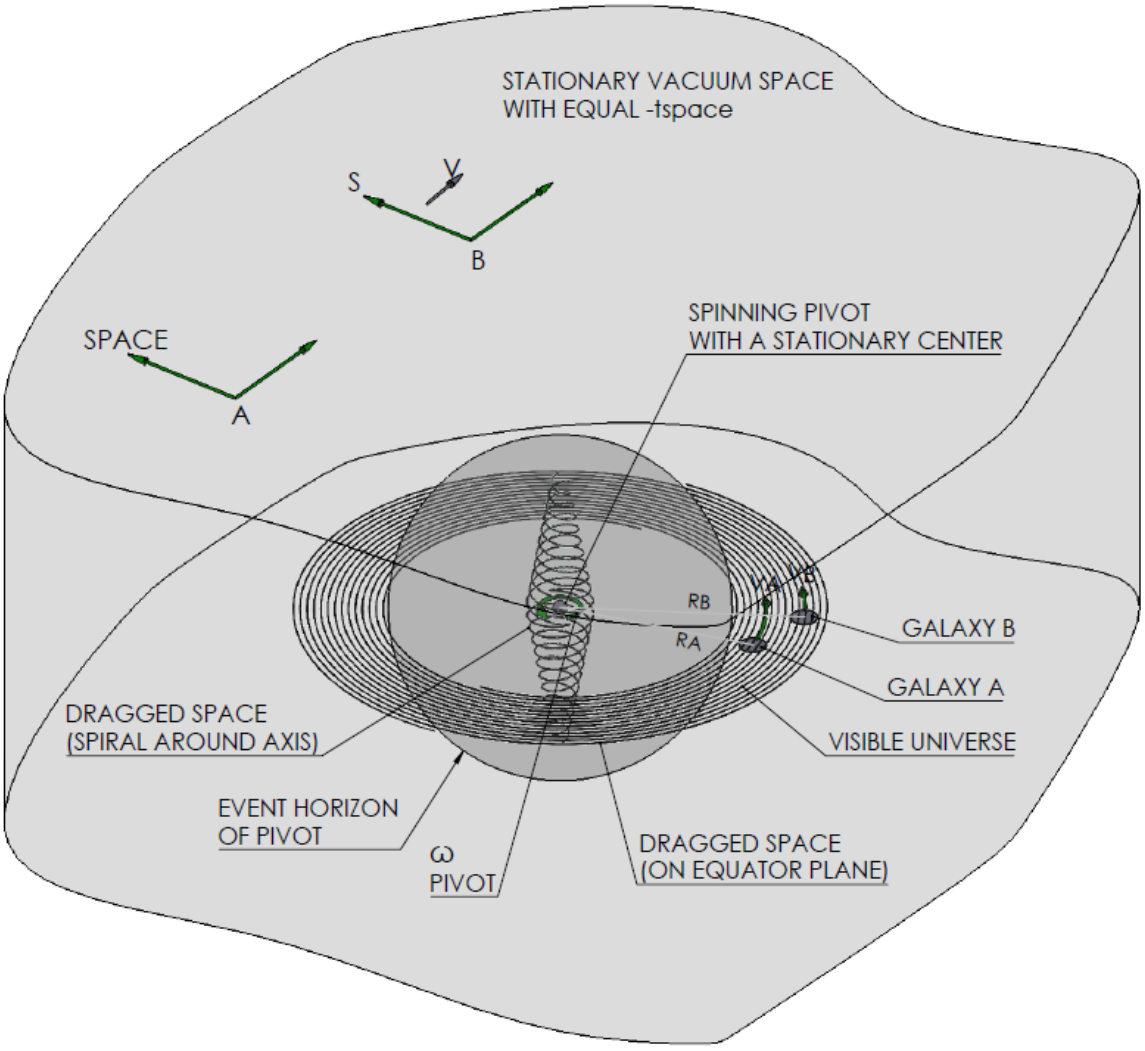

Fig.1- Our matter universe is located in infinite vacuum space

It will be explained now how special relativity and general relativity agree with this structure.

Special relativity is based on two postulates:

1. The laws of physics are invariant in all inertial frames of reference (that is, frames of reference with no acceleration or gravity).
2. The speed of light in the vacuum is the same for all observers, regardless of the motion of the light source or observer.

From postulate 1. of SR, it can be concluded that SR is applicable only outside the matter universe, where there is no gravity.

Postulate 2.- The speed of light can be calculated by the electromagnetic properties of space as calculated by Maxwell:

$$C = \frac{1}{\sqrt{\varepsilon_0 \cdot \mu_0}} = 299792 km/s \quad (1)$$

Where the two measurable properties of vacuum:

$\varepsilon_0 = 8.854 \times 10^{-12}\ F/m$ ....Electrical permittivity of the vacuum.

$\mu_0 = 1.2566 \times 10^{-6}\ N/A^2$ ...Magnetic permeability of the vacuum.

(**Note**: I suggest an additional explanation of the light velocity that is based on fluid dynamics. Accepting the fact that space is some type of fluid that contains virtual particles it is possible to use the well-known phenomenon of dragging force exerted on a body moving in a fluid. I would like to bring the analogy of the motion of a torpedo in the water.

An example: A torpedo is an underwater weapon, once launched from a craft it is self-propelled towards a target. It can be launched from a submarine or a warship. Some data: The speed of a torpedo in water is hampered by the drag force of the water. The speed is limited to under 190 km/h. A submarine can travel at a speed of ~50km/h. A warship has a velocity of ~110km/h. Using this data, I raise the following question: If the torpedo is launched from a submarine or a warship while in motion, from the same location, in what case will the torpedo reach the target sooner? The trivial answer is from the warship because the speed of the torpedo + warship is 300km/h (=110+190) vs. 240km/h (=50+190) from the submarine. But this is a wrong answer. The instant that the torpedo is launched into the water it moves, self-propelled, at its maximal velocity 190km/h, no matter at what was the speed of the craft from which it was launched).

First, I relate to the way special relativity behaves in vacuum space. The reference frame "SPACE" is stationary. Reference frame S is moving relative to reference frame "SPACE" with a velocity v. Special relativity claims that there is a time dilation between frame S and reference frame "SPACE" according to:

$$t_s = \frac{t_{space}}{\sqrt{1-\frac{v^2}{c^2}}} \qquad \text{Eq. (1)}$$

From Eq. (1) it is clear that time dilation exists only when there is a relative velocity between frame SPACE and frame S. When v=0 there is no time dilation and $\Delta t=t_s-t_{space}=0$. This claim solves the twin paradox. At first, the twins are located at point A. One of the twins takes a journey to another star located at point B at a velocity of v. During the entire journey there is a time dilation between A and B according to Eq. 1. However, as the moving twin lands on the star at B, there is no time dilation between the time at B and the time at A, and both are equal to the time t_{space} of the vacuum space. During the journey back from B to A time dilation exists, but as the moving twin lands on point A there is no time dilation i.e., the twins remain at the same age. To sum up – special relativity applies to the vacuum space.

Referring to the matter universe, the question is how special relativity is applicable in our matter universe in which gravity pervades everywhere. The Pivot influences our universe in two ways: The first is the Pivot's gravity causes the galaxies to orbit around it. The second is that the Pivot drags space around it. The shape of dragged space can be calculated according to the general relativity equation of frame dragging. The shape is shown schematically in Fig. 1. There is a dragged space in the shape of a disk at the equatorial plane and also the dragged space in the shape of spirals around the axis of rotation of the Pivot. It is important to note that there is only one point in the matter universe that does not move and neither rotate - this is the center of the Pivot. The time there is equal to t_{space} of the vacuum space. This point is an absolute reference frame of the matter universe.

Unlike the situation in the vacuum space, celestial bodies such as Galaxy A and Galaxy B must be in a constant circular motion around the Pivot. (Note: Galaxy A and Galaxy B are located at different radii (R_A and R_B) from the Pivot, therefore, they have different orbital velocities V_A and V_B.). This situation that seems to contradict the first postulate of special relativity is possible only if the time duration of the measurement is small enough such that the reference frame of the galaxy remains approximately parallel to the reference frame of the Pivot and then Eq. 1 is applicable. As the circular motion of the galaxy never stops there will always be time dilation between any galaxy and the Pivot.

To explain better the issue of the applicability of special relativity in our matter universe I would like to bring the known example of the global positioning system (GPS). The GPS is a verified technology and is used many million times a day by users all over the world. The GPS includes a relativistic correction factor that is comprised of both GR gravitational time dilation and SR time dilation. Not using the relativistic correction factor renders the GPS useless. More details in Is_Special_Relativity_compatible_with_General_Relativity I claim that the situation of the matter universe is similar to the GPS. Just replace Earth with the Pivot and the satellite with a galaxy.

If the observer is located at Galaxy A, rather than at the Pivot, the kinetic time dilation of Galaxy A relative to Galaxy B can be calculated using Eq. (1)

$$\Delta t_{s(\mathrm{A-B})} = \frac{t_{space}}{\sqrt{1-\frac{v_A^{\,2}}{c^2}}} - \frac{t_{space}}{\sqrt{1-\frac{v_B^{\,2}}{c^2}}} \qquad \text{Eq. (2)}$$

General relativity is not applicable in vacuum space far from any gravity. But it is applicable in our matter universe, where the gravity of the Pivot pervades everywhere. There is a gravity time dilation at any celestial body dependent only on its orbital radius as shown in Eq. (3)

$$t_{g-A} = \frac{t_{space}}{\sqrt{1-\frac{2\cdot G\cdot M_{Pivot}}{r\cdot c^2}}} \qquad \text{Eq. (3)}$$

To find the gravitational time dilation between Galaxy A and Galaxy B:

$$\Delta t_{g(A-B)} = \frac{t_{space}}{\sqrt{1-\frac{2\cdot G\cdot M_{Pivot}}{R_A\cdot c^2}}} - \frac{t_{space}}{\sqrt{1-\frac{2\cdot G\cdot M_{Pivot}}{R_B\cdot c^2}}} \qquad \text{Eq. (4)}$$

Finally, the total time dilation between two galaxies A and B is the sum of the kinematic time dilation + the gravitational time dilation, i.e., Eq. (2) +Eq. (4).

To Sum up:

The suggested structure of the Pivot universe unifies special relativity and general relativity. Those theories can be broadened by including quantum physics. My hypothesis, based on Quantum physics, is that the matter universe was built gradually in vacuum space out of the energy of the infinite vacuum space.

An additional speculative remark. Additional matter universes may exist in the infinite vacuum space. I say “speculative” because, unlike our matter universe, we currently have no observations to confirm the existence of additional universes.