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General relativity as a quantum van der Waals torque effect

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By definition space is an abstract boundless container that contains all matter. It is not physical and therefore cannot have physical dimensions. The physical dimensions and clock rate of space arise from the wavelengths and frequencies of the quantum fluctuations that make up the field of standard quantum field theory. The wavelengths and frequencies are in turn self-regulated by the quantum field's own van der Waals torque that in turn regulates all motion. Space, since it is non-physical, must always be treated as geometrically flat in the quantum field rest frame and by extension, any other frame of reference. The presence of matter increases van der Waals torque shifting the quantum field's distribution of frequencies and wavelengths. This changes the local electric and magnetic constants and, subsequently, the speed of light. This increase in van der Waals torque causes gravitational red-shifting. Light deflection around bodies of matter is due to both the variable speed of light and variable clock rates. Quantum field theory forces us to accept a geometrically flat space with variable speed of light and variable clock rates in our approach to general relativity.

1. Background

General relativity theory has been irrational since its inception due to the lack of a physical explanation for the physical dimensions and clock rates of space. In a purely linguistic sense space is an abstract boundless container that contains all matter. Space is non-physical. Because it is non-physical it cannot have dimensions or clocks. Non-physical dimensions are not real dimensions. Non-physical clocks are not real clocks. Anything that is said to be non-physical is not real. Space is only real because of the physical matter it contains.

It is also important to note that general relativity theorists have never proposed a mechanism for how mass curves space. Of course, without a physical description of how space acquires its dimensions in the first place it is logically impossible to describe how those dimensions could change.

Since the theory of general relativity was first proposed physicists have attempted to come up with a physical explanation for the so-called proofs of general relativity. These efforts usually sought to show that general relativity has a quantum electrodynamic origin.

Fortunately, space can never be truly empty as it always contains the quantum field of standard quantum field theory. The quantum fluctuations that make up the field have wavelengths and a frequencies, so the quantum field has physical dimensions and a clock rate. The quantum field consequently gives space its physical dimensions and clock rate.

So, if we want to come up with a theory of quantum general relativity that explains the changing properties near stable matter, we must consider what is happening with the quantum field.

2. Quantum van der Waals Torque

To understand how quantum general relativity arises from the quantum field we must first understand how the quantum field's wavelengths and frequencies come about. The first step in understanding that is noting the existence of the Casimir effect.[1] The Casimir effect tells us that some, or perhaps all quantum fluctuations behave as electrical charge dipoles that interact to produce van der Waals forces. Casimir theorized, and it has been proven experimentally, that quantum van der Waals forces can be retarded in a cavity between objects causing the plates to be pushed together by the quantum field.[2][3]

Since Casimir's van der Waals force effects have been experimentally verified, we must also consider that all known van der Waals forces that exist in any sea of dipoles must also exist in the quantum field. That includes van der Waals torque. Van der Waals torque arises from interactions between rotating dipoles. Quantum van der Waals torque resists the linear and rotational motion of all quantum dipoles.

As such, the quantum van der Waals torque resists all motion in space, including the motion of the quantum dipoles themselves. The quantum field is then self-regulating with the wavelengths and frequencies of the quantum fluctuations determined by the instantaneous local van der Waals torque. Thus, the physical dimensions and clock rate of space are determined by the quantum van der Waals torque.[4]

The quantum field also has its own rest frame. Its rest frame has even been measured by measuring the cosmic microwave background. The cosmic microwave background is black body radiation and black body radiation in a vacuum is caused when quantum fluctuations interact with matter and receive thermal energy such that the quantum fluctuations turn into black body photons. The quantum fluctuations are Plank type resonators and as such are themselves ideal black body radiators assuming they have acquired energy by some means. The cosmic microwave background could not exist without the quantum field.

3. Light

Robert Dicke recognized that "The most striking effect of the presence of virtual pairs in the vacuum is the polarizability of the vacuum." And, "With the neglect of quantum effects the polarizability of the vacuum can be described by classical field quantities $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$."[5] Of course the electric and magnetic constants are entirely quantum effects, but the average values of the constants do not include highly localized quantum effects.

The electric and magnetic constants are due to the resistance of the quantum field to polarization and magnetization respectively. That resistance comes about due to the quantum van der Waals torque in both its electric and magnetic forms. As such, $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$ are properties of the self-regulating quantum field, where the quantum van der Waals torque is more fundamental than those constants.

Equation 1

$$\epsilon_0 \mu_0 = \frac{1}{c^2}$$

The speed of light is a function of $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$ as shown in Equation 1 for the speed of light in free space. The speed of light is, therefore, not a fundamental constant but a third-tier constant after the first-tier quantum van der Waals torque and the second-tier electric and magnetic constants. This means that it is better to think of relativity theory in terms of what is happening to $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$ rather than $\boldsymbol{c}$. It is, however, mathematically simpler to continue using $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$ rather than constants based on units of torque.

4. Matter and van der Waals Torque

General relativity theory does not provide an explanation for how space has spatial dimensions and a clock rate, even less provide an explanation for how mass changes the spatial dimensions and clock rates. In accordance with quantum field theory, spatial dimensions and clock rates are due to the wavelengths and frequencies of quantum fluctuations, so quantum field theory provides a physical solution to that part of the problem.

Previously, however, quantum field theorists who attempted to explain general relativity as a quantum field effect have not provided a physical mechanism for how dimensions and clock rates change due to the presence of stable matter. Physicists have, for example, tried to invoke Mach's principle or Dirac's large number hypothesis while not providing a physical explanation of how that comes about.[5][6] These papers and others like them still contain useful approaches for developing quantum general relativity theory once we acknowledge the underlying physical mechanism.

By recognizing that the quantum field induces a quantum van der Waals torque we now have a physical explanation for relativistic clock rate changes. Any object moving relative to the quantum field's rest frame experiences an effective increase in van der Waals torque which serves to slow physical clock rates in a relativistic manner.

But not only do local quantum fluctuations affect the local van der Waals torque, so does local stable matter. Stable matter interferes with the rotation of rotating quantum fluctuation dipoles. Thus, in the presence of stable matter including protons, neutrons, and electrons, van der Waals torque increases. Note that metastable matter can also briefly change the local van der Waals torque if it exists long enough to interact with local quantum fluctuations. This minimum time is determined by the equation $\boldsymbol{\Delta E \Delta t = h/2}$ or variations thereof.

The increase in van der Waals torque due to the presence of matter shifts the local distribution of quantum fluctuation frequencies and wavelengths, while still retaining the continuum. The increase in van der Waals torque slows the clock rate which reduces the frequencies of nearby quantum fluctuations. The increased quantum van der Waals torque due to the presence of matter also changes the electric and magnetic constants, which changes the local speed of light. The changing quantum van der Waals torque in the vicinity of stable matter is the physical basis for quantum general relativity.

5. Clock Rates and Energy Shifts

An increase in quantum van der Waals torque leads directly to the slowing of physical clock rates and the consequent shifting of light frequencies and energies. Clock slowing occurs due to the effective increase in van der Waals torque when a physical clock moves at a velocity relative to the quantum field rest frame. Physical clocks also slow when they are accelerated. And lastly, physical clocks slow when the van der Waals torque increases due to proximity to stable matter. An increase in van der Waals torque always leads to physical clock rate slowing regardless of the cause of the torque increase.

As light photons leave and move away from a massive object, the light is red-shifted due to clock rate changes. The light has increasingly longer wavelengths and lower energy as the quantum van der Waals torque decreases. Conversely, as the quantum van der Waals torque increases with gravitational potential, light approaching a massive body becomes blue-shifted and therefore appears more energetic.

Physical changes in spatial dimensions are not needed to explain clock rate changes and energy shifts of light photons. Rather, if someone attempts to apply a length contraction correction in addition to a clock rate change, they get the wrong answer. They effectively are squaring the relativistic gamma term. Only one relativistic correction term can be applied at a time and still get the correct result.

This problem was first discovered with the Michaelson-Morley experiment as physicists first applied a Fitzgerald-Lorentz contraction to explain relativistic effects and later they applied clock slowing. Einstein recognized that we could abandon the length contraction correction term entirely and rely solely on the clock slowing term when analyzing the Michaelson-Morley experiment.[7] Yet, even after recognizing this, he failed to remove length contraction terms from his theory of special relativity.

Since clock rate slowing has been experimentally confirmed with clocks used in global positioning system satellites, clock rate slowing is the relativistic correction term that should be applied rather than length contraction. That is not to say that distances traveled do not change relativistically, but those are a clock rate change effects rather than dimension of space effects.

Gravitational redshift is often cited as a proof of general relativity theory. It is easy to see the changes in quantum van der Waals torque that must occur in quantum field theory account for gravitational redshifting without resorting to a curved spacetime model. In actuality, a curved spacetime model is detrimental to gravitational red-shifting theory as only a change in clock rate is needed to account for it. To the extent that light curves, bends, or deflects, that occurs due to interactions with the quantum field rather than a "curvature" of non-physical space.

6. Deflection of Light Due to Matter

The existence of large stable masses of matter near a beam of light has been shown to deflect the light's path. For the Sun Einstein predicted the light deflection would be 1.7 arcseconds.[8] This is normally considered to be a proof of general relativity theory. We will see, however, that it is a natural consequence of quantum field theory and the increase in quantum van der Waals torque caused by stable matter.

The index of refraction (***n***) in a medium is equal to the ratio of the speed of light in the original medium, which we can take to be c_0 in free space, and the speed of light (***c***) in the modified medium that we can take as space in the vicinity of a body of stable matter. The local van der Waals torque in the vicinity of stable matter changes the electric and magnetic constants as well as the speed of light as shown in Equation 2.

Equation 2

$$n = \frac{c_0}{c} = \frac{\sqrt{\epsilon\mu}}{\sqrt{\epsilon_0\mu_0}}$$

The increase in quantum van der Waals torque due to nearby matter causes the speed of light to vary.

Einstein recognized in his 1907 and 1911 papers on general relativity that the speed of light is not constant when there are relativistic changes due to nearby stable matter.[7][9] As stated before, he did not have knowledge of the underlying physical mechanism.

Using the fact that the speed of light varies near stable matter Einstein calculated the deflection of light passing near the Sun as 0.83 arcseconds and published his result in his 1911 paper.[9] It was not until 1915 that he published his corrected result using his spacetime tensor mathematics that he calculated the closer to correct value of 1.7 arcseconds which can be computed based on Equation 3.[8] His 1911 result had been half of that value.

Equation 3

$$\theta = \frac{4GM}{rc^2}$$

Sadly, Einstein had failed to recall the lesson he learned from the application of relativity theory to the Michaelson-Morley experiment. Given that both length contraction and clock slowing corrections can be applied separately, but applying both simultaneously gives the wrong answer, we can only choose one. Einstein recognized in 1907 that clock slowing was the correct correction term, yet there he was in 1915 including a length correction term in his general relativity theory.[7][8]

When we consider general relativity theory as it applies to light deflection, we find there are three correction terms that each contribute a factor of $2GM/rc^2$ to the result. They are;

a. variable speed of light,
b. variable clock rate, and
c. variable length.

In order to get the correct result, we need a combination of two of these terms, but not all three. Picking the correct combination is critical. In his general relativity theory of 1915 Einstein used a spacetime metric that included both variable clock rate and variable length leading to a description of a spacetime that can be curved. He either abandoned the variable speed of light correction term or incorrectly assumed it would somehow be automatically included without adding it as a separate term.

The second possibility is a curved space and variable speed of light model with fixed time which is not viable as it is contradicted by the evidence for changing clock rates due to gravitational potential.

The quantum field interpretation of general relativity as a quantum van der Waals effect tells us that it is absolutely necessary to include variable speed of light in the theory. And, from global positioning systems we have experimentally confirmed the existence of variable clock rates due to gravity, so that is necessary as well. The weakest of the three choices is variable length, particularly since it was previously determined that it is unnecessary.

Consequently, we must base our understanding of general relativity theory on a flat space, variable time, and variable speed of light model. Einstein chose poorly. Instead of general relativity theory being due to the curvature of spacetime it is due to clock rate slowing and variable speed of light in flat space. The path of light and objects deflect due to the changes in local quantum van der Waals torque.

7. Flat space, Variable Clock Rate, and Variable Speed of Light Relativity

Quantum field theory leads us to understand that space must be treated as geometrically flat with its spatial dimensions being due to the wavelengths of the quantum field. Changes in quantum van der Waals torque makes the speed of light variable and also causes clock rates to change. This tells us that general relativity theory must incorporate flat space, variable clock rates, and variable speed of light.

There has fortunately been a number of physicists who have investigated this possibility, but without understanding the underlying quantum physics mechanisms. One of the most notable was Dicke who developed an electromagnetic theory of gravity in a paper published in 1957.[5]

Since then other researchers have taken this line of research and it has been shown that flat space, variable clock rate, and variable speed of light relativity theory can account for all the proofs of general relativity theory.[10][11] The cited examples were based on different hypotheses for the physical interaction but are otherwise flat space, variable clock rate, and variable speed of light theories. That said, there are many researchers who have contributed to this field who unfortunately slip back into using length contraction equations in sections of their work.

When considering alternatives to Einstein's general relativity theory there is great concern that any new theory matches the conclusions of general relativity first and foremost. Physicists using this approach lose sight of the fact that a successful theory of gravitation must conform with physical reality first and foremost. To accomplish this, it is necessary to abandon Einstein's general relativity due to its irrational basis of ascribing physical dimension and clock rate properties to non-physical space and start over with a theory based on the physical realities of quantum field theory.

8. Discussion

If someone does not know the physical cause of acceleration due to gravity then they do not truly understand gravity. The same is true for inertia. The author has previously addressed both.[12][13]

The acceleration due to gravity can be thought of as a Fatio-Casimir effect with the physical action of van der Waals forces as discovered by Casimir and retardation of those forces caused by the shadowing effect one body has on another as first hypothesized by Fatio and later popularized by LeSage. All acceleration due to electromagnetic forces follows the Casimir effect paradigm and the Fatio-LeSage shadowing effect is just another means by which retardation occurs.

Inertia on the other hand is a self-induction interaction between matter and the quantum field mediated by quantum van der Waals torque. The speed of light limit is the same for light, electrically charged bodies and electrically neutral bodies indicating that the speed of light limit is based on the same physical cause for all three. That cause is quantum van der Waals torque. And, each velocity is regulated because the motion of all matter causes quantum field dipoles to rotate.

As such, electrically neutral inertia is a form of self-induction. When we extend the principles of inertia, we also derive electrically neutral Lorentz forces and overall an electrically neutral Maxwell force with equations similar to Maxwell's equations of electromagnetic force theory. In actuality, any reasonable theory of electrically neutral inertia expands to an electrically neutral Maxwell force.

This matter force, as the author calls it since the most obvious possible available dipole is matter-antimatter, can be shown to directly lead to the precession of elliptical orbits such as Mercury's and other phenomena associated with general relativity theory. And, these forces can be derived much more simply than using the mathematics of Einstein's general relativity theory, while also explaining forces that are currently missing from the standard model. These phenomena are derived directly from any successful theory of inertia regardless of what we call it.

The advantage of an electrically neutral Maxwell force is clear when we consider the Lense-Thirring effect. In that effect in general relativity, spacetime is treated as if it is rotating and causing frame-dragging. Space is not rotating. Since it is non-physical it can't rotate. Also, since it is non-physical it cannot be dragged. The quantum field does not rotate either, nor can it be dragged. Individual quantum fluctuations rotate, and collectively they can mimic a rotating field. Similarly, an electrically neutral Maxwell force explains most phenomena attributed to general relativity much more simply than Einstein's formulation of general relativity.

A complete model of quantum general relativity must incorporate three elements;

1. the acceleration due to gravity,
2. inertia and the associated electrically neutral Maxwell force (matter force), and
3. the general relativistic effects due to quantum van der Waals torque changes in the presence of stable matter.

Note that the increase in torque due to stable matter affects the first two, so a complete theory must account for that. We can also note that the torque changes due to matter includes all matter, so while the baseline ε_0 and μ_0 are not Machian, the correction term is due to the sum of changes in van der Waals torque due to all matter.

9. Conclusion

An analysis of quantum field theory shows that the spatial dimensions and clock rate of space are due to the wavelengths and frequencies of quantum fluctuations within the field. The wavelengths and frequencies of the quantum field are self-regulated by quantum van der Waals torque. Quantum van der Waals torque also sets the clock rates for all physical clocks and is therefore responsible for producing relativistic effects due to velocity, acceleration and the presence of stable matter.

Based on those starting principles we can understand the nature of quantum general relativity and determine that quantum field theory requires that quantum general relativity be consistent with geometrically flat space, a variable clock rate, and a variable speed of light that change in the vicinity of stable matter due to an increase in quantum van der Waals torque.

Previous work with general relativity models with geometrically flat space, variable speed of light, and variable clock rates has been shown to be consistent with the so-called proofs of general relativity. To have a complete theory of quantum general relativity we must also include quantum field mechanisms for acceleration due to gravity, and inertia and its associated electrically neutral Maxwell force. With those theories combined, and their effects interrelated, we can develop a complete theory of quantum general relativity as an extension of quantum electrodynamic theory.

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