The Three Kinds of Gravity

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Main body of paper:

A hypothesis of three kinds of graviton interactions with matter, spacetime and other gravitons.

Assumptions:

Space is digital. It is composed of spin networks, according to Loop Quantum Gravity theory. Ref. 1 I call spin networks: **pixels.**

Pixels can be created and destroyed.

Spacetime is constantly being created and destroyed.

Around black holes, pixels are destroyed faster than light can interact with pixels.

Gravitons exist and do interact with other quantum fields and with each other.

Each of the three kinds of gravity are active at all scales, **but only one of them is predominant at its scale.** The predominant gravity may be positive (attracting), or negative (repulsing).

The cumulative effects of the three kinds of gravity are what cosmologists observe in the distribution of stars, galaxies, and large structures in the Universe.

The **first kind of gravity** that we are familiar with is “Newtonian Gravity”. It is gravity we experience on Earth and in the Solar System. It is quantified by Newton’s Law of Universal Gravitation. The effect of this type of gravity decreases rapidly with distance.

On the quantum level: When a graviton interacts with baryonic matter, such as a proton or neutron, a spacetime pixel is deleted, resulting in negative pressure between two stars. We experience it as a positive gravity, which keeps us down on

earth and keeps the Earth circling around the Sun. The energy liberated when a pixel is deleted is transferred as kinetic energy of the baryonic matter.

On the quantum level, all action is local, that is, pixels are deleted at the Earth and the Sun; there is no curvature of space. Pixels are not removed where there are not protons or neutrons. There is no pixel removal or bending of space when the Earth is not at that location. It is the removal of pixels over time and position that results in spacetime to "bend" in the mathematics of general relativity.

The force between bodies of matter according to Newton is:

$$F = \frac{GMm}{r^2}$$

F is the force in Newtons between two bodies of matter, such as Earth and Sun

G is the universal constant of gravitation: = 6.674 x 10^{-11}N-m^2/kg^2 Ref. 7

M and m are the respective masses in kg

r is the distance between their centers in meters

Since this is an inverse square law, its effect rapidly decreases. Above half a light year distance between two stars, Modified Newtonian Gravity MOND dominates.

The **second kind of gravity** is dominant on galactic scales. This gravity is currently hypothesized to be due to dark matter. There are other hypotheses, such as Modified Newtonian Dynamics by M. Milgrom Ref. 5; modification of an equation of General Relativity at galactic scales proposed by professor A. Deur, at the University of Virginia Ref. 6.

My hypothesis is the slight bending of geodesics toward the line of center between any two stars. Please read my paper on viXra.org viXra:2108.0141. Ref. 2 On the quantum level: when two gravitons interact in antiparallel streams between two stars, nearly parallel and counter-streaming, the spin network is moved slightly towards the line of center between these two stars. This results in a slight bending of the geodesics toward the disk of the star. More gravitons will be exchanged at the star, resulting in an increased gravitational attraction.

The proposed second kind of gravity holds the stars in the local galaxies together, by what I call "**gravitational strings**". Although gravity due to a string between two

stars is small, its total effect is huge. These gravitational strings are between each star and all other stars, resulting in a very dense network of gravitational strings. Assuming at least 100 billion stars in the Milkey Way galaxy, the calculated number of gravitational strings is (n-1)*(n/2), which is ½ (n^2 – n), which is about $5*10^{21}$ strings.

I posit that antiparallel streams of gravitons act the same as antiparallel streams of light. They very slightly attract each other. Papers to read are Tolman, Ehrenfest, and Podolsky. Ref. 3 and "The gravitational interaction of light: from weak to strong fields" by Faraoni V., and Dumse R.M. Ref. 4 on arXiv.org

Gravity between two stars on a galactic scale is given by:

(Keep in mind that Newton's contribution of gravity rapidly decreases. At Alpha Leonis, 79 light years from the Sun, the contribution of Newtonian gravity between our Sun and this star is only 0.002745 of the total gravity.)

$$F_{gms} = \sqrt{G_{a_0}} \left(\frac{\sqrt{M_f}}{r} \right) m_s \qquad \text{Ref. 2}$$

F_{gms} = gravitational force on star s with mass m_s due to field of gravity radiating from star f.

G = the gravitational constant G = 6.67 $x10^{-11}$ $N \cdot m^2/kg^2$ Ref. 7

a_0 about 1.2 +/- 0.2 x 10^{-10} m/s^2 estimated by M. Milgrom Ref. 8

The **third kind of gravity** is at the scale of the Universe. Here gravity is negative. This is currently attributed to dark energy. It is expressed by Hubble's Law. Let's call it "**Negative Gravity**".

Pixels are constantly being created and destroyed. A predominant flow of gravitons, results in positive gravity, Newtonian and Mondian. This results in negative entropy, which is more than balanced by Negative gravity, thereby not violating the second law of thermodynamics.

There is very little order due to gravity in the vast spacetime beyond galaxy clusters. When two gravitons interact at larger angles, not near parallel, due to the small size of gravitons, the interaction is extremely infrequent. But when two

gravitons do interact, a pixel of spacetime is created, thus spacetime is expanding. The energy used to create a pixel comes from the electromagnetic field. The result is the measured by the Hubble Constant.

Hubble-Lemaitre Law:

$$v = H_0 D$$

v = speed of separation

H_0 = Hubble constant in km/s/Mpc; A galaxy 1 megaparsec away (3.09×10^{19} km) will move away at 70 km/s.

D = proper distance to galaxy

The Hubble constant can also be stated as a relative rate of expansion, at H_0 = 7%/Gyr. Which means that at the current rate of expansion it takes one billion years for an unbound structure to grow by 7%.

In gravitationally bound structures, such as our Milky Way, negative gravity has no meaning, since it is held together by the second kind of gravity, the gravitational strings between stars. It's expansion due to negative gravity is very, very small, only 0.00187% in a billion years. Its diameter is 26.8 kpc. (1,000/26.8 = 37.3; 0.07/37.3 = 0.00187%)

At the Big Bang, the density of gravitons was extremely high, therefore spacetime was created in an extremely short time. As the density and temperature decreased, the expansion slowed. This was called the inflationary field. What is now called dark energy is a continuation of the inflationary field at the beginning of the Universe's expansion. Now the expansion is much, much slower.

As matter condensed, positive gravity of the graviton-baryonic matter interaction further slowed down the expansion of the Universe.

As the distances between galactic clusters increased, the effect of negative gravity increased again. We are now in this phase of the expansion of the Universe.

The very large structures show the history of expansion in the Universe.

Conclusion:

Predominantly ordered flows of gravitons result in positive gravities, called Newtonian Gravity and Modified Newtonian Dynamics.

Negative gravity, currently called Dark Energy, is the result of the random creation of pixels of space in the vast expanses of the Universe.

References:

Ref. 1 Rovelli, Carlo; Vidotto, Francesca; Covariant Loop Quantum Gravity, An Elementary Introduction to Quantum Gravity and Spinfoam Theory.

Ref. 2 Becker, Kurt; On Cornell University's website viXra.org, paper viXra:2108.0141, The Gravitational Force Between Two Stars on a Galactic Scale,

Ref. 3 Tolman R.C., Ehrenfest, P, Podolsky B; Phys. Rev. 37 (1931) 602

Ref. 4 Faraoni V., and Dumse R.M.; https://arxiv.org/pdf/gr-qc/9811052;

Abstract: The interaction of light beams in linearized general relativity is also revisited and clarified, a new result is obtained for photon-to-photon attraction, and a conjecture is proved. Given equal energy density in the beams, the light-to-light attraction is twice the matter-to-light attraction and four times the matter-to-matter attraction.

Ref. 5 Milgrom, M. arXiv:1404.7661v2 [astro-ph.CO] 31 Aug 2014 MOND theory

Ref. 6 Deur, A. University of Virginia, Charlottesville, VA. arXiv:2108.04649v1 [physics.gen-ph] 9 Jul 2021 "Effect of gravitational field self-interaction on large structure formation".

Ref. 7 All physical constants are from physics text book: PHYSICS Second Edition, Ohanian, H., Rensellaer Polytechnic Institute

Ref. 8 Milgrom, M., arXiv:1404.7661v2 Astrophysics 31 August 2014 Title: MOND Theory