

A corpuscular Space-Time to explain Gravitation

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Abstract

We want to show here that it is possible to conceive a theory of gravitation built with very simple physical notions derived from the most classical mechanics. This is achieved by making the assumption that physical space is a granular fluid medium, constituted by “corpuscles” with infinitesimal energy and dimension and endowed with quantified cooperative properties. We will show that such a point of view can explain the principles on which Relativity is based and recover all its results. It also allow us to understand a quantum character for Newton's strength and shed some light on these mysterious "black objects”.

Hypothesis on the structure of the Universe

We formulate the hypothesis that our physical space is constituted by granular fluid. This fluid can be treated as a quantum condensate and thus present several distinct phases, in the thermodynamic sense of the term and according to the dynamic and interactive state of its elementary constituents (**QF**) .

The first phase is a state of ordered, collective and periodic movement of the **QF** in a microscopic area of space, it takes the form of a Vortex in the condensate. This phase corresponds to so-called "ordinary" matter and energy in elementary particles shape, it can also be described as the local state of excitation of the fluid to constitute these particles, this state is governed by electromagnetism, it present a minimum entropy .

The second phase is, unlike the first, made up of **QF** subjected to disordered microscopic displacements (Brownian movements), that gives to the whole a static character at macroscopic scales, in a state of maximum entropy. We presume that this phase constitutes the gravitational field of the masses and so-called “black matter” .

Finally, the third phase, unlike the first two, is not a static phase; the QF that constitute it are almost free to move like a real gas, it is therefore a dynamic phase without inertia that we will identify with dark energy .

These three phases are interactive and in balance, they cohabit in the same place according to a specific weighting, which implies relations of continuity and balance at the level of their limits.

The second and third phases constitute Vacuum; as the energy of a **QF** is a constant regardless of the phase, the vacuum energy density is always measured by a scalar function which is the number of **QF** per unit volume.

A second hypothesis is the definition of the **graviton**; this comes from the balance between an elementary particle (phase 1) and phase 2 of the vacuum; we assume that this equilibrium between the two phases is based on the periodic exchange of an action modulus (**h**, which is Planck constant) due to the absorption of a vacuum **QF** by the particle. The time interval between two exchanges is equal to the internal period of particle-vortex . This reaction causes a deficit of **QF** in phase 2, which propagates in straight line step by step and according to a solitary wave with period identical to those of the particle, it is the graviton.

The graviton wave is a "free" wave, just like that of the photon, it moves at the speed **c** (speed of light), the gravitons all have the same kinetic momentum (**m°c**) which characterizes their corpuscular aspect.

These hypotheses can only be justified by their consequences on the interpretation of gravitation, the fact remains that the theories in force of quantum fluids (condensates, superfluid Helium, etc.) (*) can support the very simple interpretation (mathematically and in its representation) which we give here .

Newton's force

This force is interpreted by the impetus exchange of gravitons (**m°c**) emitted by a mass **M** and the constituent elementary particles of a mass **M'**, phase 2 is the intermediary. We first calculate the gravitons flow, emitted by the mass **M** and constant for any directions ($1/r^2$ variation if **r** is the distance between the center of the mass and the measured point), knowing that each of the elementary particles constituting the mass **M**, emits one graviton per period of rotation which is the inverse of its quantum frequency. The frequencies being additive, we will write that the flow is proportional to the quantum frequency Mc^2/h which, multiplied by the impetus of a graviton (**m°c**), will constitute the gravitational pressure **Pg** exerted at the distance **r** on the mass **M'**. It

then suffices to multiply P_g by the total mass capture surface of the mass M' , whose value is $N \pi l_0^2$, where N is the number of capture sections of M' , ($N = M'/m^{\circ}c$), to obtain Newton's force using identification .

πl_0^2 is that capture section, where l_0 is the amplitude of the graviton wave.

The calculation has been published in reference 1, it lead to the value of l_0 which was necessary to establish the electron mass formula .

$l_0 = 2 (hG/c^3)^{1/2}$, the calculate value is near $8 \cdot 10^{-35}$ m

This value, close to the Planck length (reference 2), identifies it with the transverse amplitude of the graviton, which is also the dimension of the **QF**.

We also note the extreme smallness of the energy $m^{\circ}c^2$, (i.e. approximately 10^{-50} J) which is calculated from P_g (2) . Thus the characteristics of the fundamental “grain” (the **QF**) are infinitesimal and probably inaccessible to any direct experimentation.

These points of view, which are added to the justification of Newton's law, seem to us of great importance because they give, for the first time, a physical meaning to this Planck length, while accounting for the fact that it is a veritable “wall” limiting our perception of the infinitely small because the **QF** cannot be broken down, and own characteristics absolutely fixed .

The previous development shows that Newton's force derives from a quantum interaction which is the exchange of impetus between a graviton emitted by the mass M and an elementary particle (m° mass) of the mass M' , as this reaction occurs a very large number of times in the same moment for macroscopic masses, this quantum character does not appear to us; it nevertheless exists on the most infinitesimal possible scale, in length and time, which is that of Planck.

Principle of equivalence

This corpuscular interpretation of Newton's law also provides a demonstration of the principle of equivalence. Indeed, as we have seen, the flow of gravitons emitted by a mass defines its gravitational field ("grave mass"), this flow is determined by the sum of the quantum frequencies (F) of all the particles m° constituting this mass, well, but this sum also measures the totality of the energy-matter (“heavy mass”) by the relation $Mc^2 = h F$, we have, here, the demonstration of the

principle of equivalence for the two ways of considering and defining the mass.

Fundamental principle of dynamics

This effect, applied to Newton's force (\mathbf{F}), directs the movement of the stars.

Here too, the exchange of kinetic momentum between the gravitons emitted by the mass \mathbf{M} , considered as fixed, and the elementary particles (of mass \mathbf{m}) of the mobile mass \mathbf{M}' , causes a differential displacement ($d\mathbf{l}$) at the speed ($d\mathbf{l}/dt$) of these, which is accumulated by sum of the differential deviations of the time $d\mathbf{t}$ between two pulses.

It is the very definition of an acceleration (\mathbf{a}) for the mass \mathbf{M}' , which is therefore proportional to the force of Newton.

This acceleration is also inversely proportional to \mathbf{M}' because we have $d\mathbf{l}/dt = \mathbf{m}^{\circ}\mathbf{c}/\mathbf{m}$, accorded to kinetic momentum exchange, and the mass \mathbf{M}' obviously has the same kinetics as \mathbf{m} , which is a constituent of it.

This demonstrates the principle which results in the formula :

$$\mathbf{F} = \mathbf{M}' \mathbf{a}$$

Curvature of Space

The kinetic momentum exchange of a graviton is not limited to static elementary particles, it can take place between the gravitons themselves and static \mathbf{QF} , which leads to a deviation of their trajectories or positions. It is this exchange which gives for the phase 2 its "Brownian" character due to the jerky movements of the \mathbf{QF} which constitute it and caused by the passage of gravitons which are only mobile gaps in this "sea" of \mathbf{QF} . We postulate that this kinetic momentum exchange between gravitons is quantized and causes a trajectory shift of value $2\mathbf{l}_0$, we have seen that \mathbf{l}_0 is the diameter of the section of the graviton.

Thus, when a graviton passes close to a mass \mathbf{M} , it undergoes a certain number of attractive "shocks" due to the gravitons flow emitted by this mass which each bring it closer to $2\mathbf{l}_0$ from the center of mass \mathbf{M} .

In an element of length $d\mathbf{l}$ of its trajectory, this graviton will undergo a number of shocks \mathbf{n} proportional to the flow, thus bringing its trajectory closer to $2\mathbf{n}\mathbf{l}_0$, which results in a differential angle of curvature :

$d(\mathbf{a}) = 2\mathbf{n}\mathbf{l}_0/d\mathbf{l}$. The total angle of curvature \mathbf{A} will be obtained by integration over all the elements of length $d\mathbf{l}$ of the hyperbolic trajectory,

utilizing $\mathbf{I_0}$ value obtained in Newton force paragraph; the calculation leads to the value :

$\mathbf{A = 4GM/(c^2 r)}$, Where \mathbf{r} is here the smallest distance from the trajectory to the center of mass \mathbf{M} .

We can associate to this result the local curvature :

$$\mathbf{C = 4GM/(c^2 r^2) (*)}$$

It shows that the curvature is equivalent to the gravitational field, it thus intersect the result of General Relativity (reference 3)

From this new point of view, the local curvature of space is due to the mutual interaction of the gravitons which are the fundamental dynamic constituents of this space, it is directed by the asymmetry inside their density in phase 2, produced by the proximity of a mass.

Elongation of time in a gravitational field

The curvature of space, than we have demonstrated, is accompanied by the elongation of local time; indeed, the image of the “arc and arrow” illustrate the small elongation of light trajectory from one end to the other. It corresponds to a lengthening of the proper time \mathbf{dt} because it is the frequency (and not the speed) of light which varies slightly under the effect of the gravitational field (gravitons flow), this is shown by the spectral shifts .

The calculation, starting from previous formula (*) give ;

$$\mathbf{dt/t = GM/(c^2 r)}$$
, \mathbf{r} is the smallest distance to the center of mass .

Mercury perihelion advance

It is, more generally, the influence of the curvature of space on the orbit of the planets.

We know that the orbit of the planets is elliptical, most often approaching the circle, only Mercury has a notable eccentricity (0.21) with a minimal perihelion (less than a third of the Earth-Sun distance). In addition, it is the planet whose period of revolution is the lowest (88 days).

The influence of the space curvature, due to the sun, on the planetary orbits is very weak, the data relating to Mercury allow, nevertheless, to

account for the secular advance of the position of the perihelion of its orbit.

The same calculation principle as for space curvature can be applied to the determination of this value . It is obtained by considering the curvilinear integral of the differential curvature offset dr/r^2 all along the elliptical orbit which is known with precision.

Let us consider, first, the simple case of a circular trajectory which, as we know, is a particular ellipse and moreover quite usable (in good approximation) for the calculation of the advance of the perihelion of most planets.

Let us take the formula giving the differential angle of deviation due to gravitons shocks : $da = 2 \int dn/dl$, this value is so the differential curvature of space due to the sun at r distance i.e ;

$$da = 2 MG d(\theta)/(r c^2) \text{ where } \theta = dl/r$$

It is applied to the circular trajectory whose Cartesian equation is $x^2 + y^2 = R^2$, we translates into polar coordinates (origin at the center of the circle) by the very simple function : $r(\theta) = \text{constant} = R$. The integration of $da = 2MG d(\theta)/(r c^2)$ between 0 and 2π (one period of revolution) gives easily ;

$$a = 4\pi MG / Rc^2 , \text{ this is the periodic perihelion advance}$$

Let us now move on to the case of the ellipse (Mercury case) whose eccentricity e is the main characteristic, the Cartesian equation is then: $x^2/a + y^2/b = 1$ where a and b are the semi-axes of the ellipse .

The equation in polar coordinates is a little more complicated than previous; if we take the origin at the center of the ellipse, we obtain:

$$r = b/(1 - e^2 \cos(\theta))^{1/2}$$

The integration of the function $da = 2MG d(\theta)/(r c^2)$ between 0 and 2π (one period of revolution), gives then :

$$a = 4\pi MG / (c^2 b(1-e^2)) \text{ for the periodic perihelion advance angle, this formula is very near the old result of General Relativity (reference 4)}$$

The numerical application, for Mercury, gives $a = 39 \text{ arcseconds}$ per century, which is within the range of the measurements corrected by the influence of other planets (reference 5).

The margin experimental error (3%) remains high due to the sum of the other parameters which concern the influence of the nearest planets and which is more than 10 times greater than that of the relativistic effect.

Conclusion

The hypothesis of a fluid Universe, made up of indivisible corpuscles of infinitesimal dimension and energy, is absolutely fundamental. Indeed, we have shown that this environment can define matter and energy, in their different forms, as well as the Vacuum and its properties. For example, in phase 1, the notion of synchronous periodic motion of the **QF** would be treated by studying the vortices of the quantum fluid from its fundamental state, these are all derived wave functions which would each define an elementary particle of so-called "ordinary" matter by all the elements of multiplicity and symmetry of the complex periodic motions of the **QF**. We also believe that the interactive balances between the different phases of this fluid, in particular vacuum phases 2 and 3 which that we attribute to "dark matter" and "dark energy", are likely to explain the global dynamics of the Universe and the evolution of the different forms of energy that it contains.

In this paper, our objective was to indicate by a theoretical outline, an overview of all the physical interpretations that could be given from our starting hypotheses; in addition to Newton's law, this set contains all the results of Relativity but also it gives a simple explanation of the principles on which this theory is based .

May be more important is a link with Quantum Physics which lead to conceive a quantum granular fluid medium for the universe space-time .

It would remain to support these hypotheses by a real formal theory of this new space-time, it is likely that this will require heavy conceptual work, may be in the development of quantum thermodynamics.

References

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