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The Dark Matter

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Abstract
We present here elements which validate the identification of what is call "dark matter" to the classical gravitational energy. The corpuscular gravitation theory gives a very concrete interpretation to this energy which concerns the space void of all matter and radiation [1,2]. Measuring the energy density of the vacuum by the Casimir effect may be an experimental verification.

1. Introduction

Two previous publications present the Vacuum space, containing neither particle of matter nor electromagnetic radiation, such as a medium energy made up of discrete elements, equivalent to vibrators of infinitesimal energy and unbreakable (the QF), see [2]. This vacuum can be separated in two phases; one in interdependence with the matter, we have assimilated it to gravitational energy and it constitutes, for us, what we called "dark matter", and the other which is in equilibrium with the previous one in a limit way constitutes the ground state of the universal quantum fluid, identified with "dark energy", see [3].

The aim of this publication is to validate this assimilation and using the Casimir effect, to specify the nature of this dark matter and the possibility to measure its density and distribution in the universe.

2. Gravitational Energy

Its classic expression is linked to the Newtonian potential which provides its density (Eg) in a point :

(Eg) = {Si} (G Mi^2 / 8pi Ri^4) (1)

{Si} designates the sum of index i of all the masses Mi at the distance Ri from the point considered, G is the constant of gravitation.

This energy density is the sum of those of the vibrators (QF) which constitute a buffer zone between particles of matter and the integral vacuum (level fundamental), this zone is that of gravitons flows which are wave solitons corresponding to the progression of QF deficits linked to their periodical absorption by the mass particles [2].

We can also consider this phase as a set of virtual waves, with identical energy and whose vibrational phase is determined by the space-temporal proximity with a graviton (*), that explains the virtual nature of these waves (the word virtual is associated with a very short lifetime). This property gives this phase a high entropy (**), which contrasts with those of particles of matter and fundamental level (dark energy).

3. Gravitational Energy and Dark "Matter"

The assimilation of the two notions may appear very paradoxical since we consider that the gravitational energy is a phase of the vacuum! Yet we know that it is possible to understand some gravitational anomalies without resorting to material sources (MOND theory). This "matter" becomes, quite simply in the corpuscular theory : an overconcentration of two QF, stabilized with the gravitons flows. The problem is that adding up the gravitational energy of all known masses (stars, black holes etc …), we are well far from reaching 25% of the energy of the universe as this is indicated by the analysis of the cosmic microwave background (satellite Planck)! We will see that the existence of black holes allows to consider a solution to this question.

4. Black Holes

The existence of these objects is now proven, we remembers the origin of their prediction as a particular solution of Einstein's equations which allowed to write some of their properties, but without anything about the nature of the energy they are made. We give here another definition, much more simple and concrete: A black hole is a cosmological object whose gravitational energy is equal to that of mass energy; it is therefore a limit state since the first is consequent on the second. If R is the radius of the object, it is easy (using1) to demonstrate the equality:

$R = 2GM/c^2$ (2)

In this demonstration, no hypothesis is made on the nature of the mass of the object, only the estimation of its density could give an indication. We can show that the density of a black hole is inversely proportional to the square of its mass, a solar-type black hole will have a mass density of the order of 10^{20} kg/m^3, no known material reach such a value !

On the other hand, supermassive black holes which are found in the centers of galaxies can have densities close to that of water!

It nonetheless remains that the sum of energies known black holes cannot explain the 25% .

Analysis of the movement of galactic clusters "neighbors" of our local group allows, in addition to verify Hubble's law, to show an identical component on the directional category for these clusters which then group into a supercluster called Laniakea, see [4]. The size of this supercluster reaches several hundreds of millions light years, and so, all the clusters of galaxies it contains are thus subjected to what we called "the great attractor"…

If we assume that it is, in fact, a gigantic black hole whose gravitational range Rg would correspond to this dimension; the formula: **$Rg = (MTG/2c)^{0.5}$,** see allows us to attribute it a mass of around 10^{49} kg, which is very far superior to anything we know!, it would suffice some thousands of these black holes in the universe to account for 25% of the total energy, by adding up their gravitational energies.

It is interesting to note that if we translate the above values in terms of acceleration **($A = GM/R^2$)** at the edge of the supercluster (which is the case for our galaxy), we find the order of magnitude of 10^{-10} m s^{-2}, which corresponds to the value used by MOND to render account of the star velocity anomaly at the periphery of the galaxy...

We believe that these black holes could have been formed very early (with a much lower mass) 300 000 years after the Big Bang, following segregation whose origin is the destabilization of the plasma after the release of infrared photons, around 3000°C, which extends the mechanism for the entire universe.

These giant black holes would today have a dimension of the order of that of a large galaxy (formula 2) and a surface gravitational field (horizon) extremely faint, which makes them perfectly harmless to any massive object crossing their limit (horizon), therefore very difficult for detection; only a detailed analysis of galactic clusters movements can highlight them. All these elements are in agreement with the data analysis of cosmological radiation (Planck satellite) and recent observations from the James Webb telescope which detected very old black holes, which defy the standard model.

5. Validation

This is, of course, the hypothesis of equivalence between gravitational energy and "dark matter".

In addition to the elements of the previous chapter, we let us bring an argument, which we think is convincing, accorded to the Casimir effect. This effect is considered by the standard model, via the quantum field theory (TQC), as a manifestation of vacuum energy which is attributed to the fluctuations of the electromagnetic field on zero state. The calculation is a summation of virtual waves amplitudes and a renormalization which results in a function giving the Casimir energy density (Ec) compared to the spacing of the plates d; see Wikipedia "Effect Casimir".

We obtain a function which matches the empirical formula established by Casimir: **$Ec = hc/(1440)\ d^4$,** where h is the Planck's constant and c the speed of light. This formula is verified (experimentally) by measuring the Casimir's strength. If we consider that Ec is the energy density of the vacuum in a terrestrial laboratory, which implies that this (finite) value would suppose a "cutting" in the wavelength series, corresponding to a minimum active value, which would lead to practically zero energy density between the plates; our hypothesis then consists of writing **$Ec = Eg$** (formula 1).

The numerical application, for the terrestrial laboratory, provides: $d = 2.2\ 10^{-10}$ m which is then the "cutting" wavelength value.

In our corpuscular theory, the relationship between the gravitational energy density Eg and that of energy of gravitons Egr is given by the formula: **$Eg/Egr = GMT/4c\ R^2$** (see [2]) in a terrestrial laboratory, M and Rare respectively the mass and radius of the earth and T the age of the universe see [2]. The inverse of this ratio is also the distance between two QF which are directly involved in the construction of a graviton over a length L = 1m. The interval of length between two contributions is so the minimal wavelength of all the virtual components (*), equivalent to the previous "cutting".

We therefore have: **$l = 4c\ R^2\ L / GMT$** (3) whose calculated numerical value is $l = 2{,}6\ 10^{-10}$ m, this value is close to the cutting wavelength obtained by the direct use of Casimir formula ($2{,}2\ 10^{-10}$ m), the difference (20%) can be explained by the fact that we have here a Casimir curve which tends towards saturation (zero derivative) for d = l , which is not the case for the standard Casimir curve; the calculation which show it is not reported here.

This overlap justifies the equivalence between the energy of vacuum, in the "dark matter" phase, and the gravitational energy within the framework of the corpuscular theory, we can even say that it justifies this theory…

6. Experimental Verification, Measurement of Vacuum Energy

Formula (3) gives a plates spacing value l at the saturation of Casimir's force (this force would be constant for lower values) which would allow to evaluate the vacuum energy at a defined location; (see the combination of relations (1) and (3)). This value, for the surface of the earth (2.6 10^-10 m) is too small to be measured , it would therefore be necessary to stand away from the attraction of the earth by a measurement in a very distant artificial satellite.

To more simply check the equivalence between vacuum and gravitational energies, we can suggest measuring Casimir's force as a function of the altitude, idem to the gravitational field . For one fixed plate spacing as small as possible (<1micron), using altitudes between zero (sea level) and 5000 m (Andean highlands), the whole relative variation would be around 3 per thousand, which seems detectable to usaround a pressure of 10^-3 Pascal.

7. Conclusion

It should be noted that everything that has been said concerns only the so-called "gravitational" vacuum phase.

Beyond, towards the domain of dark energy, that is to say in the very large spaces separating the galactic clusters, the Casimir force no longer exists.

It is very curious to think that the classic notion of gravitational energy can respond to the obsessive question of dark matter ! , we think that Relativity, because its geometrization formalism of space, has discarded its consideration, but the structuring of space has an obvious cost; it is easy to show that the local curvature, which is **C = 4 G M/c^2 R^2,** is, within one coefficient, the square root of the gravitational energy density, see (1). Energy directs the structure and not the contrary, what is not put forward by the current theory.

We believe that we have shown that the Casimir effect, which is a "quantum" effect, just like physical "granular" space is a quantum fluid, allows to establish the fundamental relationship explaining what is "dark matter" and so its importance in the universe, considering giant black holes of the "big attractor" type. We proposed an experimental verification of this vacuum energy equivalence with gravitational energy by a measurement of the Casimir force as a function of the altitude.

Annexes

(*) Virtual waves composing gravitational energy, are the harmonics of those which are directly linked to the presence of gravitons, which mark a limit and only concern one part infinitesimal. The summation of these harmonics therefore leads to the energy density of the vacuum; number total of QF per unit of volume, which cause the external pressure on the plates of the Casimir device. The calculation is identical to that of the TQC except immediate vicinity of the limit ("cutting"), we join therefore identical Casimir curves by increasing the spacing of the plates, which allows the presence of a part of the harmonics components between them.

(**) The virtuality of the waves corresponds to a very large number of states (completions) which address a QF vibrator in a given time, the energy gravitational force is thus associated with high entropy.

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