On the relationship between the Hubble constant, the universal gravitation constant and their dependencies over time

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Summary

According to the theory of generalized relativity, the dependence over time of the universal gravitation constant and the Hubble constant has been determined. An equation relates both to the speed of light

1.- DETERMINING THE DEPENDENCE OF THE HUBBLE CONSTANT OVER TIME

According to the relativity tensor, the linear differential element of it is given by

$dl = (-c^2dt^2+dr^2)^{1/2}$

where dr = H´t dt, with H being the Hubble constant or rate of expansion of universe at the ends of it.

$dl = (-c^2dt^2+ (H't)^2dt^2)^{1/2} = (-c^2 +(H't)^2)^{1/2}dt$

dl/dt = space-time expansion rate = ic

by squared the two members of the equation:

$-c^2 = -c^2+ H't$

$0 = H't$

$H' = 0$

H = const.

Thus, according to the theory of generalized relativity, the Hubble constant remains unchanged over time.

2. THEORETICAL DETERMINATION OF THE VALUE OF NEWTON'S UNIVERSAL GRAVITATION CONSTANT THROUGH THE RELATIVITY THEORY

2.1.- Speed of expansion of space-time

According to the relativity tensor, the speed of space-time is "ic" being $i=(-1)^{1/2}$

2.2.- Acceleration of the gravitational field at the ends of the universe caused by the curvature of space-time.

The gravitational field, according to the theory of generalized relativity, is created because of our movement in space-time, the same thing that happens to us with centrifugal force when we travel in a car in a curve. If our motive is space-time and its velocity which we know and it is -ic-, being the radius of our curve the radius of the universe, we can calculate the value of the acceleration centrifuge at the ends of the universe that will match the value of the acceleration of gravity there, resulting in

$a = V^2/r$

$V = ic$

$a = -c^2/R$

acceleration of the gravitational field at the ends of the universe caused by the curvature of space-time.

According to Newton:

$F = G\ M.m/\ r^2 \quad (1)$

$F = M.a \qquad (2)$

According to these formulas the acceleration we have calculated must coincide with the value of G since, if M represents the mass of the universe, m a mass of 1Kg, r is 1 meter, we have according to (1) and (2)

$(M+1).a = G\ M$

As M is much higher than 1Kg we have that the value of G will coincide with the value of "a"

Resulting:

$$G = c^2/\ R$$

3.- DEPENDENCE OF THE UNIVERSAL GRAVITATION CONSTANT OVER TIME

Like

$R = H.t$

$$\mathbf{G = c^2/Ht}$$

That is, according to this the constant of gravitation if it depends on time and is inversely proportional to it.

4.-Study of the equation G = K/t

Let's determine G values between time periods of the universe.

Let's adjust the value of K

$G = 6{,}674.10^{-11}$ N.m^2/ Kg,

$t = 0{,}1377.10^{11}$ years, age of the universe

$K = 6{,}674.10^{-11}.\ 0{,}1377.10^{11} = 0{,}919$

Time in millions of years	Value of G
13	$7.07.10^{-8}$
130	$7.07.10^{-9}$
1.300	$7.07.10^{-10}$
13.000 (close to the age of the universe)	$7.07.10^{-11}$
130.000	$7.07.10^{-12}$

According to this table the variation of G in the last 11700 million years has been $6{,}36.10^{-10,}$ therefore, we are talking about insignificant variations at the level of 10000 years, for example.

4.- Conclusions

According to the theory of generalized relativity, the demonstrated that the expansion rate of the universe has not changed over time, i.e. H is a constant value independent of time. It is not the same with G the universal gravitation constant that if it is dependent on time finding the equation that relates it. In addition, adjusting this equation to the current experimental time and G value values, it is observed that this variation is extremely small considering historical time periods where we have evidence of astronomical measurements.

An equation has also been obtained that relates the Hubble constant to the universal gravitation constant and the speed of light.

5.- References

Constante de gravitación universal - Wikipedia, la enciclopedia libre

Universo observable - Wikipedia, la enciclopedia libre

Problema de planitud - Wikipedia, la enciclopedia libre

valor de la constante de hubble - Buscar (bing.com)

13.770 millones de años. Esa es la edad del Universo (abc.es)