Adaptable Cosmological Constant to Solve Major Problems of Cosmology without Inflation or Dark Quantities

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Abstract

We propose a cosmological constant that changes according to the scale of the application of the field equation. This proposal is found to resolve the cosmological constant problem , flatness problem and horizon problem and remove the contrived quantities and concepts such as dark matter , dark energy and Inflation. The proposal does not involve any modification of general relativity or any other theory.

The Proposal

Because the universe is not perfectly homogenous, some of its features may manifest themselves in certain scales and disappear in other ones, so if we assume that the cosmological constant is affected by the distribution of the energy around the region of the application of the field equation then it seems unreasonable to insist to use the same cosmological constant in different scales of application. For example , in the scale of our solar system , other stars in our galaxy and other galaxies in outer space is not expected at all to have any significant effect on the geometry or anything else in this scale because of the great ratio between the average distance between the stars and the distances in our solar system which makes it practical to assume an empty background and neglect the existence of objects other than the sun, not like the case of the application of the equation to make calculation about the rotation of a star around the galactic center where all other stars in the galaxy appear as clear background for a region with this size or the application of the equation in the galaxy as a whole where the background density of the universe is taken into consideration because the average size of the galaxy is comparable to the average distance between galaxies.

Our proposal is clear and simple:

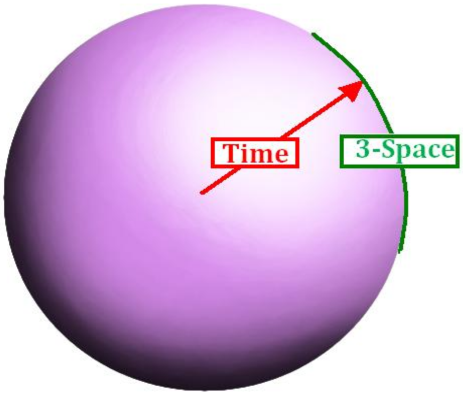
The Cosmological Constant is composed of two independent parts: a geometrical part that represents a non-zero lower state for the curvature (ground curvature) and a material part which represents the distribution of energy in a space around the region of the application of the field equation with a size comparable to the size of the region of the application of the field equation (background density) .

Thus the field equation will be:

$$G_{\mu\nu} - G_{\mu\nu}^{ground} = k\,T_{\mu\nu} - k\,T_{\mu\nu}^{background} \qquad (1)$$

The Ground Curvature

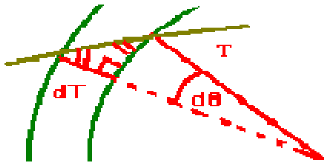
Let us assume the simple model of the shape of the universe of a radial time and a spherical 3-Space:



For this shape of space-time the space has a global curvature that depends only on the age of the universe (T) :

$$G_{\mu\nu}^{ground} = \frac{constant}{T^2}$$

This Shape of the space-time can explain *Hubble's Law*. It can be proved that the world line of light (c = 1) as it travels through such 4-dimensional space-time between the source of light and the observer is a logarithmic spiral (tends to straight line in large values of the age of the universe) this is because it keeps making an angle (Π / 4) with the 3-dimensional surface in every time because the speed is equal to the tangent of this angle. Thus the relation between the time of emission (T*e*) and the time of observation (T*o*) and the angle between the world lines of the observer and the source (ɵ) can be obtained as follows :



We have : (*d*T = T *d*ɵ) then by integration (from T = T*e* to T = T*o*) we arrive at the important result:

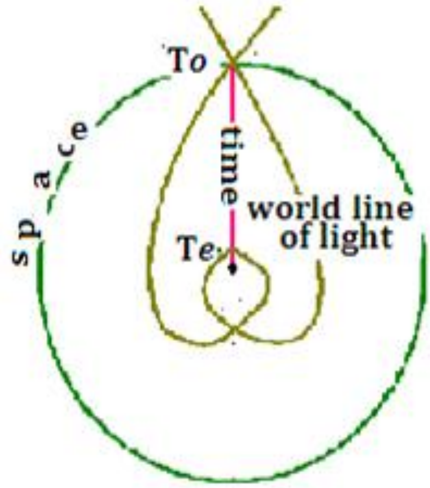
T*o* = T*e* (e^ɵ)

The red-shift (z) resulted from this relation between the time of emission and the time of observation is :

z = (e^ɵ) - 1

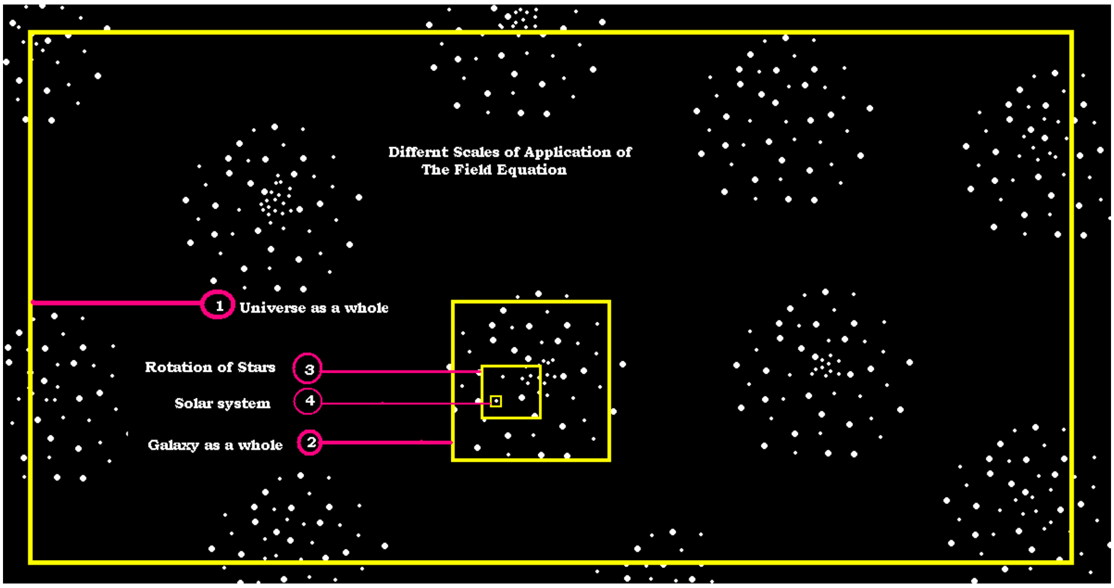
This relation *{ z = (e^ɵ) - 1}* agrees with Hobble's law and can also be used to explain red-shift data claimed to be results of accelerated expansion (which is impossible according to this model) such as supernova observations and thus introduce another source for red-shift other than movement and gravitational field. This can also resolves the *Horizon Problem* (The problem with the standard cosmological model that different regions of the universe have not contacted each other but have the same physical properties. The cosmic background radiation which fills the space between galaxies is precisely the same everywhere).

According to the above equation of the world line of light { T*o* = T*e* (e ^ *θ*) } , all the radiation emitted from a source whose world line is at angle (nΠ) with our world line reaches us at time (T*o* = T*e* (e ^ n Π) from all direction. This provides us with a simple definition for cosmic background radiation as *the radiation that we receive from all directions although it comes from the same source due to the effect of the global geometry of space-time* .



The Background Density

This is the density of matter which appear as distributed around the region we choose to apply the field equation in it. The value of this density differs according to the scale of the application of the equation because certain parts of the matter in the universe is taken into consideration or be neglected according to this scale.



Now we can see how the background density of space is changed according to the scale and how this can solve the problems of cosmology using the assumption (or the approximation) that the matter is distributed homogenously in the background in each case:

1) Global Application : Here the background energy density is the average density of the universe itself and thus the right-hand side of the equation is equal to zero and the global geometry of the universe is independent from its density:

$$G_{\mu\nu}^{universe} = g_{\mu\nu} \Lambda \qquad (2)$$

This solves the *Problem of the Cosmological Constant* because any distribution of energy which permeates all the space homogenously will be canceled out because it appears in the right-hand side of the equation two times with opposite sign .This independence of the global geometry from the density solves the *Flatness Problem* without *Inflation* because the concept of *Critical Density* becomes meaningless and will also eliminate the need for *Dark Energy.*

2) Application of the Equation in a Galaxy as a Whole: If we assume a homogenous distribution of matter in the galaxy then the background energy density is the average density of the universe and the equation is:

$$G_{\mu\nu}^{galaxy} - G_{\mu\nu}^{universe} = k\,T_{\mu\nu}^{galaxy} - k\,T_{\mu\nu}^{universe} \quad (3)$$

3) Application of the Equation in the Scale of the stellar systems(like the application of the equation in our solar system) : In this scale the density of the galaxy does not appear as a background for such small systems and the star appears as located in empty universe**.**

$$G_{\mu\nu}^{near\ or\ inside\ star} - G_{\mu\nu}^{universe} = k\,T_{\mu\nu}^{near\ (T_{\mu\nu}=0)\ or\ inside\ star} \quad (4)$$

4) Application of the Equation in the Empty Space in the Scale of the Movement of the Stars inside the Galaxy : Here the background density of the space is the density of the galaxy **.**

$$G_{\mu\nu}^{empty\ space} - G_{\mu\nu}^{universe} = k\,T_{\mu\nu}^{empty\ space} - k\,T_{\mu\nu}^{galaxy} \quad (5)$$

This property of space (shown in equation **(5)**) of being equivalent to having negative density which appears in this scale that generates what is interpreted as *Dark Matter* in the standard model that is because according to the field equation **(1)** when an astronomical object is found in such a space its geometrical (gravitational) affects will increase (more than its effect if it were embedded in a space of zero or positive density). The source of the gravitational field (group of stars in the center of the galaxy) and the gravitating object (a star) appear as having more than their real masses because of the negative background density which appears in this level of application of the field equation. This also explains why we can only detect (what is interpreted as) dark matter in the scale of the rotation of stars inside the galaxy but not in local observation near the stars (such as our solar system) .

Conclusion

We can solve many problems of modern cosmology if we define the cosmological constant as the geometrical ground curvature in addition to the background material density which depends on the scale of the application of the equation such as Global , Galactic , Stellar and Planetary scales… and what about Quantum Scales?