A Proposed Explanation of Dark Matter within General Relativity

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Abstract

A simple explanation to dark matter within the framework of general relativity is given . The explanation is shown to be a result of a new proposed definition for the cosmological constant.

Introduction

Although written to be understood independently this paper represents another confirmation of our proposal of adding the average stress –energy tensor of any homogenous distribution of matter and energy around the region of the application of the field equation to the cosmological constant. The fact that this proposal can solve many other major problems of cosmology can be found in other papers by the same author (*The Detectability of the Zero-point Energy in General Relativity and Quantum Mechanics* , A Comparison between The Standard Cosmological Model and A Proposed Model with Radial Time and Independent Geometry and Another Cosmological Constant to Solve More Problems of Our Cosmological Model)

Dark Matter

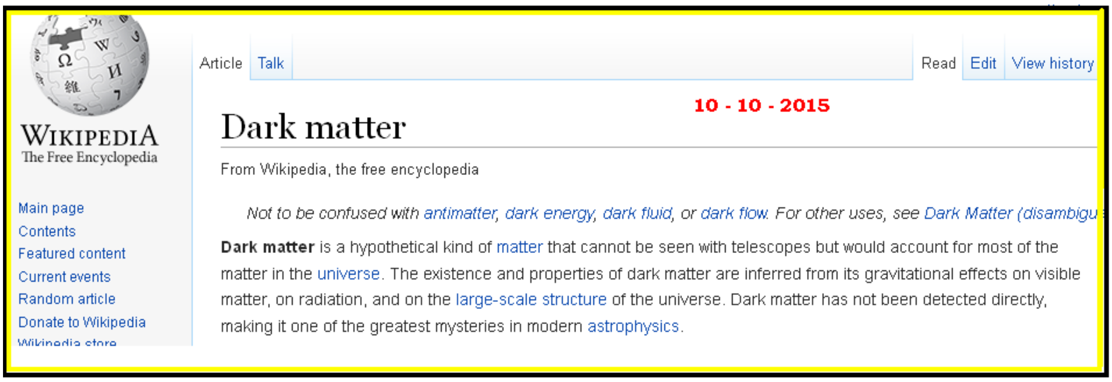
Our proposal can be summarized as follows:

The Material side of the field equation (usually the right-hand side) is not the absolute value of the stress-energy tensor but rather its difference from the average value of the stress-energy tensor of the space which surrounds the region in which we apply the equation (The background energy density) .

It should be emphasized here that this is not a modification to general relativity but rather it is simply equivalent to thinking of the cosmological constant as a quantity that composed of two independent parts : a material part which is the average stress-energy tensor and a geometrical part which represents a non-zero ground state curvature which can be determined from the shape of the universe (as shown in other papers mentioned in the introduction but not needed to understand our current situation) . Thus the field equation will be:

$$G_{\mu\nu} - g_{\mu\nu}\Lambda = k\,T_{\mu\nu} - k\,T_{\mu\nu}^{average} \qquad (1)$$

In the standard model the existence of dark matter (which never emits nor absorbs any electromagnetic radiation) is hypothesized to account for the discrepancy between the mass of the large astronomical objects determined from their gravitational effects , and their mass as calculated from their electromagnetic effects.



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Dark matter

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Not to be confused with antimatter, dark energy, dark fluid, or dark flow. For other uses, see Dark Matter (disambigu

Dark matter is a hypothetical kind of matter that cannot be seen with telescopes but would account for most of the matter in the universe. The existence and properties of dark matter are inferred from its gravitational effects on visible matter, on radiation, and on the large-scale structure of the universe. Dark matter has not been detected directly, making it one of the greatest mysteries in modern astrophysics.

In our proposal we can explain what is interpreted in the standard model as dark matter as follows:

The value of the background energy density which is subtracted from the right-hand side of the field equation is defined according to the level of the application of equation :

1) **Global Application :** Here the background energy density is the average density of the universe 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:

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

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:

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

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.

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

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 .

$$G_{\mu\nu}^{empty\ space} - g_{\mu\nu}\,\Lambda = k\,T_{\mu\nu}^{empty\ space} - k\,T_{\mu\nu}^{galaxy}$$

$$G_{\mu\nu}^{empty\ space\ inside\ galaxy} - g_{\mu\nu}\,\Lambda = -\,k\,T_{\mu\nu}^{galaxy} \qquad (5)$$

It is 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) . Both 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

The slightest modification which maintains the success of the local application of Einstein's Field Equation and resolves many of the problems and contradictions of the global application is the subtraction of the background energy density from the material side of the field equation.