Journal of Physics & Astronomy

Theory | Vol 9 Iss 2

On Dark Matter Gravity Force Generated by the Expansion of the Universe

Jesus Delso Lapuerta*

Bachelor's Degree in Physics by Zaragoza University, Spain

***Corresponding author:** Jesus Delso Lapuerta, Bachelor's Degree in Physics by Zaragoza University, Spain. E-Mail: jesus.delso@gmail.com

Received: March 04, 2021; **Accepted:** March 25, 2021; **Published:** April 04, 2021

Abstract

Dark matter gravity force is generated by the expansion of the universe, gravitational force is not strong enough and an extra centripetal force is needed due to this expansion, energy related to this new force is stored in the dark matter energy tensor D(4,0) related to the Riemann curvature. The cosmological redshift energy loss due to the expansion of the universe is stored in the dark matter energy tensor D(4,0). The Cosmic Microwave Back- ground energy loss has been stored in the dark matter energy tensor D(4,0). Dark matter gravity is generated by D(4,0) energy related directly to the S(4,0) tensor, however this gravity is attributed to exotic particles never detected, galaxies in our universe are rotating with such speed that the gravity generated by their observable matter could not possibly hold them together. Total Energy T(4,0) and energy tensors are defined to complete the General Relativity field equations. The Ricci decomposition is a way of breaking up the Riemann curvature tensor into three orthogonal tensors, Z(4,0), Weyl tensor C(4,0) and S(4,0).

Keywords: ***Dark matter; Gravity; Cosmic; Energy; Universe***

Dark Matter Gravity Force is generated by the Expansion of the Universe

In an expanding universe a satellite is in a uniform circular orbit around a planet, satellite mass m << planet mass M, initial radius r_0, initial constant angular velocity ω_0, initial velocity v_0 << c, c the speed of light, due to the expansion of the universe the final radius $r_f = ar_0$, a>1, final constant angular velocity ω_f , initial gravitational force F_0g equals centripetal force.

$$F_{0g} = G\frac{Mm}{r_0^2} = mr_0\omega_0^2, G\frac{Mm}{r_0} = mr_0\omega_0^2, V_0 = I_0\omega_0^2 = 2T_0$$

In the expansion of the universe angles remain invariant, so $\omega_0 = \omega_f$ and gravitational force F_g equals centripetal force

$$F_g = G\frac{Mm}{r^2} = mr\omega^2, G\frac{Mm}{r_0} = mr_0^2\omega^2 \text{a}^3, \omega^2 a^3 = \omega_0^2$$

Since $\omega<\omega_0$, gravitational force Fg is not strong enough and an extra centripetal force is needed, this extra force is attributed to exotic particles never detected

$$E_{dm} = E_f - E_0 = T_0 a^2 - 2T_0^{a-1} + T_0$$

Dark Matter energy E_{dm} has been stored in the dark matter energy tensor D(4,0) defined below, differentiating we get the dark matter force F_{dm}.

Citation: Lapuerta JS. On Dark Matter Gravity Force Generated by the Expansion of the Universe. J Phys Astron. 2021;9(1):103.

$$F_{dm} = 2T_0 a + 2T_0 a^{-2}$$

Cosmological Redshift Energy Loss due to the Expansion of the Universe

In an expanding closed universe, regardless our universe is closed or open, the final wave length of the photon when the closed universe reaches its maximum radius is [1]:

$$\frac{\lambda_{now}}{r_{now}} = \frac{\lambda_f}{r_f}$$

$$\frac{v_f}{r_{now}} = \frac{v_{now}}{r_f}$$

$$E_l = hv_{now} - hv_f$$

Where h is the Planck constant and E_l is the energy loss, in a closed universe after reaching its maximum expansion the universe comes backwards and will reach r_{now} again restoring the loss of energy to the photon, so this E_l has been stored and was not definitely lost.

The cosmological redshift energy loss due to the expansion of the universe is stored in the dark matter energy tensor D(4,0) related directly to the S(4,0) tensor, however this gravity is attributed to exotic particles never detected.

The Cosmic Microwave Background energy loss has been stored in the dark matter energy tensor D(4,0), gravitational waves and other fields are subject to the same redshift phenomena.

Conformal Energy U Defined as a Combination of C and the Hodge Dual of C, Dark Matter Energy D defined as a Combination of S and the Hodge Dual of S, Similar Definitions for V/Z and T/R

The Ricci decomposition is a way of breaking up the Riemann curvature tensor into three orthogonal tensors, Z, Weyl tensor C and S, S tensor generates the dark matter gravity

$$R_{ijkl} = Zi_{jkl} + C_{ijkl} + S_{ijkl}$$

$$S_{ijkl} = \frac{1}{12} R(\mathrm{g}_{il}\mathrm{g}_{jk} - \mathrm{g}_{ik}\mathrm{g}_{jl})$$

$$Y_{jk} = R_{jk} - \frac{1}{4} Rg_{jk}, Z_{ijkl} = \frac{1}{2}(Y_{il}\,\mathrm{g}_{jk} - Y_{jl}\,\mathrm{g}_{ik} - Y_{ik} g_{il} + Y_{jk} g_{il})$$

Where R_{abcd} is the Riemann tensor, R_{ab} is the Ricci tensor, R is the Ricci scalar (the scalar curvature)

The conformal energy tensor U can be defined as a combination of C and the Hodge dual of C [2]

$$U_{abcd} = 1/8\pi(C_{amcd}C^m_{bcd} + C_{amcd}C^m_{bcd} + C_{abcn}C^n_{abd} + C_{abcn}C^n_{abd})$$

The new dark matter energy tensor D can be defined as a combination of S and the Hodge dual of S

$$D_{abcd} = 1/8\pi(\mathrm{S}_{amcd}\mathrm{S}^m_{bcd} + \mathrm{S}_{amcd}\mathrm{S}^m_{bcd} + S_{abcn}S^n_{abd} + \mathrm{S}_{abcn}\mathrm{S}^n_{abd})$$

The new energy tensor V can be defined as a combination of Z and the Hodge dual of Z

$$V_{abcd} = 1/8\pi(\mathrm{Z}_{amcd}\mathrm{Z}^m_{bcd} + \mathrm{Z}_{amcd}\mathrm{Z}^m_{bcd} + Z_{abcn}Z^n_{abd} + \mathrm{Z}_{abcn}\mathrm{Z}^n_{abd})$$

The new Total Energy tensor T can be defined as a combination of the Riemann tensor R and the Hodge dual of R

$$T_{abcd} = 1/8\pi(\mathrm{R}_{amcd} R^{m}_{bcd} + \mathrm{R}_{amcd}\mathrm{R}^{m}_{bcd} + R_{abcn}R^{n}_{abd} + \mathrm{R}_{abcn}\mathrm{R}^{n}_{abd})$$

Hodge Dual Definitions

The Hodge dual definition for Electromagnetic tensor and Weyl tensor [3]

$$F_{ab} = \frac{1}{2}\varepsilon_{ab\ln}F^{\ln}$$

$$\mathrm{C}_{abcd} = \frac{1}{2}\varepsilon_{ab\ln}C^{\ln}_{cd}$$

The Hodge dual definition for dark matter S tensor, Z and R tensors

$$S_{abcd} = \frac{1}{2}\varepsilon_{ab\ln}S^{\ln}_{cd}, Z_{abcd} = \frac{1}{2}\varepsilon_{ab\ln}Z^{\ln}_{cd}, R_{abcd} = \frac{1}{2}\varepsilon_{ab\ln}R^{\ln}_{cd}$$

Weyl tensor C(4,0) is related to the new Conformal Energy tensor U(4,0). Dark matter tensor S(4,0) is related to the new dark matter energy tensor D(4,0). Z(4,0) tensor is related to the new energy tensor V(4,0). Riemann ten-sor R(4,0) is related to the new Total Energy tensor T(4,0).

Complete General Relativity Field Equations

The complete field equations are described by a new T(4,0) tensor for Total Energy, the new conformal energy tensor U(4,0), the new energy tensor V(4,0) and the new dark matter energy tensor D(4,0)

$$Z_{ab} - \frac{1}{2}Zg_{ab} + \Lambda_Z g_{ab} = -k_z V_{ab}$$

$$C_{ab} - \frac{1}{2}Cg_{ab} + \Lambda_c g_{ab} = -k_c U_{ab}$$

$$S_{ab} - \frac{1}{2}Sg_{ab} + \Lambda_s g_{ab} = -k_s D_{ab}$$

$$R = Z + C + S$$

$$\kappa T = k_z V + k_c U + k_s D$$

$$\Lambda = \Lambda_z + \Lambda_c + \Lambda_s$$

$$\kappa T_{abcd} = k_z V_{abcd} + k_c U_{abcd} + k_s D_{abcd}$$

In the general theory of relativity the Einstein field equations relate the geometry of space-time to the distribution of matter [4].

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + \Lambda g_{\mu\nu} = -\kappa T_{\mu\nu}$$

REFERENCES

1. Tipler JF. The Physics of Immortality. Doubleday. New York,1994.
2. Lapuerta DJ. On the conformal energy tensor dened as a combination of Weyl tensor and the Hodge dual of Weyl tensor. Relativity and Cosmology. 2012.
3. Chapter in book by Penrose R, pg. 572 in The road to reality, Jonathan Cape (2004).
4. Chapter in book by Einstein A, pg. 175 in The meaning of relativity, Planeta - De Agostini, Barcelona 1985.