

# Analysis of the four dimensional sphere being metric of Einstein's equation

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## ABSTRACT

We evaluate Einstein's equation with metric being a four dimensional sphere.

## INTRODUCTION

We depart from Einstein's equation with metric being a four dimensional sphere., i.e.,

$$x = \cos\varphi\cos\psi\cos\vartheta, \tag{1a}$$

$$y = \cos\varphi\cos\psi\sin\vartheta, \tag{1b}$$

$$z = \cos\varphi\sin\psi, \tag{1c}$$

$$ct = \sin\varphi. \tag{1d}$$

Einstein's equation is discussing a four-dimensional relativistic field. From mechanics and electrodynamics we know that equations that are describing reality are containing two dimensional derivations of a physical, like, f.e., the mechanical force is  $F = m\ddot{x}$ .

We are going to develop a proposition regarding the content of Einstein's equation, specialized on the metric that is a four dimensional sphere.

First of all the evaluated metric seems to lead to a vary new solutions. The solutions are quantized. It appears that such quantized solutions are inherited from Einstein's equation.

From now on we are using the term metric, being the four-dimensional sphere. We depart from Einstein's equation, i.e.,  $G_{\mu\nu} = 8\pi T_{\mu\nu}$ .  $\tag{2}$

In [1] we discussed solutions of  $T_{\mu\nu}$  being the derivation of an electromagnetic field and moreover the thermodynamical energy.

Later on our goal is the discussion of a massive quadropole. The solution of those equations are the energy of photons, gravitons and that temperature is carried by gravitons.

The last fact is a result by  $T_{\mu\nu}$  the derivation of temperature, with respect to the entropy [1] and moreover the displacements of mass showing here. The ladder is easy to interpret: Mass that is becoming a quadropole has here the solution identified as the graviton.

Photons, gravitons, E, T,  $\omega$   $m_{xy}$  are quantized where  $m_{xy}$  is a massive Quadropole.

Einstein's equation is the result of a derivative of a matrix that describes the geometrical space and the derivative of some term describing mass or energy.

Our results are expressing the economic principle, that any system that is able to follow a geodesic is expressing nature.

## The evaluation of the energy-stress of a quadropole

We are compressing mass of some particle or particles, f.e., so the body looks like two ellipses in directions x and y. Being more precise,  $\delta m_x = m_x - m_{x0} = 1$   $\delta m_y = m_y - m_{y0} = 1$  Using Pythagoras' theorem, we observe that:

$$\frac{\delta^2 m_x}{\delta x^2} + \frac{\delta^2 m_y}{\delta y^2} = \frac{\delta^2 m_{xy}}{\delta x \delta y} \tag{3}$$

and this results in

$$\left(\frac{1}{2}\right)^2 \frac{kg}{m^2} + \left(\frac{1}{2}\right)^2 \frac{kg}{m^2} = \frac{1}{2} \frac{kg}{m^2} \tag{4}$$

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**Evaluating the massive quadropole in Einstein’s equation**

Einstein’s equation of a quadropole is yielding:

$$G_{\mu\nu} = 8rT_{\mu\nu} = 8r(\delta^2_{mxy} + \delta^2_{mzx})c^2 = 8\pi \cdot 2 \left(\frac{1}{2}\right) c^2 \tag{5}$$

We receive:

$$2 \frac{\hbar}{r^2} n = 8\pi m_l c^2 \tag{6}$$

We have introduced natural numbers, i.e.,  $n, m_l = 2\delta^2_{mxy}$ . As an example we choose a system of atoms of radius  $r = 1 \cdot 10^{-10}m$  and  $c = 3 \cdot 10^{10}m/s$ . By inserting those numbers into (5) we receive:

$$\hbar n = 8r \cdot 9m_l \tag{7}$$

with  $n = 1,2,3 \dots$  is number of gravitons and  $m_{l=1,2,3\dots}$  is the number of Dirac Fermions carrying mass. (7) is showing several problems.

First of all the L.H.S. is interpreted as the product of spin and the number of Dirac Fermions, whereas the r.h.s. is some quantity interpreted as gravitons, since of  $8r$ . Moreover the factor 9 cannot be interpreted. It is perturbing an interpretation.

Thus, we decide to look at the equation if we use natural units, i.e.,  $\hbar = c = 1$ . We depart from (6). This is leading to:

$$2 \cdot \frac{n}{r^2} = 8\pi m_l \tag{8}$$

With  $r^2 = 1 \cdot 10^{-20} m^2$  and some rearrangement, we arrive at:

$$m_l = \left(\frac{1}{2}\right) k_B \cdot n, \quad k_B = \frac{1}{8\pi \cdot 10^{-20} m^2} \tag{9}$$

where  $k_B$  is the Boltzmann constant which is proposed being depending on the system. In [1] we have discovered, that

We make the discovery that  $n$  can be identified as the entropy of the system, i.e.,

$$S = n \cdot 8r \cdot 10^{-20} m^2 \tag{10}$$

Thus the entropy of a quadropole of a massive particle is interpreted as the surface of a fourdimensional sphere. This is remarkable, by computing the Einstein equation of quadropoles of a massive body we receive its entropy as the surface of the object.

This is interesting, since the Black Hole entropy is believed to be the event horizon of its volume. Furthermore (10) is showing that entropy and temperature are quantized.

**Our proposal on black holes and dark matter**

The formula of entropy by Bekenstein and Hawking is given by

$$S = \frac{k_B A}{4l_p}, l_p \sqrt{G\hbar/c^3} \tag{11}$$

From [1] we know that:

$$dF = d(U - TS) = \hbar d\omega + k_B T - p dV \tag{12}$$

Where we added for our purpose the last term on the r.h.s.

A Black Hole is called black, since it totally is absorbing light. Regarding (12) we need to set  $d\omega = 0$ . It follows:

$$dF = k_B T - p dV \tag{13}$$

We now look for the equilibrium, e.g.,  $dF = 0$ . This results to

$$k_B T = p dV. \tag{14}$$

We remind the reader that here

$$k_B = \frac{1}{8\pi \cdot 10^{-20} m^2} \tag{15}$$

Thus pressure is of a factor  $10^{20}$ . This pressure is made of gravitons revealed by (14).

Recall, we propose that  $k_B$  is system depending. We observe that a black body, possibly a Black Hole can grow all the time, and will always be in equilibrium. This is a very interesting result.

Dark Matter is a riddle, since there’s a discrepancy between objects that are emitting and absorbing light and matter that is absorbing and emitting gravitons. That’s the theory. We propose something different. But first a mathematical analysis. We depart setting  $dF = 0$  and we arrive at

$$\hbar\omega + k_B T = p dV \tag{16}$$

We observe that in equilibrium the volume of the system is growing by pressure that is build on the system by photons and gravitons. Our result is revealing that Dark Matter is a natural system, that is emitting gravitons and is emitting photons. Why 85% of Dark Matter is made of mass that is emitting and absorbing gravitons is still a riddle.

**Proposition**

Einstein’s equation is revealing fermions that are able to emit and absorb gravitons as well as photons in the same system. It appears, that Black Holes and Dark Matter are showing extensions of their volume, even in equilibrium, i.e.,  $dF = 0$ .

**DISCUSSION**

The used metric is revealing many solutions, that already known.

Without quantum equations we find natural solutions that are quantized. Moreover we found a deeper truth for the cause of temperature. We have used our metric and  $8rT_{\mu\nu}$  being the derivative of temperature, and by interpreting the geometrical spin  $2 [1] \cdot 4\pi$  of a graviton, and which is known to be 2. Moreover we found that the Boltzmann constant depends on the system.

Here we proposed that Einstein’s equation has other solutions than yet known. A quadropole of mass is leading to gravitons that are also lead to the known phenomenon discovered by Bekenstein and Hawking, which is proposing that entropy of Black Holes is basically the surface of the Black Hole, that known as the event horizon.

The same formula can be used to propose that Einstein’s equation is able to combine photons and gravitons to be originated from the same particle, which is true, since fermions have mass and carry charge

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