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Nature Of Space-Time

Determining the nature of space-time and extrapolate the possibilities into String Theory

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Abstract: This study has been undertaken to investigate the possibilities of the nature of Space-time fabric . Following Einstein's Field equations in general relativity(1905) which marvelously described the way space-time behaves along with the concept of curvature and gravity. The following paper attempts to understand the cosmological nature of space-time and how it is distributed throughout which gives out and interesting revelation about the point of uniting "gravity" with one of the most successful theories in Modern Physics i.e String Theory .

***Index Terms* - Einstein Field equations,String theory,Beta-Strings,Stress tensor,Black holes,Mass**

I. INTRODUCTION

Briefly the known facts are first presented which will be further required for this paper:

1) **The space-time is completely defined by Einstein's Field equations.**
2) **Space-time is curved and gives definition somewhat to that of mass and explains the nature of gravity and gravitational waves.**
3) **The gravitational waves travel through space time in a progressing manner .**
4) **The curvature of the space-time is dependent on the mass of the object in space.**

The above facts explains most of the doubts we have regarding space-time and builds a picture of how the entire outer space can be represented in the curved Space-time.This pictorial representation, on the other hand leaves us with a question about how the original space-time is? How do we visualize the properties and extend them to the masses associated with it .

Now this question seems to pose an answer with manifold explanations. However, a most important theory comes into play while trying to find an possible answer to the question i.e. String theory.The idea behind this theory is simply the fact that all the fundamental particles are made out of nothing but vibrating strings and the frequency of these vibrations give rise to these different particles.However ,the question is Should we limit String theory to justify the nature of particles ?.For a moment if we consider the theory to be flexible then we could have a possible explanation of the "nature" of space-time.

II. PROPOSALS

Significant scaling of the space-time may be used as an assumption for explaining that space-time is itself made out of strings .
The nature of strings are highly different than the ones responsible for the existence of particles. In fact this may correspond to a new classification of strings,let it be Beta-string(β-String).The nature of these strings are described as under:

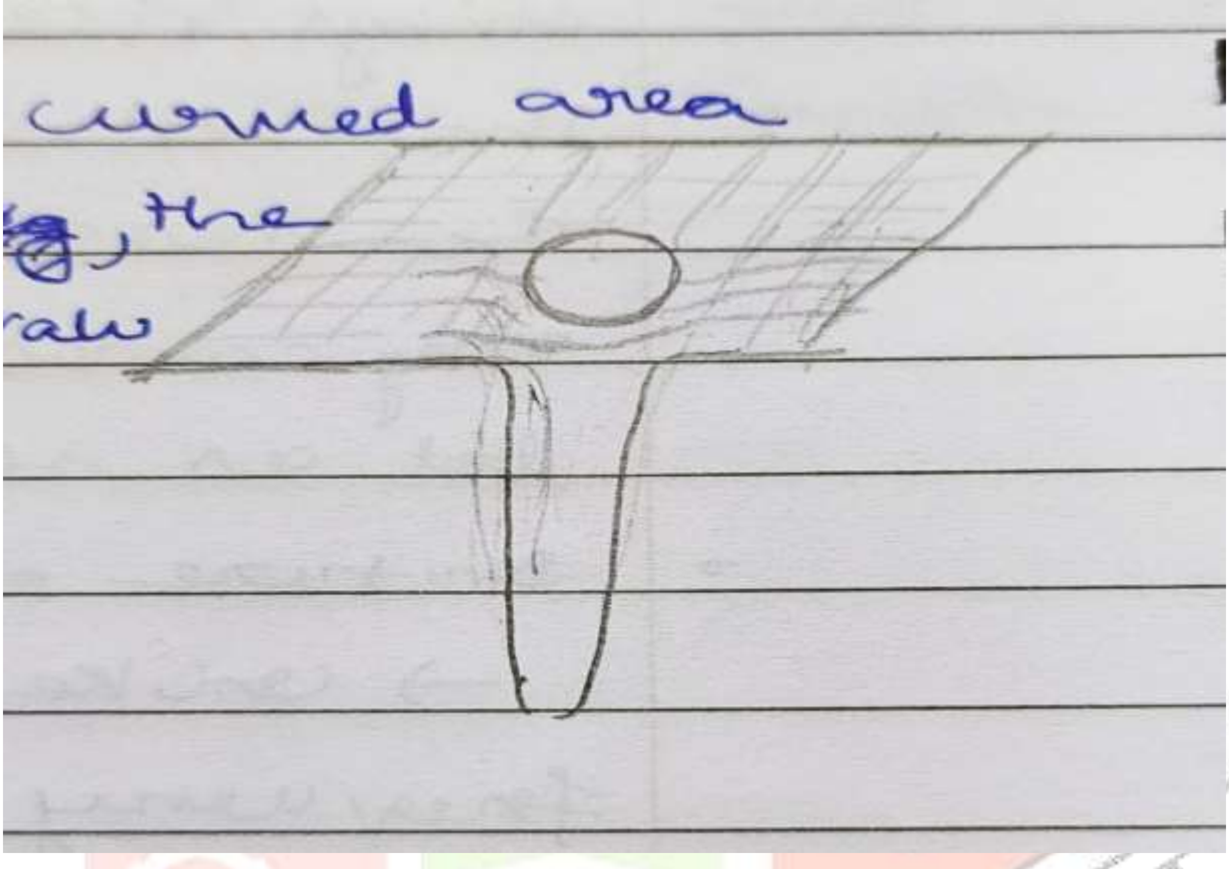
a) Unlike the other strings vibrating at a particular frequency to produce a particle ,these strings do not or should not contain any vibrations.
b) β-String does not form any loop rather they are more like a thread connected to one another .
c) On interactions with an object the bending of space-time ,these strings experience a "stress" which are itself on a very small scale or microscopic level.
d) This force or"stress" force ,if I may use, when collaborated for all the strings under consideration and involved in the area of curvature results in an amount of force that is conceivable and thus what we define as the "mass" of the system.

These above ideas form the basis of the paper which may now be utilized to explain the behavior of masses and their interactions with the field of gravity and Space-time as well.

III. CALCULATIONS AND EQUATIONS

Let us consider rather heavy mass objects like a black hole for instance which causes a huge curve or bend int the space time and which further increases depending on the gain of mass by the black hole.

For reference let us consider an image



Let the Stress tensor be given by Y_{ab} (where a and b are the dimensions of space-time) for each string.

For a group of strings under the curved area of the mass eg a black hole the force experienced by them can be evaluated as

$$F_{(beta)} = P \lim(r \to 0) \sum_{r=R}^{0} (Yab / 4\pi r * r)$$

Where r is the radius of curvature

R= Schwarzchild radius

P=Some Cosmological constant.

Now as the radius of the black hole decrease , the gravitational pull becomes severe over the radiation pressure and as it continues to collapse,the mass further increases and it further collapses cumulatively i.e.

$$\mathbf{F_{(beta)} \to infinite\ as\ r \to 0}$$

Which means as the black hole becomes heavier and heavier the force on the β-strings increases and as they tend to infinite to curve the space time infinitely for huge masses .

Constant "P" involves all the cosmological factors that may effect the stretching of the field(space-time) and the Beta-strings .

Those factors include gravitational waves from the other adjacent or surrounding bodies which have caused a curvature in space nearby and hence is responsible for an extra amount of stress on the strings thereby modifying the stress tensor by a factor P.

Thus the original values and the calculated values of F_{beta} can be defined as :

$$|F_{(beta)(calc)} \sim F_{(beta)(actual)}| = f(P,x)$$

Where x is the distance between two bodies involved in space-time.

IV. ENERGY CALCULATIONS

Having covered the equations and the force associated with these strings it is of utmost importance to calculate the energy associated with these Beta-strings. We know,

$$F_{(beta)} = -\nabla U(beta)$$

Or, $U_{(beta)} = -\int_{R}^{0} F(beta)\,dr$

Where

$$\mathbf{F_{(beta)}} = \mathbf{P}\ \lim(r \to 0) \sum_{r=R}^{0} (Yab/4\pi r * r)$$

An important thing to notice is the fact Y_{ab} is actually equal to $Y_{ab} = Y^* g_{ab}$,

where g_{ab} is the Metric Tensor in Einstein field equation .

And Y is the stress vector for a Beta-string .

This particular amount of energy stored gives us an idea about the gravitational waves which may be considered as the manifestation of this energy $U_{(beta)}$ and also follows the conservation of energy principle.

So at last expressing the Force tensor for beta strings for any masses and not only black holes we can write:

$$\mathbf{F_{(beta)}} = \mathbf{P}\ \lim(r \to \sigma) \sum_{r=0}^{Rm} (Yab/S)$$

where S=surface area of the projection of the mass on curved space-time.

r=radius of curvature.

$\sigma = R_m$ generally(except for Black Holes)

Hence from the above explanations and equations which supports the Einstein field equations and the nature of Black Holes along with the gravitational waves thereby giving us the impression that an explanation on this basis can be one of the possible options to explore the nature of Space-time.

V. CONCLUSION

It can be successfully concluded that the essential question of Nature of space-time has been given a solution which further opens up to the new questions and experimental observations to be verified .This nature has also been able to provide a link for uniting String theory with General relativity and in turn Gravity thereby giving a answer to one of the most challenging tasks of the last and present decade .it promises future implications regarding in detailed study and further observations regarding this topic thereby opening up new scopes to develop further working models or simulations to verify the above theory .

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