The metric of parallel universe

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Abstract

In this paper, I vividly illustrated how to obtain an equation to describe a parallel universe with our universe parameters such as velocity, speed of light, scale factor, and so forth. I did this work by theoretical methods. Moreover, I used the Robertson-Walker metric and metric definition to achieve an equation that is the metric for a parallel universe. I assumed three hypotheses for this scientific project.

1 Introduction

The theory of relativity successfully explains The universe in late-time expansion with the four dimensions that Robertson- walker metric truly elucidates. In the first place, Minkowski geometrize the theory of relativity and defined the time dimension. Also, he used differential geometry and utilized a metric that described a universe with four dimensions it had three spatial dimensions, and one dimension of time. In this paper, I used the theory of relativity structure, and three hypotheses to describe a parallel universe. Furthermore, we can analyze a parallel universe with data from our universe. I mean, we can calculate the expansion rate and acceleration of another universe with ours.

2 The first hypothesis

I assume that all the parallel universes have been started in the same point. I mean, all the universes have been mixed to gather, and the started point and endpoint are the same. There is a possibility that we can see these parallel universes by going to black holes.

3 The second hypothesis

The speed of light is constant and equal in all parallel universes.

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4 The third hypothesis

Elapsing time is the same for all the universes Hence, we can write the following equation for two universes:

$$c^2 dt^2 = \gamma^2 ds_2^2 + \eta^2 ds_1^2 \tag{1}$$

γ, η could be functions of time and space, and ds_1^2 is the metric of our universe that we can describe with Robertson- Walker metric and ds_2^2 is a parallel universe. The metric is as follows:

$$ds_1^2 = c^2 dt^2 - \alpha^2 d\Sigma^2 \tag{2}$$

5 Mathematical Method application to obtain the metric of a parallel universe

Based equation (1) and (2) we can write down :

$$\begin{aligned}
&c = dt\sqrt{(\gamma^2 \tfrac{ds_2^2}{dt^2} + \eta^2 \tfrac{ds_1^2}{dt^2})} \\
&cdt = dt\sqrt{(\gamma^2 \tfrac{ds_2^2}{dt^2} + \eta^2 \tfrac{ds_1^2}{dt^2})} \\
&ds_1^2 = c^2 dt^2 - \alpha^2 d\Sigma^2 \\
&\tfrac{ds_1^2}{dt^2} = c^2 - \alpha^2 \tfrac{d\Sigma^2}{dt^2} \\
&cdt = dt\sqrt{(\gamma^2 \tfrac{ds_2^2}{dt^2} + c^2\eta^2 - \eta^2\alpha^2 \tfrac{d\Sigma^2}{dt^2})} \\
&cdt = dt\sqrt{(\gamma^2 \tfrac{ds_2^2}{dt^2} + \eta^2 c^2(1 - \alpha^2 \tfrac{d\Sigma^2}{c^2 dt^2}))} \\
&cdt = dt\sqrt{(\gamma^2 \tfrac{ds_2^2}{dt^2} + \eta^2 c^2(1 - \tfrac{\alpha^2 V_\Sigma^2}{c^2}))} \\
&c^2 = (\gamma^2 \tfrac{ds_2^2}{dt^2} + \eta^2 c^2(1 - \tfrac{\alpha^2 V_\Sigma^2}{c^2}))
\end{aligned} \tag{3}$$

Then, we divide c^2;thus,the equation is as follows:

$$1 = (\gamma^2 \frac{ds_2^2}{c^2 dt^2} + \eta^2(1 - \frac{\alpha^2 V_\Sigma^2}{c^2})) \to ds_2^2 = \frac{\eta^2}{\gamma^2 c^2}(1 - \frac{\alpha^2 V_\Sigma^2}{c^2})dt^2 \tag{4}$$

Based equation (1):

$$\gamma^2 = c^2 \frac{dt^2}{ds_2^2} - \eta^2 \frac{ds_1^2}{ds_2^2} \tag{5}$$

I apply (4)in (5); thus, we have:

$$\begin{array}{l}
\gamma^2 = c^2(\frac{\gamma^2 c^2}{\eta^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2})}) - \eta^2 \frac{ds_1^2}{ds_2^2} \\
\gamma^2(1 - \frac{c^4}{\eta^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2})}) = -\eta^2 \frac{ds_1^2}{ds_2^2} \\
c^2dt^2 = \gamma^2 ds_2^2 + \eta^2 ds_1^2 \rightarrow ds_2^2 = \frac{c^2dt^2 - \eta^2 ds_1^2}{\gamma^2} \\
\frac{ds_1^2}{ds_2^2} = \vartheta^2 \rightarrow \vartheta^2 = \frac{c^2dt^2 - \alpha^2 d\Sigma^2}{\frac{c^2dt^2-\eta^2 ds_1^2}{\gamma^2}} \rightarrow \vartheta^2 = \frac{\gamma^2 c^2 dt^2 - \gamma^2\alpha^2 d\Sigma^2}{(1-\eta^2)c^2dt^2 + \eta^2\alpha^2 d\Sigma^2} \\
\gamma^2(1 - \frac{c^4}{\eta^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2})}) = -\eta^2 \frac{\gamma^2 c^2 dt^2 - \gamma^2\alpha^2 d\Sigma^2}{(1-\eta^2)c^2dt^2 + \eta^2\alpha^2 d\Sigma^2} \\
(1 - \frac{c^4}{\eta^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2})}) = -\eta^2 \frac{c^2 dt^2 - \alpha^2 d\Sigma^2}{(1-\eta^2)c^2dt^2 + \eta^2\alpha^2 d\Sigma^2} \\
(1 - \frac{c^4}{\eta^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2})}) = -\eta^2 \frac{c^2 dt^2 - \alpha^2 d\Sigma^2}{(1-\eta^2)c^2dt^2 + \eta^2\alpha^2 d\Sigma^2} \rightarrow \frac{c^4(1-\eta^2)c^2dt^2}{(1-\frac{\alpha^2 V_\Sigma^2}{c^2})} = \eta^2 c^2 dt^2 + \alpha^2 d\Sigma^2
\end{array} \tag{6}$$

We divide dt^2

$$\frac{(1-\eta^2)c^6}{(1-\frac{\alpha^2 V_\Sigma^2}{c^2})} = \eta^2 c^2 + \alpha^2 V_\Sigma^2 \tag{7}$$

$$\begin{array}{l}
(1-\frac{\alpha^2 V_\Sigma^2}{c^2})\eta^2 c^2 + \alpha^2 V_\Sigma^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2}) = c^6 - \eta^2 c^6 \\
(1-\frac{\alpha^2 V_\Sigma^2}{c^2})\eta^2 c^2 + \eta^2 c^6 = c^6 - \alpha^2 V_\Sigma^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2}) \\
\eta^2((1-\frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6) = c^6 - \alpha^2 V_\Sigma^2(1-\frac{\alpha^2 V_\Sigma^2}{c^2}) \\
\eta^2 = \frac{c^6 - \alpha^2 V_\Sigma^2 + \frac{\alpha^4 V_\Sigma^4}{c^2}}{(1-\frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6}
\end{array} \tag{8}$$

Now we come back to the equation (1)

$$c^2dt^2 = \gamma^2 ds_2^2 + \eta^2 ds_1^2 = \gamma^2 ds_2^2 + (\frac{c^6 - \alpha^2 V_\Sigma^2 + \frac{\alpha^4 V_\Sigma^4}{c^2}}{(1-\frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6})(c^2dt^2 - \alpha^2 d\Sigma^2) \tag{9}$$

The metric of equation (1) is as follows:

$$\tilde{g}(X) = \begin{pmatrix} \gamma^2 & 0 \\ 0 & \eta^2 \end{pmatrix} \tag{10}$$

Based the general theory of relativity, there is an equation for determinant of the metric that is as follows:

$$\begin{array}{l}
\nabla_0(\sqrt{-\tilde{g}}) = 0 \\
\nabla_0(\sqrt{-\gamma^2\eta^2}) = 0 \\
\frac{-\gamma\dot{\gamma}\eta^2 - \eta\dot{\eta}\gamma^2}{\sqrt{-\gamma^2\eta^2}} = 0 \\
\gamma\dot{\gamma}\eta^2 + \eta\dot{\eta}\gamma^2 = 0 \\
\gamma d\gamma\eta^2 + \eta d\eta\gamma^2 = 0 \\
\frac{1}{\gamma}d\gamma + \frac{1}{\eta}d\eta = 0 \\
\ln\gamma = -\ln\eta \rightarrow \gamma \equiv \frac{1}{\eta}
\end{array} \tag{11}$$

Now we have all the coefficients in(1).

$$c^2dt^2 = \frac{(1-\frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6}{c^6 - \alpha^2 V_\Sigma^2 + \frac{\alpha^4 V_\Sigma^4}{c^2}} ds_2^2 + (\frac{c^6 - \alpha^2 V_\Sigma^2 + \frac{\alpha^4 V_\Sigma^4}{c^2}}{(1-\frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6})(c^2dt^2 - \alpha^2 d\Sigma^2) \tag{12}$$

Finally, we can describe the metric of a parallel universe with the Robertson-Walker metric :

$$ds_2^2 = (\frac{c^6 - \alpha^2 V_\Sigma^2 + \frac{\alpha^4 V_\Sigma^4}{c^2}}{(1 - \frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6})c^2 dt^2 - (\frac{c^6 - \alpha^2 V_\Sigma^2 + \frac{\alpha^4 V_\Sigma^4}{c^2}}{(1 - \frac{\alpha^2 V_\Sigma^2}{c^2})c^2 + c^6})^2 (c^2 dt^2 - \alpha^2 d\Sigma^2) \tag{13}$$

6 Conclusion

As we understood there is a weird relationship between our universe and the parallel universe. By using equation (13) into the Einstein field equation:

$$G_{\mu\upsilon} + \Lambda g_{\mu\upsilon} = \frac{8\pi G}{c^4} T_{\mu\upsilon} \tag{14}$$

We can calculate the acceleration and Hubble parameter of the parallel universe. Moreover, we can calculate the Friedmann equations in the new universe.

References

[1] Professor Steven Weinberg,Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity, *John Wiley & Sons, Inc.* 1 edition (July 1972),ISBN-13: 978-0471925675