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Super Accelerated Motion in Rindler Spacetime

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Abstract: *In the general relativity theory, we discover formulas that the super accelerated matter moves with the acceleration* a_0 *about Rindler space-time. We can represent the super accelerated motion about coordinates* x, ct, ξ^0. *PACS Number:04,04.90.+e*

Keywords: *General relativity theory, Super accelerated motion, Rindler spacetime*

1. Introduction

In the general relativity theory, we discover formulas that the super accelerated matter moves with the acceleration a_0, about Rindler space-time.

At first, Rindler coordinate is

$$ct = \left(\frac{c^2}{a_0} + \xi^1\right)\sinh\left(\frac{a_0\xi^0}{c}\right) \tag{1}$$

$$x = \left(\frac{c^2}{a_0} + \xi^1\right)\cosh\left(\frac{a_0\xi^0}{c}\right) - \frac{c^2}{a_0} \tag{2}$$

$$y = \xi^2, z = \xi^3 \tag{3}$$

In Eq (1),

$$\xi^1 + \frac{c^2}{a_0} = \frac{ct}{\sinh\left(\frac{a_0\xi^0}{c}\right)} \tag{4}$$

If we insert Eq(4) in Eq(2),

$$x = ct\coth\left(\frac{a_0\xi^0}{c}\right) - \frac{c^2}{a_0} \tag{5}$$

If we insert Eq(5) in Eq(2),

$$ct\coth\left(\frac{a_0\xi^0}{c}\right) = \left(\frac{c^2}{a_0} + \xi^1\right)\cosh\left(\frac{a_0\xi^0}{c}\right) \tag{6}$$

Hence, the result is

$$\xi^1 = \frac{ct}{\sinh\left(\frac{a_0\xi^0}{c}\right)} - \frac{c^2}{a_0} \tag{7}$$

2. The Super Accelerated Motion about an Uniformly Accelerated Frame

$$d\tau^2 = (1+\frac{a_0\xi^1}{c^2})^2(d\xi^0)^2 - \frac{1}{c^2}[(d\xi^1)^2+(d\xi^2)^2+(d\xi^3)^2] \quad (8)$$

Hence, if the super accelerated matter moves with the acceleration $a_0{}'$ about an uniformly accelerated frame,

$$a_0{}' = \frac{d}{d\xi^0}\left[\frac{(\frac{d\xi^1}{d\xi^0})}{\sqrt{(1+\frac{a_0\xi^1}{c^2})^2 - (\frac{d\xi^1}{d\xi^0})^2/c^2}}\right] \quad (9)$$

If we compute,

$$(a_0{}'\xi^0)^2 = \frac{(\frac{d\xi^1}{d\xi^0})^2}{(1+\frac{a_0\xi^1}{c^2})^2 - (\frac{d\xi^1}{d\xi^0})^2/c^2} \quad (10)$$

Then,

$$(\frac{d\xi^1}{d\xi^0})^2 = (a_0{}'\xi^0)^2[(1+\frac{a_0\xi^1}{c^2})^2 - (\frac{d\xi^1}{d\xi^0})^2/c^2] \quad (11)$$

If we compute about $\frac{d\xi^1}{d\xi^0}$,

$$\frac{d\xi^1}{d\xi^0} = \frac{a_0{}'\xi^0(1+\frac{a_0\xi^1}{c^2})}{\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}}} \quad (12)$$

In Eq(12), if we multiply $\frac{d\xi^0}{(1+\frac{a_0\xi^1}{c^2})}$,

$$\frac{d\xi^1}{1+\frac{a_0\xi^1}{c^2}} = \frac{a_0{}'\xi^0 d\xi^0}{\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}}} \quad (13)$$

If we integrate Eq(13),

$$\frac{c^2}{a_0}\ln\left|1+\frac{a_0\xi^1}{c^2}\right| = \frac{c^2}{a_0{}'}(\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}} - 1) \quad (14)$$

Hence, if we compute about the coordinate ξ^1, we can represent the super accelerated motion by

Rindler coordinates ξ^1, ξ^0.

$$\xi^1 = \frac{c^2}{a_0}[\exp\frac{a_0}{a_0{}'}(\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}} - 1) - 1] \quad (15)$$

If we insert Eq(7) in Eq(15),

$$\xi^1 = \frac{c^2}{a_0}[\exp\frac{a_0}{a_0{}'}(\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}}-1)-1] = \frac{ct}{\sinh(\frac{a_0\xi^0}{c})} - \frac{c^2}{a_0} \tag{16}$$

Hence, we can represent the super accelerated motion about coordinates ct, ξ^0.

$$ct = \frac{c^2}{a_0}\exp\frac{a_0}{a_0{}'}(\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}}-1)\sinh(\frac{a_0\xi^0}{c}) \tag{17}$$

If we insert Eq(17) in Eq(5), we can represent the super accelerated motion about coordinates x, ξ^0.

$$x = ct\coth(\frac{a_0\xi^0}{c}) - \frac{c^2}{a_0} = \frac{c^2}{a_0}\exp\frac{a_0}{a_0{}'}(\sqrt{1+\frac{(a_0{}'\xi^0)^2}{c^2}}-1)\cosh(\frac{a_0\xi^0}{c}) - \frac{c^2}{a_0} \tag{18}$$

3. Conclusion

In the general relativity theory, we discover formulas that the super accelerated matter moves with the acceleration in an uniformly accelerated frame.

Reference

[1] S.Weinberg, Gravitation and Cosmology (John wiley & Sons,Inc,1972)

[2] P.Bergman, Introduction to the Theory of Relativity (Dover Pub. Co.,Inc., New York,1976),Chapter V

[3] C.Misner, K,Thorne and J. Wheeler, Gravitation(W.H.Freedman & Co.,1973)

[4] S.Hawking and G. Ellis,The Large Scale Structure of Space-Time(Cam-bridge University Press,1973)

[5] R.Adler, M.Bazin and M.Schiffer, Introduction to General Relativity(McGraw-Hill,Inc.,1965)

[6] M.Schwarzschild, Structure and Evolution of the Stars (Princeton University Press,1958; reprint, Dover, N.Y.1965), chapter II

[7] S.Chandrasekhar, Mon,Not.Roy.Astron.Soc.95.207(1935)

[8] C.Rhoades," Investigations in the Physics of Neutron Stars", doctoral dissertation, Princeton University

[9] J.Oppenheimer and H.Snyder, phys.Rev.56,455(1939)

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