VOL. 3, NO. 7, July 2013 ISSN 2225-7217
ARPN Journal of Science and Technology

http://www.ejournalofscience.org

Collapsing of Moving Mass to Singularity before Attaining the Velocity of Light

[1] M. Kumar, [2] S. Sahoo
Department of Physics, National Institute of Technology, Durgapur – 713209, West Bengal, India

[1] manishphmath@gmail.com, [2] sukadevsahoo@yahoo.com

ABSTRACT

It has not been predicted till now why a moving mass cannot attain the velocity of light. According to my view a moving mass may collapse to singularity just before attaining the velocity of light. Considering the moving mass as spherically symmetric and possessing spin at very high velocity, its size may contract up to Schwarzschild radius for its moving mass and can be considered to be collapsed to singularity i.e. it can be defined only through its mass, angular momentum and charge.

Keywords: *Einstein's field equation, Schwarzschild solution, Gravity*

1. INTRODUCTION

Till now it has not been predicted, why a moving mass cannot attain the velocity of light. Considering the moving mass as spherically symmetric and possessing spin at very high velocity, its size may contract up to Schwarzschild radius for its moving mass and can be considered to be collapsed to singularity i.e. it can be defined only through its mass, charge and angular momentum. There is possibility that the size of the moving body may reduce to the Schwarzschild radius and mass of the moving body may increase to such extent that it becomes black hole. The value of v^2/c^2 so obtained can be used in the Schwarzschild solution of Einstein's field equations for centrally symmetric metric [1]. The angular momentum of the moving mass collapsed into singularity can be calculated using the formula

$$l = M \mathrm{v} \mathrm{R}_{\mathrm{m}}, \qquad (1)$$

where $l, M, \mathrm{v}, \mathrm{R}_{\mathrm{m}}$ are angular momentum, mass, velocity and radius of the moving mass collapsed into singularity respectively. The density of the moving mass when collapsed to singularity can be calculated as

$$\rho = \frac{M}{(4/3)\pi R_m^3}. \qquad (2)$$

The angular momentum and the density of the moving mass collapsed to singularity can be calculated using equations (1) and (2) respectively.

2. COLLAPSING OF MOVING MASS TO SINGULARITY AND COMPARISON WITH SCHWARZSCHILD SOLUTION OF EINSTEIN'S FIELD EQUATIONS

According to special theory of relativity there is length contraction and increment in mass when a massive body moves with velocity v [2]. The relationship between moving length and rest length and moving mass and rest mass can be written as [2]:

$$L = L_0\sqrt{1-\frac{\mathrm{v}^2}{c^2}}, \qquad (3)$$

$$M = \frac{M_0}{\sqrt{1-\frac{\mathrm{v}^2}{c^2}}}, \qquad (4)$$

where L and L_0 are moving length and rest length of the body and M and M_0 are moving mass and rest mass of the body respectively.

Considering the moving mass as spherically symmetric and possessing spin at very high velocity, its size may contract up to Schwarzschild radius for its moving mass and can be considered to be collapsed to singularity which can be written as:

$$R\sqrt{1-\frac{\mathrm{v}^2}{c^2}} = \frac{2G_N M_0}{c^2\sqrt{1-\frac{\mathrm{v}^2}{c^2}}}. \qquad (5)$$

Here, R is the radius of the original mass (i.e. when the body is at rest). From equation (5), we can

ARPN Journal of Science and Technology

http://www.ejournalofscience.org

calculate the critical velocity at which the moving body becomes black hole.

$$R\left(1-\frac{v^2}{c^2}\right)=\frac{2G_N M_0}{c^2}\ ;\ \frac{v^2}{c^2}=1-\frac{2G_N M_0}{c^2 R};$$

$$v=c\sqrt{1-\frac{2G_N M_0}{c^2 R}} \qquad (6)$$

The expression $\frac{v^2}{c^2}=1-\frac{2G_N M_0}{c^2 R}$ is used in the Schwarzschild solution of Einstein's field equations for centrally symmetric metric which is given by [1]:

$$ds^2=c^2\left[1-\frac{2G_N M_0}{rc^2}\right](dt)^2-\left[1-\frac{2G_N M_0}{rc^2}\right]^{-1}dr^2-r^2(d\theta^2+\sin^2\theta d\phi^2) \qquad (7)$$

From equation (7), it is clear that the value of v^2/c^2 has been used as coefficients of two terms on the right hand side.

3. ANGULAR MOMENTUM OF THE MOVING MASS COLLAPSED TO SINGULARITY

The angular momentum of the moving mass collapsed to singularity can be calculated using equation (1) as follows:

$$l=M\,\mathrm{v}\,\mathrm{R}_m=\frac{M_0 \mathrm{v}}{\sqrt{1-\frac{v^2}{c^2}}}R\sqrt{1-\frac{v^2}{c^2}}=M_0\mathrm{vR} \qquad (8)$$

Using eq. (6), we can write

$$l=M_0 cR\sqrt{1-\frac{2G_N M_0}{c^2 R}} \qquad (9)$$

Analysis of equation (9) gives us three cases.

CASE I:

For $R<\frac{2G_N M_0}{c^2}$ we get $l=iM_0 cR\sqrt{\frac{2G_N M_0}{c^2 R}-1}$ means angular momentum is an imaginary quantity.

CASE II:

For $R=\frac{2G_N M_0}{c^2}$ we get $l=0$ means angular momentum is zero.

CASE III:

For $R>\frac{2G_N M_0}{c^2}$ we get $l=M_0 cR\sqrt{1-\frac{2G_N M_0}{c^2 R}}$ means angular momentum is real.

From CASE II, it is clear that the black hole formed due to collapsing of its own gravity has zero angular momentum.

4. DENSITY OF THE MOVING MASS COLLAPSED TO SINGULARITY

The density of the moving mass collapsed to singularity can be calculated using equation (2) as follows:

$$\rho=\frac{\text{Mass}}{\text{Volume}}=\frac{M_0\big/\sqrt{1-v^2/c^2}}{(4/3)\pi\left(R\sqrt{1-v^2/c^2}\right)^3} \qquad (10)$$

Using the value of $1-v^2/c^2$ from equation (6) in eq. (10), we get

$$\rho=\frac{M_0}{(4/3)\pi R^3\left(2G_N M_0/c^2 R\right)^2} \qquad (11)$$

Or,

$$\rho=\frac{c^4}{(16/3)\pi G_N^2 M_0 R} \qquad (12)$$

When a body having mass M_0 is compressed within its Schwarzschild radius, its density can be calculated as follows:

$$\rho_c = \frac{M_0}{(4/3)\pi\left(2\mathrm{G}_{\mathrm{N}} M_0/c^2\right)^3} = \frac{c^6}{(32/3)\pi G_N^3 M_0^2} \qquad (13)$$

Analysis of equation (13), gives us three cases:

CASE I:

For $R < \frac{2G_N M_0}{c^2}$ we get

$$\rho > \rho_c. \qquad (14)$$

CASE II:

For $R = \frac{2G_N M_0}{c^2}$ we get

$$\rho = \rho_c. \qquad (15)$$

CASE III:

For $R > \frac{2G_N M_0}{c^2}$ we get

$$\rho < \rho_c. \qquad (16)$$

5. CONCLUSION

There is possibility that the size of the moving body may reduce to the Schwarzschild radius and mass of the moving body may increase to such extent that it becomes a black hole [3]. The value of v^2/c^2 so obtained can be used in the Schwarzschild solution of Einstein's field equations for centrally symmetric metric [1]. Considering the moving mass as spherically symmetric and possessing spin at very high velocity, its size may contract up to Schwarzschild radius for its moving mass and can be considered to be collapsed to singularity i.e. it can be defined only through its mass, angular momentum and charge. We have come to conclusion that the density of the moving mass collapsed to singularity and the density of the black hole formed by collapsing of the same mass within its Schwarzschild radius are the same.

REFERENCES

[1] S. K. Srivastava. 2008. General Relativity and Cosmology, Prentice Hall of India Private Limited, New Delhi.

[2] R. Resnick. 2002. Introduction to Special Relativity, John Wiley & Sons, Singapore.

[3] M. Kumar and S. Sahoo**.** 2013. ARPN Journal of Science and Technology, 3(2), 169.