A NEW DIMENSION IN THE AREA OF EVENT HORIZON

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Acknowledgments

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Contents

Introduction

In this paper, calculations and arguments are reported which gives us a basis of a new dimension in the area of event horizon of black hole astrophysics.We know that two black holes in different regions of space-time can never be similar in terms of their mass, temperature (event horizon) and entropy [1]. This paper further extends the idea and states that two black holes in different regions of space-time can never be similar in terms of their area of event horizon too. To avoid later confusion in calculations this paper contains various symbols describing the different properties at different stages of the black holes.

FOR BLACK HOLE 1:
hv_1N - Photon intensity (in terms of energy) near the black hole
a_1 - Initial area of event horizon
a_2 - Area of event horizon taking into account the absorption of Cmb
Δa - Area change due to absorption of Cmb photons
FOR BLACK HOLE 2:
Similarly hv_2N , a_1' , a_2' , $\Delta a'$ for this black hole.
SYMBOLS REPRESENTING THE FINAL EQUATIONS:
ΔA - Represents magnitude of difference in area of event horizon of the two black holes (Δa - $\Delta a'$)

Before proceeding we should consider some initial assumptions:

- The black holes don't absorb radiation (or matter) other than Cmb.
- It is assumed that the two black holes taken into consideration are located in two different regions of space-time in accordance with Cmb anisotropy, such that $hv_1N > hv_2N$. So even if the intensity of photons near the two black holes is same, the energies are different.

- Absorption of Cmb photons from regions other than near the black hole is ignored.

For a non-rotating (Schwarzschild) black hole, we have
$A = 4\pi R_s^2 = \frac{16\pi G^2 M^2}{c^4}$
"A" represents the area of the event horizon of a black hole

For black hole 1:

$$a_1 = \frac{16\pi G^2 M_1^2}{c^4}$$

Now, taking the point of view that Cmb radiation is being absorbed by the black hole, we can write,

$$a_2 = \frac{16\pi G^2 M_2^2}{c^4}$$

$$\Delta a = a_2 - a_1$$

$$= \frac{16\pi G^2 (M_2^2 - M_1^2)}{c^4}$$

For black hole 2:

$$a_1' = \frac{16\pi G^2 M_1'^2}{c^4}$$

Now, taking the point of view that Cmb radiation is being absorbed by the black hole, we can write,

$$a_2' = \frac{16\pi G^2 M_2'^2}{c^4}$$

$$\Delta a' = a'_2 - a_1'$$

$$= \frac{16\pi G^2 (M_2'^2 - M_1'^2)}{c^4}$$

$$\Delta A = \Delta a' - \Delta a$$

$$= \frac{16\pi G^2 (M_2'^2 - M_1'^2)}{c^4} - \frac{16\pi G^2 (M_2^2 - M_1^2)}{c^4}$$

$$= \frac{16\pi G^2}{c^4} \left[(M_2'^2 - M_1'^2) - (M_2^2 - M_1^2) \right]$$

$$= \frac{16\pi G^2}{c^4} \left[(M'_2 + M_1')(M_2' - M_1') - (M_2 + M_1)(M_2 - M_1)) \right]$$

$$= \frac{16\pi G^2}{c^4}\left[\left\{\ \left(\frac{\hbar c^3}{8\pi G K_B}\right)^2\left(\frac{1}{t_2'} + \frac{1}{t_1'}\ \right)\ \left(\frac{1}{t_2'} - \frac{1}{t_1'}\ \right)\right\} - \left\{\left(\frac{\hbar c^3}{8\pi G K_B}\right)^2\left(\frac{1}{t_2} + \frac{1}{t_1}\ \right)\ \left(\frac{1}{t_2} - \frac{1}{t_1}\ \right)\right\}\right]$$

$$= \frac{16\pi G^2}{c^4}\ \left(\frac{\hbar c^3}{8\pi G K_B}\right)^2\left[\left(\frac{1}{{t_2'}^2} - \frac{1}{{t_1'}^2}\ \right) - \left(\frac{1}{t_2^2} - \frac{1}{t_1^2}\ \right)\right]$$

References

Amal Pushp. A new Effect in Black Hole Physics. 2018. <hal-01823055v2> [1]

Conclusions

With this we can conclude that two black holes located in two different regions of space-time in accordance with Cmb anisotropy can never be identical with respect to their area of event horizon as viewed on the microscopic scale, provided the inequality condition, $hv_1N > hv_2N$