

Kruskal-Szekeres Asymptotic Darkness

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Abstract

The author proposes that the light cone closes at the event horizon, wherein incoming and outgoing null geodesics align, forming a null surface and that the closure is coordinate independent. Without means of entry for particles, the interior below the Schwarzschild radius is defined as a white hole. In choosing the Kruskal-Szekeres coordinates the geometry of this interior may be defined as an inverted hypersphere, a hyperpseudosphere. As mass does not enter the event horizon both interior regions are defined as white holes. These interior regions correspond to hyperpseudospherical halves with negatively curved geometry. Mass surrounding event horizons would undergo continuous gravitational collapse, resulting in the spawning of constant, multiple white hole surfaces: Asymptotic Darkness.

Introduction

It is the position of the author that the interpretation of black hole behavior is incorrect. The foregone conclusion of the science was that mass would be collapsed into a physical singularity at $r=0$.

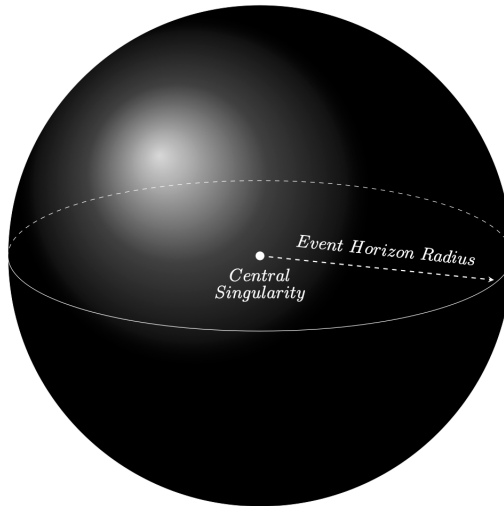


Fig. (1) - Image Taken from <https://scitechdaily.com/images/Black-Hole-Event-Horizon-Diagram-777x775.png>

This interpretation was decided decades before the first observation of a black hole.

The metric to describe the spherically symmetrical, uncharged, unspinning black hole was formulated by Schwarzschild.

$$ds^2 = -\left(1 - \frac{2m}{r}\right) dt^2 + \left(1 - \frac{2m}{r}\right)^{-1} dr^2 + r^2 (d\theta^2 + \sin^2(\theta) d\phi^2) \quad (1)$$

The metric is singular at $2m$, which is a coordinate singularity where the time coordinate vanishes. The metric is also singular at the origin which is a physical singularity. The coordinate singularity $2m$ may be removed by a transformation such as the Einstein-Rosen.

$$u^2 = r - 2m \tag{2}$$

Giving

$$ds^2 = - \left(\frac{u^2}{u^2 + 2m} \right) dt^2 + 4(u^2 + 2m) du^2 + (u^2 + 2m)^2 (d\theta^2 + \sin^2 \theta d\phi^2) \tag{3}$$

In these coordinates the event horizon is $u^2 = 0$ and the singularity is removed. However the authors noted, again, that time vanishes at the horizon.¹ Time vanishing at the horizon, therefore, is not an artifact of singularity, nor a result of choices in coordinates but a physical description of the metric.

The vanishing of time is represented visually in the field by the closure of light cones. As values of r above the horizon decrease null geodesics of the field increasingly align, resulting in the behavior of light cones closing. It is important to note that this behavior is closure, not tilting. The null geodesics align completely at the event horizon which is absent of any timelike or spacelike separation between events and is thus, a lightlike null surface. Below the horizon the light cone edges pass one another and the light cone is inverted.

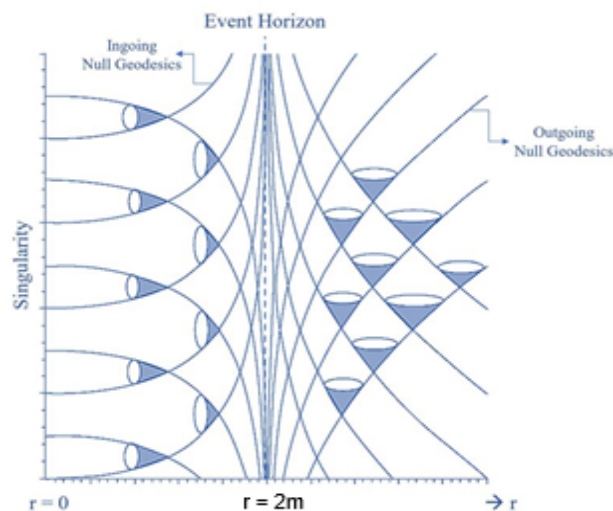


Fig.(2) – edited for $r = 2m$. Image taken from <https://www.researchgate.net/profile/Amaeswara-Prasad-Chundururu/publication/366849583/figure/fig3/AS:11431281111672791@1673105797278/Future-light-cones-inside-Schwarzschild-manifold.png>

The inverted light cone exists in hyperbolic, inverted spacetime in which particles cannot exist at speeds below the speed of light. Therefore it is absent all bosons, fermions; any and all particles native to the observed cosmos.

Since the Schwarzschild metric is spherically symmetric, and as the metric inverts at the Schwarzschild radius it is therefore necessary for a coordinate description of spherical inversion. Thus, a pseudosphere.

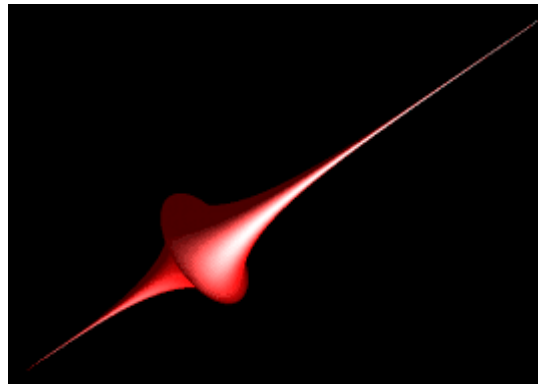


Fig 3 - Image taken from <https://www.daviddarling.info/images/pseudosphere.gif>

The pseudosphere is composed of two halves and an equator. The halves are infinite, negatively curved surfaces but the surfaces, regardless of side are absent at the origin. There is, thus, a central physical singularity in each. The equator is a circular coordinate singularity. Any surface slices parallel to the equator would be circular, each a smaller radius as distance from the equator increases. This surface geometry if it were elevated +1 dimension to a hyperpseudosphere would not be described as an area, but as a volume. This volume would be negatively curved, containing a physical singularity, apparently at its center, and would have two such hyperbolic surfaces joined at a spherical coordinate singularity. The black hole in the current theory, containing a physical singularity origin and having a coordinate singularity perimeter, is much like this description but the interior volume is purported to be gravitationally attractive, not repulsive and the novel theory must present two such volumes but the current theory recognizes only one. Fortunately the suggested geometry is present in the Kruskal-Szekeres coordinates.

The Kruskal-Szekeres (KS) are a coordinate system for Schwarzschild geometry. The KS coordinates T and X are

$$X = \left(\frac{r}{2m} - 1\right)^{\frac{1}{2}} e^{\frac{r}{4m}} \cosh\left(\frac{t}{4m}\right) \tag{4}$$

$$T = \left(\frac{r}{2m} - 1\right)^{\frac{1}{2}} e^{\frac{r}{4m}} \sinh\left(\frac{t}{4m}\right) \tag{5}$$

For $r > 2m$ and

$$X = \left(1 - \frac{r}{2m}\right)^{\frac{1}{2}} e^{\frac{r}{4m}} \sinh\left(\frac{t}{4m}\right) \quad (6)$$

$$T = \left(1 - \frac{r}{2m}\right)^{\frac{1}{2}} e^{\frac{r}{4m}} \cosh\left(\frac{t}{4m}\right) \quad (7)$$

For $0 < r < 2m$. The origin, of course, remains singular.

The Schwarzschild radius coordinate singularity is

$$T^2 - X^2 = 0 \quad (8)$$

t is absent from the event horizon coordinates and, just as Einstein and Rosen had observed time vanishes (In the case of the KS into positive and negative infinities).

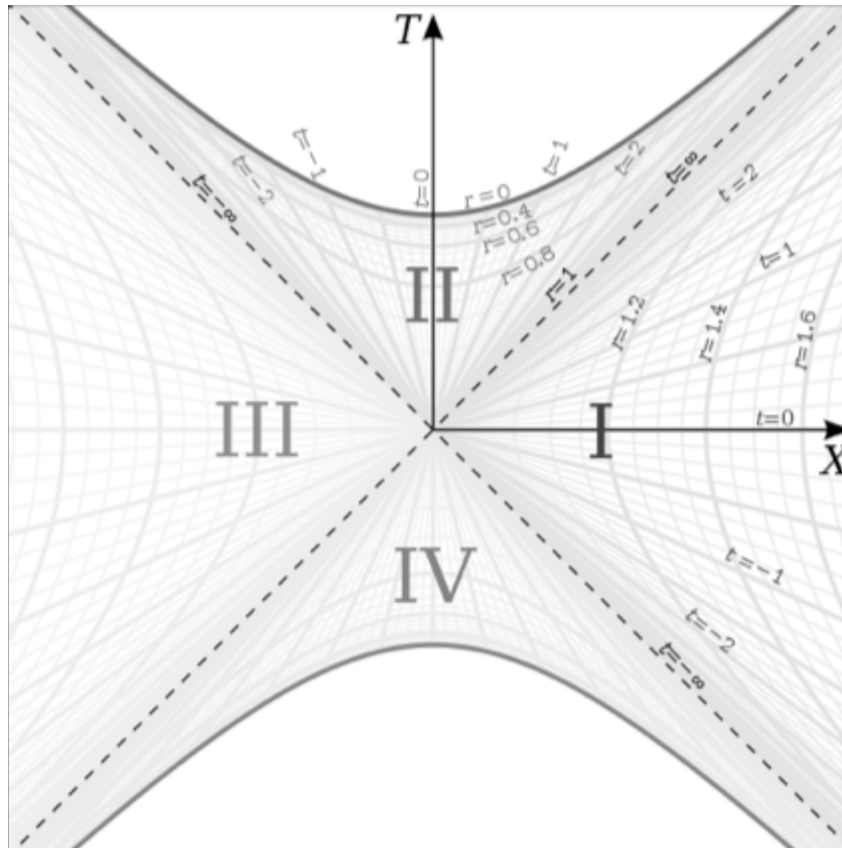


Figure 4 - The Kruskal Szekeres coordinates. Image taken from <https://www.researchgate.net/publication/370529693/figure/fig1/AS:11431281155906343@1683290624733/Kruskal-Szekeres-Coordinate-Chart.ppm>

In these coordinates quadrants III and I represent the exterior while II and IV represent the interior. Region II is currently accepted as a black hole.

In the KS the coordinates are transformed in such a way as the light cone can be represented

at 45° on either side of all lines parallel to the T axis, and that particles falling into the black hole move from the exterior quadrants III and I into quadrant II below the event horizon to the origin singularity. Under this novel theory three changes must be made to this interpretation. Firstly that there is no light cone at the Schwarzschild radius where $t = \infty$ and $t = -\infty$. Secondly that the light cone below the horizon is inverted. Last, that region II of these coordinates, which is normally interpreted to be a black hole is actually a white hole, just as region IV.

In this the hypersudosphere has been constructed. There are two infinite surfaces, of hyperbolic curvature and these surfaces share a coordinate singularity perimeter and each has a physical singularity at $r=0$.

Asymptotic Darkness

Mass falling into this geometry has nowhere to go. Gravity pulls particles in, the event horizon pushes particles out, and the particles themselves are also gravitational. This leads to a gravitational collapse in the ultra-dense incoming matter. Taken in a single instance, this would form a white hole with mass around it which would also collapse into white holes. The new expanding event horizons would exert compression, thus around them white holes would form and around them white holes would form, and so on and so forth.

Described in quantum scattering this phenomenon is known as Asymptotic Darkness. This theory represents the same concept but in terms of general relativity.

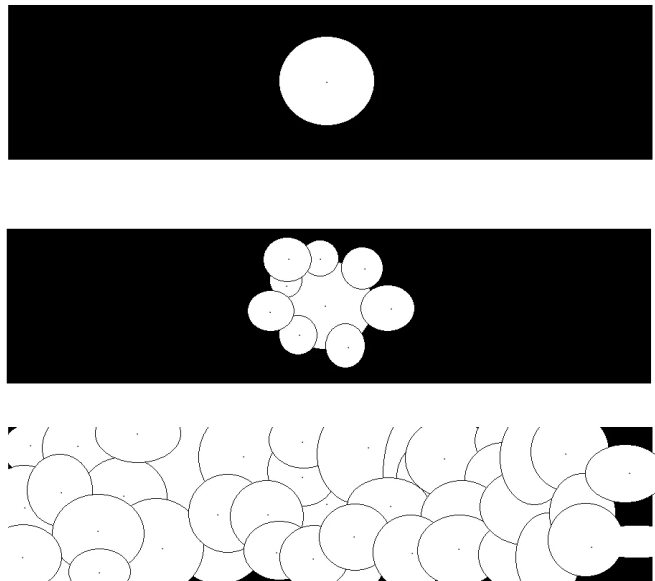


Figure 5 - Authors' interpretation of the Asymptotic Darkness phenomenon. White holes continuously emerge and collapse as they compete for mass.

Discussion

Asymptotic darkness may be able to explain the interactions of galactic clustering as well as the so called "Dark Matter" phenomenon. Beginning with the black hole cores of galaxies producing unimaginable amounts of white holes which extend into hyperspace a mechanism presents itself by which two black hole centers may entangle with one another, forming an Einstein-Rosen bridge. The tension along this connection will apply the same tension to the

spacetime around the black hole, thus resulting in greater curvature and thus, more gravitation which will mysteriously encourage gravitational clustering across physically impossible distances along with the formation of individual gravitational galactic 'halos.' Both of these expectations are observed. This theory may also explain the disparity between the stellar mass of galaxies that remain in orbit around comparatively minuscule supermassive black holes. This theory may also explain the aligned spin between distant supermassive black holes as the twisting of Einstein-Rosen bridges will affect the spin of a distant, but gravitationally entangled galactic black hole center.

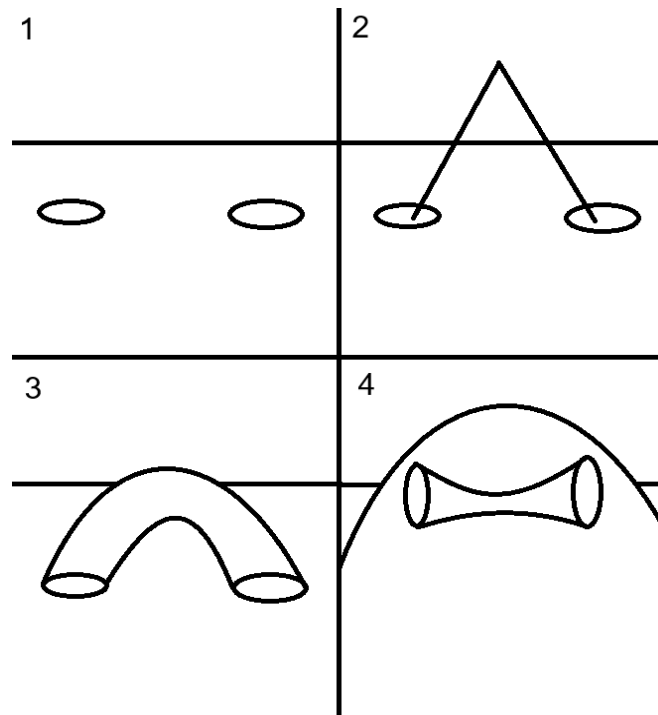


Figure 6 - Authors' illustration of a white hole/white hole interaction producing an Einstein-Rosen bridge and causing a "Dark Matter" galactic clustering event.

A means to falsify the theory may be found in the observation of merging black holes. If white holes do entangle then merge, then that tension between them, resulting in higher than expected gravity will vanish when the merge is complete. This will appear as “Dark Matter” which does not appear between the merging black holes, but indeed will disappear when the merge completes.

It may be that some such observations have already been made by LIGO.

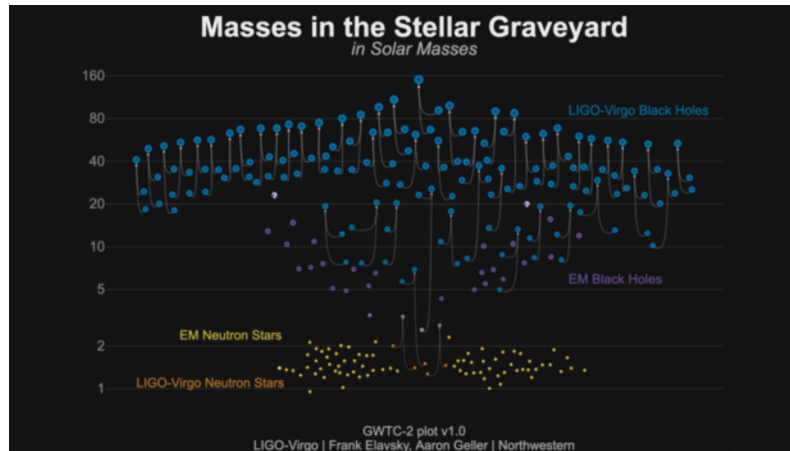


Figure 7 - LIGO detection. Note that as neutron star mergers appear to be relatively simple sums, black holes appear to lose mass after they have merged.
https://www.ligo.caltech.edu/system/news_items/images/180/page/Stellar_Graveyard_noerr_or_EM_large_16x9.png?1607555620

Asymptotic Darkness is a prime candidate for the description of the universe prior to the big bang.

It may also be possible, if incredibly unlikely, that two black holes would interact in such a way that rather than merge, they would pull at one another with such intensity that black holes may break up, producing three or more black holes from two failing to merge. Such an observation, however unlikely, would be unimaginable in the current theory.

Since the Einstein-Rosen bridges presented in the theory induce gravity by forming connections in higher dimensions the theory should be rigorously examined from the perspective of string theory, specifically force-inducing closed strings.

More research is clearly needed, but for that to begin it must be asked that this novel theory be given serious and professional scrutiny.

Reference

1: The Particle Problem in the General Theory of Relativity; A. Einstein, N. Rosen; *Physical Review*; Vol. 48, July 1, 1935