Black Hole Poly-Entanglement Using a Nonsingular Model

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Abstract

The geometry of the Einstein-Rosen bridge presents the possibility of entanglement of nonlocal black hole event horizons. The historical difficulty in the nature of these hypersurface bridges has been singularity which was shown to destabilize the spacetime throat, preventing their prolonged existence. Singularity is based upon the Eddington-Finkelstein coordinate system and is exclusively reliant upon such a transformation of the Schwarzschild metric to be viable. Comparisons between specially and generally relativistic event horizons can demonstrate that such a transformation is not necessary to define a gravitationally bound event horizon and that a field free of singularity may yield negatively curved hypersurface geometry unbounded by eminent singularity collapse. The concept of quantum foam when applied to the principle of the Einstein-Rosen bridge may produce multiple hypersurfaces from a single such black hole. This bears the possibility that Poly-Entanglement may occur between clusters of black holes. Such physical behavior, while beyond conventional detection shows potential as an explanation for the galactic clustering and rotation behavior currently thought to be the result of dark matter.

The Einstein-Rosen bridge and the Eddington-Finkelstein coordinate system.

In the case of black holes and when faced with his own equations collapsing to singularities, Albert Einstein formulated a metric which could grant his theory an easy out. By adding a variable to the energy coordinate of the metric singularities could be averted by inverting.[1]

$$ds^2 = -dx_1^2 - dx_2^2 - dx_3^2 + (\alpha^2 x_1^2 + \sigma) dx_4^2$$

1.01

By this metric a negative hypersurface at the center of a spherically symmetric collapsing body could result. While such an ill-defined and likely non-Newtonian variable of sigma seems at odds with Einstein's primarily deterministic philosophies it carried with it the favor of being most effective at magnitudes so miniscule that it would likely escape experimental detection. This negative hypersurface was shown to potentially connect to a separate hypersurface and was dubbed an Einstein-Rosen bridge between the two sheets. Although being mathematically coherent the Einstein-Rosen bridge, as all ideas without consistent experimental confirmation, was not universally accepted and the Eddington-Finkelstein coordinate system permitting singularities persisted. The idea of an Einstein-Rosen bridge was perceived to have been dealt a final blow as Fuller and Wheeler used the singular model to prove that such a bridge could not sustain itself over any length of time sufficient for one end to affect the other.

However, without employing the Eddington-Finkelstein coordinates a gravitationally bound event horizon may still result from a sustained Einstein-Rosen bridge without singularity collapse. Such a model is known as the nonsingular black hole, much like the gravistar or dark energy star. Infalling mass is compressed by general relativity to a hyper-thin surface which may be described as an Einstein-

Bose consolidate. The mass would approach infinite time dilation and by its own reference frame would be instantaneously vaporized by Hawking radiation.

Generally and Specially Relativistic Event Horizons

For such a model to persist mass must not cross below the event horizons of black holes. Such event horizons must not be traversed from either direction. Contrary to this concept, currently it is widely accepted that crossing the event horizon is inevitable for infalling matter and energy for light cones are calculated by Eddington-Finkelstein to close in such a way that all future paths point toward the singularity. Nonsingularity may be proposed simply by rejecting the coordinate transformation and allowing light cones to close entirely upon the event horizon as the Schwarzschild metric demonstrates quite normally. The model of mass crossing event horizons must now be more closely examined.

For crossing event horizons a comparison has been frequently made between a falling observer experiencing weightless free fall passing through a black hole's event horizon and into a singularity as being analogous to a relativistic accelerated reference frame in which an observer is approaching the speed of light. Such an observer would be above an event horizon and may leave their reference frame to pass through it and enter a weightless state equivalent to free fall. Relativity, after all, is founded on the idea that an observer has no means of differentiating between gravitation or acceleration or telling the difference between free fall or weightlessness infinitely distant from any gravitational field. However in the situation of the black hole event horizon these comparisons reach clear numerical distinctions between one and another.

Beginning with a coordinate rotation we see that two observers may utilize a matrix which allows them to observe and agree upon the same field of reference using axises rotated in space relative to one another.

$$\Lambda^m{}_n = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & \sin\theta & 0 \\ 0 & -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \quad (1.02)$$

This matrix does the job well for a simple 2D rotation. Any coordinate in one frame of reference can be converted into any coordinate of the alternative frame of reference. Cosine along the diagonal is not sufficient to properly rotate the frames so sine values are also needed off the diagonal. Without these sine values the two frames cannot be resolved to one another.

This same idea of rotation may be applied to relativistic moving bodies used in the opening acceleration analogy. Known as the Lorenz boost, the matrix utilizes a Lorenz transformation in a 4D rotation through one dimension of space and one dimension of time.

$$\Lambda^m{}_n = \begin{pmatrix} \cosh\phi & -\sinh\phi & 0 & 0 \\ -\sinh\phi & \cosh\phi & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

1.03

The functions behave in the same capacity but do so along the hyperbolic according to rapidity as relative frames approach the speed of light. Again we see that sine-based functions off the diagonal are needed to rectify one frame of reference with another. In the case of an accelerated body rapidity may be expressed as a function of acceleration and the concepts of force, relativistic frames, event horizons all the nuanced elements pertaining to special relativity can be applied.

Here is where the comparison between the accelerated frame in a Lorenz boost are shown to be incompatible with the Schwarzschild metric.

$$g_{ab} = \begin{pmatrix} 1-\frac{2gm}{rc^2} & 0 & 0 & 0 \\ 0 & (1-\frac{2gm}{rc^2})^{-1} & 0 & 0 \\ 0 & 0 & r^2 & 0 \\ 0 & 0 & 0 & r^2\sin^2\theta \end{pmatrix}$$

1.04

This is clearly not a metric compatible with any rotation of the frames of reference. The values needed to rectify one reference frame with another(g_{01}, g_{10}) are zero. When applied to the Einstein field equations no reference frame will have any disagreements with any of the coordinates relative to their reference frames (Proper time and Acceleration). Thus all frames of reference must concur with one another over the positions, magnitudes, curvature and effects of gravitational fields even as their perceptions of space and time relative to their coordinates within the gravitational fields differ. Following out the math it is clear that no realistic coordinates exist below the event horizon (at which point $2gm/rc^2 = 1$).

Removing the singularity

If Einstein-Rosen bridge formation is taken as a given, then the nature of singularity may be rejected for singularity by definition can have no dimensional objects contained within it, this may bypass the use of the Eddington-Finkelstein coordinates. If it is acknowledged that the Schwarzschild metric does not have the freedom of rotating frames present in Lorenz transformations then the conclusion can only be reached that conventional time-space coordinates do not reasonably exist below the event horizon. Without a third at hand these two methods of asserting the singular model can be discounted. Mass falling towards an event horizon will always fall towards an event horizon but never cross due to the nature of the metric.

A trivial observation

In the vacuum of intergalactic space the occasional interactions of gas, dust and photons have never prompted any great or remarkable phenomenon all on their own. One may make an exception of the bullet cluster in which the gaseous and dusty contents of two galactic clusters was spilled out into intergalactic space after the clusters collided but this event serves as a testament to kinetic and gravitational forces far greater than themselves at work. Ultimately not much happens amongst atoms drifting along in space. However, on the galactic scale among the denser nebulae of the cosmos there may form vast magnetic fields. While weak their overall effect may lead to the formations of filaments over long periods of time.[2] Here we see the first signs of what becomes a trend. Going down to a smaller scale, with greater pressure one can imagine an atmospheric planet in which pressures can become great enough to induce lighting, such as on the swirling storms of Jupiter. Denser still, the stars which force nuclear reactions that propagate themselves over eons of energy and heat and pressure. Still more dense are the neutron stars which have the pressure to collapse atoms and neutralize them and ultimately at the highest density one must confront the black hole. The trend of increasing density invoking higher-energy interactions within smaller dimensions comes into perfect picture in the context of the Einstein field equations. With them it is obvious that as pressure and energy density increases then gravity, the curvature of space time, will also increase. As space time increasingly curves smaller dimensions and smaller particles are forced to interact with each other in greater and greater energies.

A non-trivial supposition

When applied to nonsingular black holes specifically the idea of smaller dimensions affecting greater phenomena becomes vital. While the hypothesis rejects singularities outright it is never the less clear that a collapsing body 'wants' to be a singularity. As such its collapse must be gauged at every level of dimension and energy. At some point the collapsing gravity approaches the Plank scale – The quantum foam. It is here that Einstein's small variation in the field becomes an ubiquitous element of the landscape. Over extremely short distances variations in any coordinate collapsing to singularity will generate within it an Event Horizon and Einstein-Rosen bridge. As in the case of a collapsing massive star such points would be practically innumerable. This phenomenon of generating Event Horizons and Einstein-Rosen Bridges may occur along the entire collapsing body even the interior of the black hole may be comprised of spherical and continuously opening, closing, fusing mouths of Einstein-Rosen bridges like boiling water. The black hole itself in its entirety may be best visualized as a constant, frothing morass of mass compressed to extremely small dimensions amidst a tempest of opening Einstein-Rosen bridges perhaps determined by the structure of the quantum foam.

Geometry of inversion

The tractrix is a simple geometric curve that imagines a coordinate being pulled along by a line segment of constant distance that is connected to another coordinate in linear motion. When revolved around its asymptote the tractrix forms a pseudosphere. This surface represents the inversion of a sphere. As with all curves that are asymptotic the tractrix is infinitely long in its hyperbolic direction, however the pseudosphere it can trace does not have an infinite surface area. When confronting the idea of inverting spacetime, and of spherical mouths of Einstein-Rosen bridges coming into existence the logical conclusion of the surface beneath the event horizon would be of a pseudosphere, the inversion of the forming sphere but in a hyperdimensional volume. While each bridge would be contained within a spherical, limited volume its geometry indicates it can be potentially infinite in its hyperdimensionality.

Convergence and poly-entanglement

Of a very large number of Einstein-Rosen bridges forming potentially infinitely long hypersurfaces of inverted spacetime the likelihood of two such black holes entangling one another by converging their Einstein-Rosen bridge throats becomes a statistical game in relation to their position and the geometry of their local spacetime. Once converged the two ends may then stabilize one another and their geometry will adjust to reflect the most energetically stable arrangement. This process may be added upon. Another black hole may be introduced to entangle with the previous two. Then a fourth to the previous three and so on. As each black hole produces new throats of inverted spacetime from quantum foam so each of those throats has the potential to entangle with another, seemingly distant black hole.

Noncommunication of information across the Einstein-Rosen bridge.

While Einstein-Rosen bridges may entangle and converge with one another information should not cross the bridges themselves. The geometry of an Einstein-Rosen bridge interior must be that of a white hole. Travel across this surface is logically equivalent to exceeding the speed of light. Quantum entanglement within the Einstein-Rosen bridge across the event horizon is also impossible for there is total insulation of the internal with the external.

Discussion

The issue of dark matter has always been that of what has been missing. Gravity is being produced that has no known origin. As the only known source of gravity is matter it seems reasonable that matter must indeed be the culprit irrelevant of how elusive such matter would turn out to be, however general relativity is founded upon the concept that gravity is just space and time curved around matter and energy. The dark matter approach is to see matter and energy even where it is not so it will curve space and time. This approach is to envision the space and time unseen in Einstein-Rosen bridges and define its curvature by the forces of black holes which have the capacity to turn both space and time inside out. It should also be noted that this hypothesis may support two types of bridges: One which may converge with distant bridges or black holes and another which extends without any convergence. These two geometries may be analogous to open and closed strings, thus extending the hypothesis into the realm of string theory. But a hypothesis is nothing if it cannot make predictions. The predictions of this hypothesis are that at the center of every galaxy is a supermassive black hole. This much, so far, is known to be true. Furthermore, that the interactions of and between galaxies; their rotational velocities, their clustering behavior, their gravitational lensing can be defined by poly-entanglement of Einstein-Rosen bridges. Once the greater and more controversial hurdles of the nature of black holes are resolved it is clear that this hypothesis rests entirely upon geometry.

Bibliography:

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2)Parallel Filamentary Structure in Diffuse Nebulae, Osterbrock, D. E. Publications of the Astronomical Society of the Pacific, Vol. 71, No. 418, p.23