A Refutation of the Eddington-Finkelstein Coordinates

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Abstract

The Eddington-Finkelstein as a pair of coordinates have selectively allowed for solutions to the Schwarzschild metric which include singularity as well as a permeable event horizon. The author will demonstrate that the coordinates reduce to identities which remove tortoise coordinates from the field. Special Relativistic and General Relativistic principles will demonstrate the inaccessibility of the Event Horizon by massive particles, resulting in the removal of singularity. The Einstein-Rosen solution will establish a field free of singularities resulting in a drastically new model for the structure of black holes.

The Refutation

The Schwarzschild metric has long been problematic as it results in singularity at catastrophic gravitational collapse.

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

(1.0)

The Eddington-Finkelstein simultaneously takes the form of two coordinate systems based upon adding the the tortoise coordinates to the incoming coordinates and subtracting them from the outgoing coordinates. By selectively applying these calculations the singular model may be obtained.

$$v = t + r^* \qquad (2.0)$$

$$u = t - r^* \qquad (3.0)$$

The transformation may be applied to any coordinate arbitrarily, preserving general covariance and both equations exist simultaneously for every coordinate in the metric. The coordinates intersect at every spacetime coordinate in the field. Since v and u are prime values of t the sum of these coordinates reduces to 2t = 2t while their average is t = t. Therefore since they share universal intersection throughout the metric applying and calculating all of the Eddington-Finkelstein coordinates simultaneously as their physical behavior would demand cannot establish the tortoise coordinates thus removing access to the singularity in the field.

Event Horizons

This leaves the problematic issue of how or if event horizons may be crossed. For both general and special relativity a continually accelerated observer may be represented by Rindler coordinates and the observer perceive an event horizon in the negative direction of the acceleration. It has been presented that an observer being locally accelerated may leave the accelerated frame of reference and pass through the event horizon. Any observer in the locally accelerated frame would watch as the subject approached but remained just above the subject's intersecting coordinate with the event horizon. The observer meanwhile would pass through. However it is plain to see that in this example the event horizon ceases to be an event horizon once the observer leaves the accelerated frame. At that moment the observer enters the inertial frame and their velocity becomes tangent to the acceleration. The solutions are found using the Lorenz transformation. Thus, the 'event horizon' in this new frame of constant velocity represents one light line in an arbitrarily large field of light lines, none being governed or observed out of acceleration but of constant velocity, and therefore not inclusive of any event horizon.

It may be concluded then that event horizons cannot exist outside of accelerated frames, and that for an accelerated reference frame the observer may only approach the event horizon and never reach it as the observer may not reach the speed of light. We must conclude that gravitational event horizons cannot be crossed in relativity, removing the central singularity entirely and replacing it with the singularity of the event horizon itself.

The Einstein-Rosen

The spherically symmetric Einstein-Rosen transformation of the Schwarzschild metric gives the solution for the event horizon singularity.[1]

$$u^2 = r - 2m \qquad (4.0)$$

This allows the event horizon singularity to be formulated as $u = 0$ which is encompassed by positive and negative real values of u. It may be concluded, then, that the field is now free of singularity, inconstancy or self-canceling mathematics and preserves general covariance.

Discussion

Having been the predominant description of black holes for many decades a refutation of the singular model as the solution to the Schwarzschild metric represents a revolutionary new approach to the study of black holes. As each black hole observed represents one side of a double hypersurface coin it is now incumbent to establish the metric for the negative hypersurface just as the positive has been established.

References

1) “The particle problem in the general theory of relativity” A. Einstein, N. Rosen, Physical Review, Volume 38, July 1 1935, p. 73 – 77