

# An Explanation for Galaxy Rotation Rates without Requiring Dark Matter

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## Abstract

The rotation rates of stars in observed Galaxies are almost the same regardless of the distance from the galactic center and can currently only be explained by invoking a huge halo of invisible dark matter filling the space occupied by the galaxy. By realizing that space-time itself is an energy field that can flow, the rotation of galaxies can be explained by space-time also being consumed by the black hole at the center of a galaxy.

## Explanation

The gravity field is a field of energy surrounding matter and is comprised of the sum of all the wave functions of the particles comprising that matter (Ref 1, 2).

Around a star or planet this gravity field is more or less static, and the gravitational acceleration on other matter in this field is determined by the gradient in the energy field's intensity. Thus the acceleration is greater near the star/planet than further away.

In the case of black holes, however, the waves that comprise the energy in the gravity field cannot escape from the black hole (in the same way that light cannot) once closer than the event horizon. Thus, the fabric of space-time - the energy in space due to all the masses in the causally connected Universe (including the black hole's gravity field) - will be unable to escape too. So once a black hole forms, space-time will begin to flow into the black hole.

As the region surrounding the new black hole would then start to have a lower density of energy, more space-time energy field will continue to flow in towards the black hole to fill in the gap.

So there will be a space-time energy field flowing into the black hole, following radial lines inwards, into the black hole from all directions in the space surrounding it.

The effect this flow of space towards the black hole would have on objects embedded in that space (such as other stars/planets) would be for them to flow with the space towards the black hole too. This would appear to an observer on those stars/planets as being a greater acceleration towards the black hole.

Also as the flow rate of the space-time energy field towards the black hole would be fairly constant with distance away from the black hole, the apparent extra acceleration due to the black hole would be constant with distance.

So this extra effect (that appears to be acceleration) could explain the rotation rate of galaxies which appears to be more or less constant with distance away from galaxy centers. Thus there may be no need for the apparent halo of dark matter in galaxies to explain the galaxy rotation rates that are observed. The equation for determining the gravitational acceleration is correct for space that is stationary, but if the space is flowing then this rate of flow must be considered too (in addition to the acceleration due to the gradient in the gravitational potential) to determine the motion of objects in the gravitational field.

## **Proof of Concept:**

Open this URL to see the orbital velocity profile for stars in a classical spiral galaxy such as the M33 galaxy:

[https://en.wikipedia.org/wiki/File:M33\\_rotation\\_curve\\_HI.gif](https://en.wikipedia.org/wiki/File:M33_rotation_curve_HI.gif)

By modeling the orbital velocity based on the acceleration experienced by stars orbiting a galaxy where the space-time is flowing in towards the galactic centre at a fixed rate, we can see that the orbital velocity profile matches the observed profile (shown here in the range of distance from 10 to 50 (thousand light years) away from the galactic center:

If the additional acceleration experienced by the stars is  $a$  then the orbital velocity can be calculated using the equation:

$$a = \frac{v^2}{r} \quad (1)$$

So rearranging gives:

$$v = \sqrt{ar} \quad (2)$$

Then by plotting the orbital velocity based on distance gives the following graph:

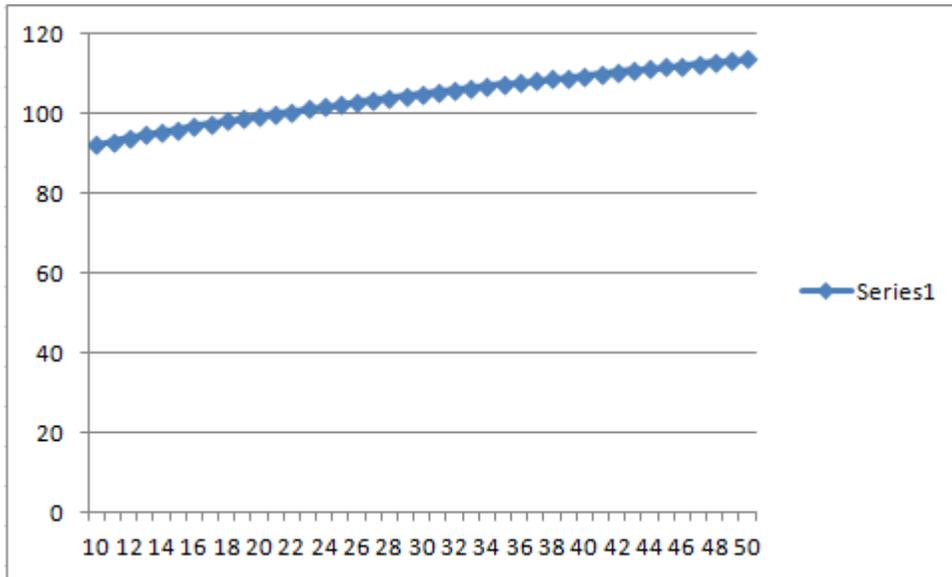


Figure (1) The orbital velocity profile for stars in a spiral galaxy.

## Proposed change to the General Relativity Schwarzschild Metric

In order to take account of the flow of space into Black Holes, it is necessary to modify the metric used in General Relativity to describe the gravity around Black Holes. For a spherically symmetrical, non-rotating body this metric is the Schwarzschild Metric [3]. This metric is as follows:

$$ds^2 = -\left(1 - \frac{2GM}{rc^2}\right) c^2 dt^2 + \left(1 - \frac{2GM}{rc^2}\right)^{-1} dr^2 + r^2 d\Omega^2 \quad (3)$$

The inward flow of space into a Black Hole is along the radial direction  $r$  and there is no dependence on angle  $\Omega$ . It represents additional space curvature other than that due to the Gravitational Potential, so the metric should be modified to give a new Metric for Black Holes:

$$ds^2 = -\left(1 - \frac{2Gm}{rc^2} + F(m)\right) c^2 dt^2 + \left(1 - \frac{2Gm}{rc^2} + F(m)\right)^{-1} dr^2 + r^2 d\Omega^2 \quad (4)$$

Here,  $F(m)$  is a function defining the flow rate of space into the Black Hole. It is dependent only on the Black Hole's mass; thus a larger Black Hole results in a greater inflow of space. As a Black Hole grows larger over time due to consumption of more mass, the flow rate  $F(m)$  will gradually increase also.

## CONCLUSION

If you compare the orbital velocity profiles between the URL and Figure (1) above you can see that they are almost identical - showing that this concept works to explain orbital velocities of stars in spiral galaxies and that Dark Matter is no longer necessary to explain the observations. A suggested change to the General Relativity Schwarzschild Metric has been made to allow this flow of space into Black Holes within galaxies to be modeled.

## REFERENCES

- [1] Traill. D. A. "Relatively Simple? An Introduction to Energy Field Theory" The General Science Journal, 2001-2008.  
[http://gsjournal.net/Science-Journals/%7B\\$cat\\_name%7D/View/1105](http://gsjournal.net/Science-Journals/%7B$cat_name%7D/View/1105)
- [2] Traill. D. A "Wave Functions for the Electron and Positron". The Global Physics Journal. P 172, Vol3, No1, 2015.  
[http://gpcpublishing.com/index.php?journal=gjp&page=article&op=view&path\[\]=367](http://gpcpublishing.com/index.php?journal=gjp&page=article&op=view&path[]=367)
- [3] "Schwarzschild Metric" Wikipedia (last accessed 17/1/2017)  
[https://en.wikipedia.org/wiki/Schwarzschild\\_metric](https://en.wikipedia.org/wiki/Schwarzschild_metric)