# WHY BARYONIC MATTER APPEARS INSUFFICIENT IN SPIRAL GALAXIES ?

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**ABSTRACT**

Considering the presence of dark matter or modifying the Newtonian laws of gravity are the most dominant scientific methods that we come across when it comes to explaining the mysterious, non-declining, non-Keplerian rotation curves exhibited by spiral galaxies. Considering the presence of baryonic matter only in order to solve the galaxy rotation problem has been explained by me in my previous papers. In this paper I present a practical approach to explain why the baryonic matter present within a spiral galaxy appears to be insufficient to account for the anomalous galaxy rotation curves.

**Key words:** galaxies: kinematics and dynamics - baryonic matter.

## 1 INTRODUCTION

Spiral galaxies truly are the most elegant celestial objects that adorn the Universe like celestial gems. Though visually elegant and pleasing such celestial objects appear to us, they are enshrouded by a mystery that continues to puzzle us all. A spiral galaxy possesses the knack for exhibiting rotation curves that do not decline according to the Keplerian expectation as observed in case of planetary systems. Galactic components, no matter where they are situated within the galaxy, even far away from the galactic centre, towards the galactic edge and beyond, exhibit orbital velocities that are as high as or sometimes even higher than the orbital velocity of a galactic component situated closer to the galactic centre. The solution to this discrepant behaviour exhibited by a galaxy is to consider the presence of a spherical dark matter halo surrounding the galaxy or to modify the Newtonian laws of gravity without involving dark matter.

The main objective of this paper is to explain why the baryonic matter/mass present within a spiral galaxy appears to be insufficient in order to account for the observed non-declining rotation curves.

## 2 THE SOLUTION

There is a misunderstanding that galactic components rotate or orbit around the galactic centre. Considering that the orbital velocities of all galactic components, no matter where they are situated within a galaxy to be entirely with respect to the galactic centre only, gives rise to the galaxy rotation problem, thereby requiring the need to involve dark matter or to modify the laws of gravity. Since the orbital velocities of every galactic component is considered to be entirely with respect to the galactic centre, therefore, the baryonic matter/mass present within a galaxy appears to be insufficient; this is the first reason. (An in-depth study regarding the kinematics and dynamics of spiral galaxies can be found in my papers - vixra.org/abs/1710.0007 and vixra.org/abs/1707.0005)

Secondly, studying a spiral galaxy face-on can be considered similar to studying a gas distribution present within a glass cylinder whose diameter is much greater than its length. For example, a hollow glass cylinder having diameter and length of 30 cm and 1 cm respectively is filled with some coloured gas, say, chlorine (greenish-yellow gas); the mass of the glass cylinder will increase by certain amount after the addition of this gas.

Now, observing the gas distribution present within the glass cylinder face-on will make us believe that the cylinder is completely empty as we would be able to see through the cylinder with crystal clear clarity. What has added mass to the cylinder then, is it dark matter, or is it some modified version of gravity?

Well, none of these theories apply, because, when we observe this glass cylinder edge-on, it is then, when we actually realize that the cylinder is not at all empty, it is filled with the greenish-yellow gas since it is obscuring our view, and, it is only this gas that has added mass to the glass cylinder instead of dark matter or modified gravity.

What is actually happening is that when we observe the cylinder face-on, then the gas thickness from which we are looking through is extremely less (1 cm) as compared to the gas thickness when we observe the cylinder edge-on (30 cm). The gas thickness is more when edge-on observation is considered as compared to face-on observation; same applies to a spiral galaxy. It is the

horizontal or the planar distribution of baryonic matter present within a spiral galaxy that matters the most to the galactic components.

If baryonic matter is not sufficient within a spiral galaxy then why we are not able to see clearly the bright galactic nucleus of our own galaxy while still being at a distance of 8 kpc away from the galactic centre? Since dark matter outweighs baryonic matter present within a galaxy as is believed, that is, baryonic matter is not enough, then we should be able to see the bright galactic nucleus since baryonic matter is insufficient and dark matter which is present in access is electromagnetically transparent since it does not interact with electromagnetic radiation; dark matter should therefore not absorb any light that is being emanated from the bright central region of the galaxy.

The key inference to be drawn from this is that it is the distribution of baryonic matter (gas, dust and stars) present within the galaxy that matters to the galactic components, and it is this distribution of baryonic matter that accounts for the non-declining, non-Keplerian rotation curves instead of dark matter or modified gravity. This leads me to conclude my paper with a quote, "It is not what we observe that matters, it is what the galactic components feel that matters".

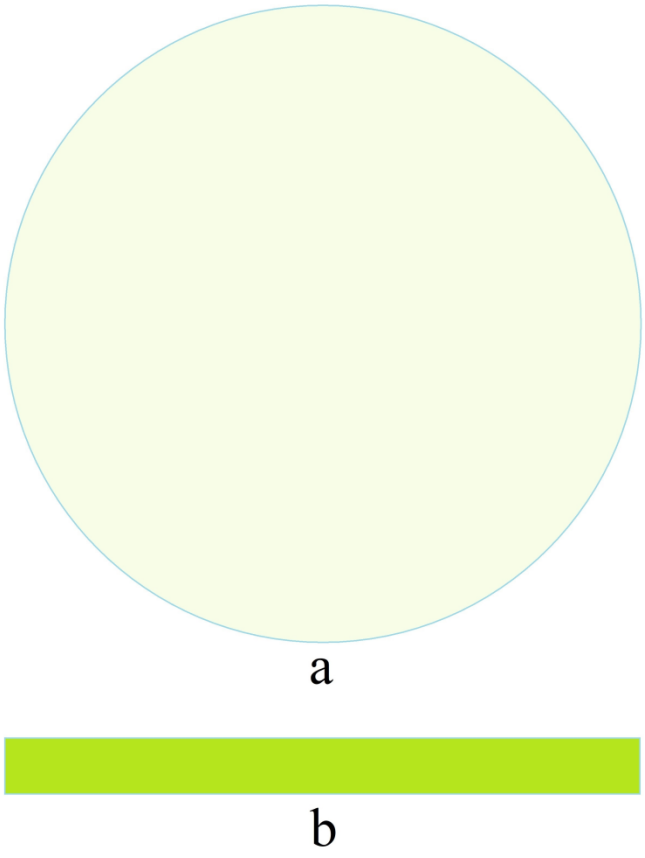


**Figure 1.** Chlorine gas filled in a glass cylinder having diameter and length of 30 cm and 1 cm respectively.

**[a]** When the cylinder is observed face-on, the gas thickness is minimum (1 cm). We can see through the cylinder very easily, therefore, the cylinder appears empty along this direction.

**[b]** When the cylinder is observed edge-on, the gas thickness is maximum (30 cm). We cannot see through the cylinder since maximum gas thickness obscures our view along this direction, therefore, the amount of gas is significant along this direction.

**Figure 2.** Spiral galaxy NGC 6814 (face-on). Image Credit: Hubble Space Telescope.

**Figure 3.** Galaxy NGC 4565 (edge-on). Image Credit: Hubble Space Telescope.

## CONCLUSIONS

(1) Considering the orbital velocities of every galactic component present within a galaxy, no matter where, to be entirely with respect to the galactic centre only gives rise to the galaxy rotation problem, thereby requiring the need to involve dark matter or to modify the laws of gravity.

(2) It is the distribution of baryonic matter (gas, dust and stars) present within a galaxy that is responsible for conferring the observed kinematics and dynamics on spiral galaxies and not dark matter or modified gravity.

(3) Face-on observation of spiral galaxies causes the baryonic matter to appear insufficient even when it is adequately present within a galaxy.

(4) Edge-on observation of spiral galaxies reveals the adequacy of baryonic matter.

(5) Since it is believed that baryonic matter is insufficient within spiral galaxies and dark matter outweighs baryonic matter, then we should be able to see the bright galactic nucleus of our own galaxy very clearly, because, baryonic matter is insufficient and dark matter which is present in access is electromagnetically transparent since it does not interact with electromagnetic radiation.

(6) It is not what we observe that matters, it is what the galactic components feel that matters.

## ACKNOWLEDGEMENTS

I am thankful for reviewing my manuscript.

## REFERENCES

vixra.org/abs/1710.0007 (Galaxy Rotation Problem: Dark Matter, Modified Gravity or just Baryons?)
vixra.org/abs/1707.0005 (Solving the Dark Matter Riddle)