Use the dark matter Cherenkov effect to explain why galaxies form and the evidences

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Abstract

Based on the cosmic dark matter fluid model, this paper proposes that the visible matter of the cosmic galaxy is formed by various turbulences of the dark matter fluid. This perturbation may be caused by a huge dark matter entity moving faster than the speed of light, which in turn forms Cherenkov radiation of gravitational waves. This paper estimates the size of this dark matter entity, pointing out that this disturbance will form two regions of high and low pressure in the dark matter fluid. The pressure gradient generated around the turbulence can be estimated using the Fujita formula for tropical cyclones. Computational analysis shows that when it reaches the outer periphery of the galaxy, the pressure gradient becomes small, and the effect of the Corio force is not obvious, so the rotation speed of the galaxy material is mainly affected by the speed of the dark matter fluid itself. This can be confirmed by the fact that the peripheral material rotation speed of all galaxies in the local group is basically the same. In addition, because the dark matter entity may have a certain length, just like a jet that produces a sonic boom, a low-pressure region and a high-pressure region will be generated at both ends of the length, which also means that the same dark matter entity may produce multiple galaxies, and there should be at least two galaxies in multiple galaxies with the same structure. This can be confirmed by some observations. Examples include the Milky Way and Andromeda Galaxy (M31), as well as the Hickson Compact Group.

1 Introduction

The formation of galaxies is a perplexing question. There are currently multiple theories to explain it. The Big Bang theory describes that as the temperature of the universe cools, hydrogen condenses, eventually synthesizing various elements to form the galactic material we see today.

Based on the dark matter fluid model of the universe [1], this paper gives a new explanation for the formation of galaxies.

2 Formation of turbulence in dark matter fluids

When I first proposed the turbulence model of dark matter fluids [1], my assumption was that dark matter fluids would have uneven flow velocities during the flow process. Turbulence occurs at locations with fast flow velocities, forming visible material. But if visible matter is produced in this way, there is a question, why does the flow rate of dark matter fluid in different locations occur unevenly? Are there obstacles in the universe like coral reefs in the ocean? And how to explain why visible galaxies actually occupy a relatively small space in the universe, but the distance between galaxies can be very large. This can be confirmed in the photographs of the Webb Space Telescope in Fig. 1.

Fig. 1. Deep space universe photographed by the Webb Space Telescope (NASA)

Another question is in Fig. 1 We can also notice that different spiral galaxies rotate in different directions. After all, according to the Big Bang theory, if the direction of the Big Bang explodes from a point outward in the direction of spherical symmetry, then the direction of motion of these galaxy materials left after the explosion should have a certain regularity. In addition to the fact that all galactic matter is moving away from each other, we should also be able to see that most galaxies should rotate in roughly the same direction, but this is not the same as what we actually observe. Judging from the photos taken by the Hubble Space Telescope or the Webb Space Telescope, the direction of rotation of various galaxies actually has a large randomness. It is far-fetched to explain it just by gravitational interactions.

Therefore, I think it is more likely that there are entities in dark matter fluids due to the presence of various motions. Some of these moving entities exceed the speed of light, forming turbulent phenomena such as shock waves, which in turn form various galaxies. These shocks are like sonic booms produced by supersonic aircraft in the air when they break through the sound barrier. The different direction of galaxy rotation may be related to the direction of dark matter fluid flow. Just like wooden blocks floating in a river, they will tumble randomly depending on the state of the flowing water.

3 Faster-than-light motion in dark matter fluids

We can assume that there are some continuously moving entities in the relatively uniform dark matter fluid, and these continuously moving entities cannot be observed by the visible matter world, because their interactions are unique to dark matter. These entities may be like creatures in Earth's oceans, moving in random directions.

Some dark matter entities are larger, others are smaller, but unlike the creatures in Earth's oceans, these entities in dark matter fluids can easily exceed the speed of light. The speed of life in the Earth's oceans does not exceed the speed of sound.

If these dark matter entities move faster than the speed of light, they will break through the light barrier in the dark matter fluid, forming shock waves similar to those in the air of the earth, where objects travel faster than the speed of sound [2]. This should be one reason for the turbulence in dark matter fluids.

Of course, to produce turbulence does not necessarily need to break through the limit of the speed of light, and the speed of some organisms in the Earth's oceans is not necessarily fast, but they can also produce turbulence in the ocean. Therefore, the generation of this dark matter turbulence has a great diversity.

We now focus on the turbulence formed by the movement of dark matter entities exceeding the speed of light, so the turbulence formed must be relatively regular. Like some very regular spiral galaxies, it may belong to this category of turbulence.

4 Estimation of the size of dark matter entities

From the diameter formed by the turbulence, it should be possible to roughly estimate the diameter of this dark matter entity moving beyond the speed of light.

There are two main types of shock waves that we know to form beyond a certain signal speed. One is the turbulence formed by breaking through the sound barrier. The other is Cherenkov radiation, which is formed faster than the speed of light.

From the perspective of Cherenkov radiation, the intensity of the radiation formed is mainly related to the speed of particles and the number of particles. The faster a particle travels faster than the speed of light, the greater the radiation intensity will be. The greater the number of particles, the greater the intensity of radiation formed.

Therefore, the turbulence formed by the disturbance of dark matter entities mainly depends on the mechanism of turbulence formation. Is the dark matter fluid similar to air or just an electromagnetic medium? If the dark matter fluid is only an electromagnetic medium, the size of galaxies formed in the cosmic fluid is mainly directly related to the speed and number of dark matter entities. The relationship with entity size is not clear.

However, we can still make an estimate of the size of dark matter entities by comparing the size of the blue whale, the largest animal in the ocean on Earth, with the volume of the ocean.

According to the average depth of the Earth's oceans of 3800m and the average area of $3.6 \times 10^8 km^2$, the total volume of the Earth's oceans is

$$3800 \times 3.6 \times 10^8 \times 10^6 = 1.4 \times 10^{18} (m^3)$$

The size of the world's largest blue whale is currently about $200m^3$

It can be seen that the ratio of blue whales to the total volume of the ocean is approximately

$$\frac{200}{1.4 \times 10^{18}} \approx 1.4 \times 10^{-16}$$

Now we calculate the size of the currently observed cosmic radius of about $1.4 \times 10^{10} ly$

$$\frac{4}{3} \pi \times (1.4 \times 10^{10})^3 \approx 3 \times 10^{31} (ly^3)$$

Then, referring to the ratio of blue whales to ocean volume, the maximum volume of possible dark matter entities can be estimated to be approximately

$$3 \times 10^{31} \times 1.4 \times 10^{-16} \approx 4 \times 10^{15} (ly^3)$$

That is, if the dark matter entity is a cylindrical shape with a base radius of $10^5 ly,$ its length is approximately

$$\frac{4 \times 10^{15}}{\pi \times 10^{10}} \approx 1.3 \times 10^5 (ly)$$

That is, the maximum length of dark matter entities moving in the universe is about hundreds of thousands of light years, and the cross-sectional radius of about 100,000 light years or so.

The currently observed radius of the Milky Way is about 100,000 light-years. However, the Milky Way is only a medium-sized galaxy in the universe, and there are many larger galaxies in the universe. Therefore, the shock waves formed by Cherenkov radiation or breaking through the sound barrier in the air produced by such a large-scale dark matter entity are basically the same as the scale of the moving entity in the ocean. More entities should be much smaller than this scale.

5 The process of forming a shock wave

When a dark matter entity moves faster than the speed of light in a dark matter fluid, it will form a gravitational wave of Cherenkov radiation [2]. The result of this radiation is the formation of a relatively pronounced ring of matter. The formation of this ring of matter then leads to the formation of a low or higher pressure region at its center, and this low or higher pressure region produces the rotation of galactic matter due to the movement of dark matter fluids, forming spiral galaxies of various shapes.

After the formation of a low or high pressure region at the center of the galaxy, a pressure gradient is formed around it, which can be described by Fujita's formula

$$P = P_\infty - (P_\infty - P_l)\left[1 + 2\left(\frac{r}{R}\right)^2\right]^{-\frac{1}{2}} \tag{1}$$

By Newton's laws of motion, then

$$a = \frac{dP}{dm} \tag{2}$$

where *m* is the mass of the gas with the length of the unit radius. therefore

$$a = \frac{dP}{\rho dr} = \frac{2}{\rho R^2}(P_\infty - P_l)r\left[1 + 2\left(\frac{r}{R}\right)^2\right]^{-\frac{3}{2}} \tag{3}$$

If the velocity of a cyclone is *v* and can be approximated as a circular motion around the center, its acceleration is

$$\frac{v^2}{r} = \frac{2}{\rho R^2}(P_\infty - P_l)r\left[1 + 2\left(\frac{r}{R}\right)^2\right]^{-\frac{3}{2}} = Ar\left[1 + 2\left(\frac{r}{R}\right)^2\right]^{-\frac{3}{2}} \tag{4}$$

such

$$v^2 = Ar^2\left[1 + 2\left(\frac{r}{R}\right)^2\right]^{-\frac{3}{2}} \tag{5}$$

It can be seen that if $r \ll R$, then

$$v^2 \approx Ar^2$$

or

$$v \approx Br \tag{6}$$

That is, the speed is proportional to the radius. Of course, this is the gas velocity due to the centripetal force. However, galactic matter and atmospheric vortexes are different, and the center density of galactic material is very large, and the gravitational effect is very large. Therefore, the centripetal force of galactic matter is the combined force of gravity and cyclone pressure difference.

If r is large enough, i.e. $r \gg R$, then

$$v^2 \approx Ar^2 \left[2\left(\frac{r}{R}\right)^2\right]^{-\frac{3}{2}} = \frac{AR^3r^2}{2^{\frac{2}{3}}r^3} \tag{7}$$

or

$$v \approx \frac{C}{\sqrt{r}} \tag{8}$$

At this time, the peripheral gravity of galactic matter has a similar relationship. But gravity is also very weak at this time. The effect produced by the combined force of cyclone pressure difference and gravity will become smaller and smaller. At this time, the speed of material in the outer galaxies of spiral galaxies is mainly determined by the laminar velocity of dark matter fluids. This also means that in the same dark matter fluid region, it is foreseeable that the speed of the dark matter fluid is roughly uniform. Therefore, this dark matter fluid region, the rotational speed of the outer part of all galactic matter, should be about the same.

The existing observation data show that in a number of galaxies adjacent to the Milky Way, the rotation speed of the material outside the galaxy is not much different, and basically maintains a relatively constant speed [3].

From these observations, if the speed of material moving in the outer reaches of the galaxy is lower than 200 *km/s*, the speed of rotation of material in the outer galaxy increases with distance. For example, NGC2403, NGC3621, NGC2574 and so on. Among them, NGC 2574 is more obvious. Its peripheral galaxy rotation speed is less than 100, so the rotation speed of material in the outer galactic galaxy increases significantly with distance. If galactic matter moves faster than 200 *km/s*, the speed of rotation of outer galactic matter decreases with distance. For example, the Milky Way, NGC 2841, NGC2903, NGC7331 and so on.

It can be seen that when the speed of rotation of the material in the outer regions of the galaxy exceeds a certain value, it will be slowed down. Below a certain value, it will be accelerated. Therefore, it can be expected that without the influence of galactic material, these galactic materials may all have a fixed speed. It's like a wooden block floating in a steady stream of water.

After using Fujita's formula, another effect is that the positive and negative central pressure difference is closely related to the rotational shape of the galaxy. If the central pressure in the formula is negative, i.e. $P_0 < P_\infty$, then the pressure difference calculated by Fujita's formula will strengthen the gravitational interaction, and the galactic material is closer to the center of the galaxy. The observation is that the radius of the galaxy will be relatively small.

Conversely, if the central pressure in the formula is positive, i.e. $P_0 > P_\infty$, then the pressure difference calculated by Fujita's formula will weaken the gravitational interaction and make the galactic material farther away from the center of the galaxy. The observation is that the radius of galaxies is relatively large.

6 Galaxies formed at the same time

In the process of breaking the sound barrier, high-pressure areas and low-pressure areas are formed in the front and rear ends of the aircraft. Therefore, there are generally two more obvious turbulent areas. However, this is due to the fact that the aircraft itself has a certain length. For Cherenkov radiation of electromagnetic waves, because the particles traveling at high speed are very small, and the electromagnetic wave radiation formed reaches the macroscopic scale, there is generally only one aperture detected in the Super Kamiokande detector.

However, for the Cherenkov radiation of gravitational waves [2], like the supernova 1987A, the released material has a certain volume, which forms multiple rings of material. Two of them are relatively large in diameter and the same shape of the ring substance is more obvious.

High-speed moving entities in dark matter fluids, if they have volume, should also be able to form two symmetrical turbulent regions. The material turbulence of these two galaxies may correspond to two galaxies that look very similar in shape.

In the Local Group, the Andromeda Galaxy (M31) as we know it is very similar to our Milky Way structure. So are these two galaxies symmetrical galactic material turbulence produced when a certain volume of dark matter entities break through the speed of light?

Of course, although M31 and the Milky Way are the same shape, the rotational normal is currently not on the same axis. This may have something to do with the fact that galactic matter vortices may also flow in dark matter fluids. This flow of galaxies causes its normal direction to be changed.

The symmetry of galaxy structure in this group can also be found in other groups. For example, in the Stephen Quintet galaxy group photographed by the Harper Space Telescope, two pairs of galaxies with basically the same structure can be found. As shown in Fig.3.

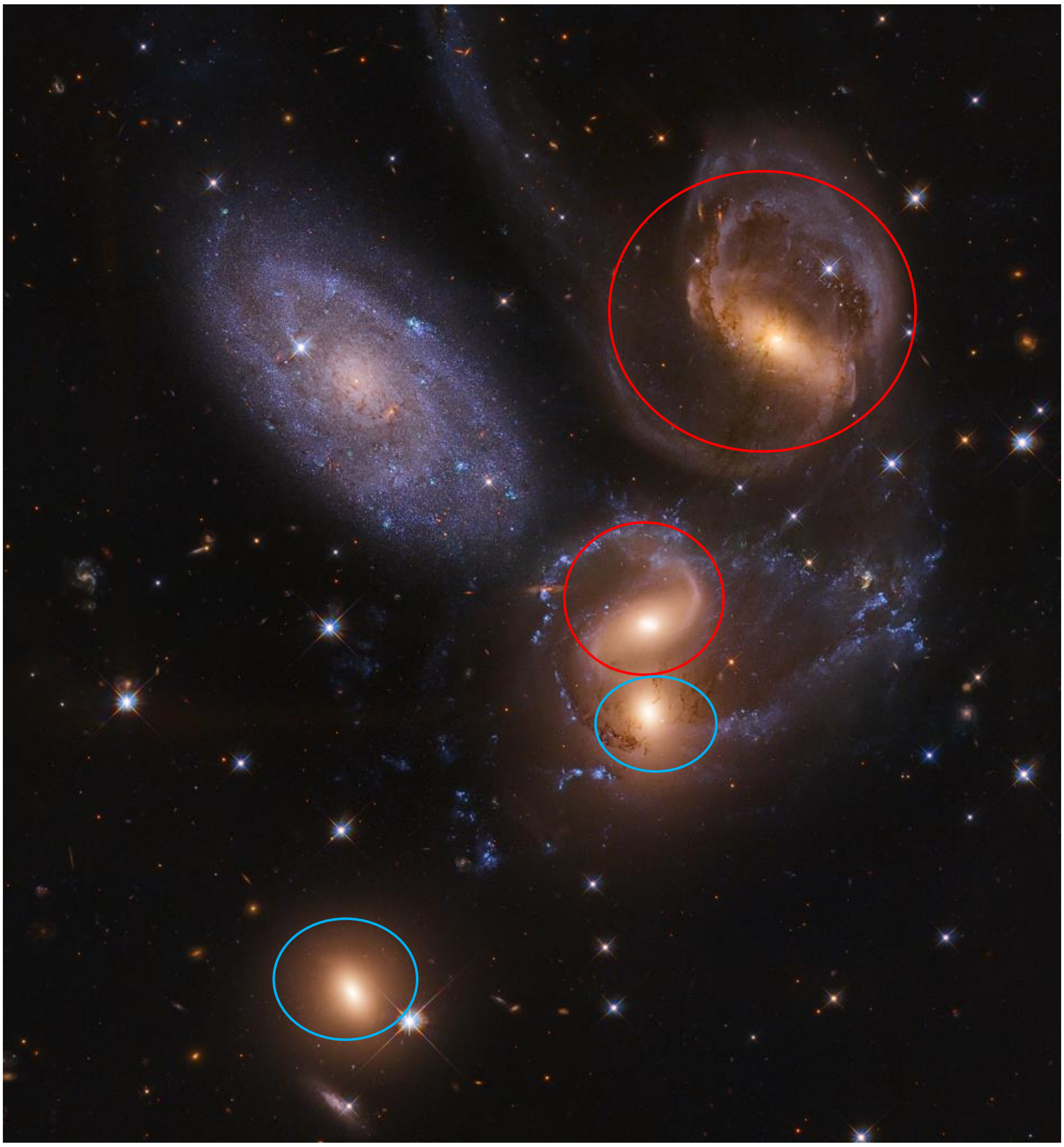

Fig.2 Stephan's Quintet was taken by Hubble Space Telescope (NASA)

It can be seen that in Fig.2, the structure of the galaxy in the two red circles and the two blue circles is the same. It can be noted that the two galaxies in the red circle rotate in opposite directions. According to the analysis in Section 5, large spiral galaxy centers should be positive pressure, while small spiral galaxy centers should be negative pressure.

The symmetry of this structure can be seen more clearly in the infrared photographs of the Webb Space Telescope (Fig. 3).

Fig.3. Stephan's Quintet was taken by Webb Space Telescope

The same structure is true for other Hickson Compact Groups galaxies.

In addition, in the local group, we can also note that the Andromeda Galaxy has a larger radius than the Milky Way, which means that the center of the Andromeda Galaxy may be positive pressure, while the center of the Milky Way may form negative pressure.

References

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