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DISCUSSION ABOUT UNIVERSE EXPANSION BY EXAMINING FORCES BETWEEN A STAR AND A GALAXY OR A NEBULA

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Abstract:

The study about the gravitational pull and radiation pressure push between a star and a galaxy or nebula shows: the star, in most cases, will push away a galaxy to expand, and the star, in all cases, will push away a nebula to expand. Considering the overall effect of radiation pressure force and cosmic rays, most part of the universe should expand. The data also shows that, in some part of the universe, even on intergalactic scale, the universe should not expand but contract. This is confirmed exactly by current astronautical observations. This article also concludes that dusts help determine the shape of galaxies.

Main Text:

To closely study whether stars will pull the universe closer or push the universe away, we now discuss whether stars' radiation pressure forces towards a galaxy or a nebula are bigger than their gravitational forces towards it.

1. Discussion about Spiral Galaxies:

Spiral galaxies accounts for 80% of total galaxies inside universe. Our galaxy is a typical spiral galaxy.

1.1 We take our galaxy and a star located 5 million light years from us as an example:

For our galaxy:

Its radius is $r_{milky\ way}$ =128000 light years
Thickness is $H_{milky\ way}$=12000light years
Its halo's radius is r_{halo} =1,000,000 light years
Its mass $M_{milky\ way}=1.8\times10^{42}$kg

- When a star which is the same as the sun is located R=5 million light years away from our galaxy:

$F_{star\text{-}milky\ way}$=（$GM_{star}M_{milky\ way}$）$/R^2$=（$6.67\times10^{-11}$ N•m²/kg²$\times2\times10^{30}$kg$\times1.8\times10^{42}$kg）/（$5{,}000{,}000\times9.4607\times10^{15}m\times5{,}000{,}000\times9.4607\times10^{15}$m）$=1.073\times10^{17}$N

The projected area of milky way from the face direction is:

$S_{milky\ way}=\pi r_{milky\ way}^2=3.14\times128000\times9.4607\times10^{15}\text{m}\times128000\times9.4607\times10^{15}\text{m}=4.6046\times10^{42}\text{m}^2$

The projected area of milky way from the side direction is:

$S_{milky\ way\ side}=2r_{milky\ way}\times H_{milky\ way}=2\times128000\times9.4607\times10^{15}\text{m}\times12000\times9.4607\times10^{15}\text{m}=2.750\times10^{41}\text{m}^2$

The projected area of milky way halo from each direction is:

$S_{halo}=\pi r_{halo}^2=3.14\times$（$1{,}000{,}000\times9.4607\times10^{15}\text{m}\times1{,}000{,}000\times9.4607\times10^{15}\text{m}$）$=2.81045\times10^{44}\text{m}^2$

The total area of the virtue ball with a radius of 5 million light years and with the star as its center is:

$S_R=4\pi R^2=4\times3.14\times$（$5{,}000{,}000\times9.4607\times10^{15}\text{m}\times5{,}000{,}000\times9.4607\times10^{15}\text{m}$）$=2.81045\times10^{46}\text{m}^2$

So the total radiation pressure force of this star on the projected area of milky way from the face direction is(we already knew that the average force of the pressure of sunlight:$F_{total\ pressure}=1.33\times10^{21}$N):

$F_{milky\ way\ pressure}=F_{total\ pressure}\times S_{milky\ way}/S_R$
$=1.33\times10^{21}\text{N}\times4.6046\times10^{42}\text{m}^2/(2.81045\times10^{46}\text{m}^{2)}=2.179\times10^{17}\text{N}$

So the total radiation pressure force of this star on the projected area of milky way from the side direction is:

$F_{milky\ way\ pressure\ side}=F_{total\ pressure}\times S_{milky\ way\ side}/S_R$
$=1.33\times10^{21}\text{N}\times2.750\times10^{41}\text{m}^2/(2.81045\times10^{46}\text{m}^{2)}=1.30\times10^{16}\text{N}$

So the total radiation pressure force of this star on the projected area of milky way halo from each direction is:

$F_{milky\ way\ pressure\ halo}=F_{total\ pressure}\times S_{halo}/S_R$
$=1.33\times10^{21}\text{N}\times2.81045\times10^{44}\text{m}^2/(2.81045\times10^{46}\text{m}^{2)}=1.33\times10^{19}\text{N}$

For the star's light radiated towards the face of the milky way, if 50 percent of light is reflected, 20 percent of light is absorbed, and 1 percent of light is reflected by halo and another 1 percent of light is absorbed by halo, then:

- the star's radiation pressure force towards milky way when the star faces the milky way will be:
  $F_{facepressure}=(50\%+20\%/2)\times F_{milky\ way\ pressure}+(1\%+1\%/2)\times F_{milky\ way\ pressure\ halo}$
  $=0.6\times2.179\times10^{17}\text{N}+0.015\times1.33\times10^{19}\text{N}=3.30\times10^{17}\text{N}$
  $F_{face\ pressure}/F_{star\text{-}milky\ way}=3.30\times10^{17}\text{N}/1.073\times10^{17}\text{N}=3.075$
- the star's radiation pressure force towards milky way when the star faces the side of milky way will be:
  $F_{sidepressure}=(50\%+20\%/2)\times F_{milky\ way\ pressure\ side}+(1\%+1\%/2)\times F_{milky\ way\ pressure\ halo}$
  $=0.6\times1.30\times10^{16}\text{N}+0.015\times1.33\times10^{19}\text{N}=2.073\times10^{17}\text{N}$

$F_{side\ pressure}/F_{star\text{-}milky\ way}=2.073\times10^{17}N/1.073\times10^{17}N=1.932$

So the radiation pressure forces in each direction are bigger than the gravitational force. And it is apparent that no matter how far the star is located from the Milky Way, the ratio of radiation pressure force vs gravitational force is always the same.

When we use the stars around the sun within 10,000pc^3 as average figure, the results will be:

- the radiation pressure force towards milky way vs gravitational force when the star faces the milky way:
  $F_{face\ pressure}/F_{star\text{-}milky\ way}=3.075\times1140.98/357.055=9.83$
- the radiation pressure force towards milky way vs gravitational force when the star faces the side of milky way:
  $F_{side\ pressure}/F_{star\text{-}milky\ way}=1.932\times1140.98/357.055=6.174$

As we already know that, inside universe, the expansion effect caused by cosmic rays is almost the same as the expansion effect caused by radiation, then the combined expansion forces vs gravitational forces will be:

- the combined expansion forces towards milky way vs gravitational forces on the face of the milky way:
  $F_{expansion\ forces}/F_{gravitational\ forces}=F_{face\ pressure}/F_{star\text{-}milky\ way}\times2=9.83\times2=19.66$
- the combined expansion forces towards milky way vs gravitational forces on the side of the milky way:
  $F_{expansion\ forces}/F_{gravitational\ forces}=F_{side\ pressure}/F_{star\text{-}milky\ way}\times2=6.174\times2=12.348$

So the total expansion forces in each direction are much bigger than the contraction force/gravitational force.

1.2 We discuss our galaxy without considering the effect of halo

Because we actually don't know the exact nature of the milky way halo, the above figures about the halo is not accurate. Now we calculate the results without considering halo:

Figures about our galaxy:

Its radius is $r_{milky\ way}$ =128000 light years
Thickness is $H_{milky\ way}$=12000light years
Mass $M_{milky\ way}=1.8\times10^{42}$kg

- When a star which is the same as the sun is located R=5 million light years away from our galaxy:

$F_{star\text{-}milky\ way}=（GM_{star}M_{milky\ way}）/R^2=1.073\times10^{17}N$

The projected area of Milky Way from the face direction is:

$S_{milky\ way}=\pi r_{milky\ way}^2=4.6046\times10^{42}m^2$

The projected area of Milky Way from the side direction is:

$S_{milky\ way\ side}=2r_{milky\ way}\times H_{milky\ way}=2.750\times10^{41}m^2$

The total area of the virtue ball with a radius of 5 million light years and with the star as its center is:

$S_R=4\pi R^2= 2.81045\times10^{46}m^2$

So the total radiation pressure force of this star on the projected area of milky way from the face direction is:

$F_{milky\ way\ pressure}=F_{total\ pressure}\times S_{milky\ way}/S_R=2.179\times10^{17}N$

So the total radiation pressure force of this star on the projected area of milky way from the side direction is:

$F_{milky\ way\ pressure\ side}=F_{total\ pressure}\times S_{milky\ way\ side}/S_R=1.30\times10^{16}N$

For the star's light radiated towards the face of the milky way, if 50 percent of light is reflected, and 20 percent of light is absorbed, then:

- the star's radiation pressure force towards milky way when the star faces the milky way will be:
  $F_{facepressure}=(50\%+20\%/2)\times F_{milky\ way\ pressure}=0.6\times2.179\times10^{17}N=1.304\times10^{17}N$
  $F_{face\ pressure}/F_{star\text{-}milky\ way}=1.304\times10^{17}N/1.073\times10^{17}N=1.218$
- the star's radiation pressure force towards milky way when the star faces the side of milky way will be:
  $F_{sidepressure}=(50\%+20\%/2)\times F_{milky\ way\ pressure\ side}=0.6\times1.30\times10^{16}N=7.8\times10^{15}N$
  $F_{side\ pressure}/F_{star\text{-}milky\ way}=7.8\times10^{15}N/1.073\times10^{17}N=0.073$

When we use the stars around the sun within 10,000pc^3 as average figure, the results will be:

- the radiation pressure force towards milky way vs gravitational force when the star faces the milky way:
  $F_{face\ radiation\ pressure}/F_{star\text{-}milky\ way}=1.218\times1140.98/357.055=3.892$
- the radiation pressure force towards milky way vs gravitational force when the star faces the side of milky way:
  $F_{side\ radiation\ pressure}/F_{star\text{-}milky\ way}=0.073\times1140.98/357.055=0.2333$

When we also consider cosmic rays, the combined expansion forces vs gravitational forces will be:

- the combined expansion forces towards milky way vs gravitational force on the face of the milky way:
  $F_{expansion\ forces}/F_{gravitational\ forces}=F_{face\ radiation\ pressure}/F_{star\text{-}milky\ way}\times2=3.892\times2=7.784$
- the combined expansion forces towards milky way vs gravitational force on the side of the milky way:
  $F_{expansion\ forces}/F_{gravitational\ forces}=F_{side\ radiation\ pressure}/F_{star\text{-}milky\ way}\times2=0.2333\times2=0.4666$

According to these calculation results, there is always apparent expansion effect in the face of our galaxy, but there is no expansion effect on the side of our galaxy. That is to say, the face of our galaxy are always pushed by the radiation pressure forces and cosmic ray particles, but the side of our galaxy are not pushed but pulled by remote stars. But, according to these figures, a mere 10 angle with the milky way surface will be more than sufficient to cause the general effect to shift from pulling to pushing. Thus it is obvious that, generally, for our galaxy (and for most other spiral galaxies inside universe) the expansion forces inside universe is bigger than contraction forces. For most part of the universe, the expansion should dominate.

But, considering the fact that the figures (7.784 and 0.4666) are not very high, it should also be pointed out that, for some galaxies or for some part of the universe, the expansion forces may be smaller than contraction forces. Typical evidence is the famous "Great Attractor". Astronomical observations show that even galaxies are hundreds of millions of light years apart, they are still not receding away from each other, but being attracted by the "Great Attractor" and all moving towards it. This evidence can also be used to prove that the accelerating expansion of the universe is caused by the balance of forces but not by the so-called "space expansion" because even on very large intergalactic scale, in some part of the universe, galaxies still do not expand away from each other.

2. A discussion About the Shape of Galaxies:

2.1 The pushing force of stellar radiation pressure and cosmic rays from outside a galaxy helps to shape the galaxy:

Up to here, we can see that the shape of our galaxy (and other similar galaxies) will also be influenced by the radiation pressure forces from stars of other galaxies and by the pushing forces of cosmic rays. The radiation pressure forces of stars from other galaxies and the pushing forces of cosmic rays tend to push the face of a galaxy and pull the side of it, or they tend to push the face of a galaxy more than they push the side of it. This will help to make the galaxy to be more flat. This factor not only helps the galaxies maintain a flat shape, but also contributes to the evolution process of spiral galaxies. Suppose if a galaxy's original shape was like a ball. Because the ball cannot be a perfect ball, it must be more flat in a certain direction. Then the surface in this direction will receive more radiation pressure forces from stars of other galaxies and this will help make the galaxy more and more flat in this direction. Thus over a very long period of time, this factor, along with other factors, will make the shape of a galaxy to be very flat, although more studies can be conducted to discover whether the effect of this factor is huge or big or small or tiny.

And, the fact that spiral galaxies usually contain more dusts than elliptical galaxies is a support for this because, if a galaxy contains more dusts, it will receive more pushing forces from stellar radiation as well as from cosmic ray particles. Thus this galaxy will be pushed by radiation pressure and cosmic ray particles and become more flat. But if a galaxy contains very few dusts, it will receive less pushing fores from radiation/cosmic ray particles. Thus the force pushing it to become more flat will be smaller. Then such a galaxy will be less flat and tend to be more round like a ball.

When we study the details, we can find that, for a galaxy with more dusts, celestial bodies located on the upside of the galaxy will receive much more pushing force from the upside direction from remote galaxies and much less pushing force from downside direction from remote galaxies because pushing forces from downside direction from remote galaxies are blocked by dusts. Similarly, for a galaxy with more dusts, celestial bodies located on the downside of the galaxy will receive much more pushing force from the downside direction from remote galaxies and much less pushing force from upside direction from remote galaxies because pushing forces from upside direction from remote galaxies are blocked by dusts. This is also true for the pushing effect of cosmic rays. Thus celestial bodies located on the upside of the galaxy will be pushed down and celestial bodies located on the downside of the galaxy will be pushed up. Although the pushing force is relatively small considering the huge mass the celestial bodies, over a very long period of time (more than billions of years), the accumulative effect will be very big. Therefore the galaxy will become more flat. Therefore, the overall effect is that a galaxy containing more dusts will become more flat. This conclusion is supported by the fact that almost all elliptical galaxies contain little dusts and almost all spiral galaxies contain much dusts.

It should also be mentioned that the shaping process can take place over a very long period of time, but, sometimes, the shaping process can also happen relatively very quickly. For example, when there is a sudden occurrence of astronomical events such as the supernova explosion, the shape of galaxy may be changed by a certain degree relatively very quickly.

2.2 The collision between celestial bodies and dusts is a major factor to shape a galaxy

When we study the relationship between the shape of a galaxy and the richness of dusts(dusts are defined here as including both small particles which measure between a few molecules and 100 micrometers and larger particles which are called meteoroids.) within the galaxy, we can find out that collision between celestial bodies and dusts is a very important factor.

Actually the collision between celestial bodies and dusts is very common inside universe. For example, With each passing day, millions of microparticles of a tenth of a millimeter cover the earth's surface. The quantity of meteoroids hitting the upper atmosphere each day varies between 0.4 and 110 tonnes per day with an estimated maximum of 300 tonnes per day (cf. CS Gradner et al., 2014), which brings the average to 33 tonnes depending on the NASA. And the earth's collision with dusts does reduce the moving speed of the earth so the length of the year changes overtime.

Similarly, the more dusts there are inside a galaxy, the more collisions between celestial bodies and dusts there will be inside this galaxy. Generally the collisions will reduce the speeds of celestial bodies and it will also change the moving directions of some of them. So the moving speed in some directions for most celestial bodies will be reduced gradually to zero, and, in general, the movements of most celestial bodies will converge in a certain direction and within a limited range of the space, just as the moving of most of the stars inside our galaxy is to rotate around galaxy center inside the galaxy disk and the moving speeds of most of our galaxy's stars in the direction vertical to the galaxy disk is almost zero.

But if there are very few dusts inside a galaxy, there are very few collisions between celestial bodies and dusts. And considering the vast space of the galaxy and the relatively small size of the celestial bodies, the collisions between celestial bodies are very rare. So the movements of the celestial bodies will probably be in any direction and will be unlikely to converge. Therefore the shape of the galaxy tend to be round but not flat. It can hence be concluded that, if a galaxy contains more dusts, it will be more flat, and if a galaxy contains less dusts, it will be less flat.

2.3 The gravitational pull between celestial bodies and dusts is another major factor to shape a galaxy

When we study the relationship between the shape of a galaxy and the richness of dusts within the galaxy, we can find out that gravitational pull between celestial bodies and dusts is another important factor.

In many occasions, although a celestial body (we name it celestial body "A") does not collide with dusts when dusts are no near enough, its gravitational field is still able to pull dusts and the dusts also pull this celestial body "A". When there is another celestial body "B" which is moving in the opposite direction of this celestial body "A" and passes by celestial body "A", celestial body "B" will also be able to pull nearby dusts and the nearby dusts will also pull this celestial body "B". Through this process, the dusts play a role to slow down both celestial bodies because of gravitational pulling effect.

Thus, the more dusts there are inside a galaxy, the more gravitational pulling effects there will be inside this galaxy. Generally the gravitational pulling effect will reduce the speeds of celestial bodies and it will also change the moving directions of some of them. So the moving speed in some directions for most celestial bodies will be reduced gradually to zero, and, in general, the movements of most celestial bodies will converge in a certain direction and within a limited range of the space, just as the moving of most of the stars inside our galaxy is to rotate around galaxy center inside the galaxy disk and the moving speeds of most of our galaxy's stars in the direction vertical to the galaxy disk is almost zero.

2.4 Summaries between the shape of a galaxy and the richness of dusts inside the galaxy

- If a round galaxy contains very few dusts, it will probably remain a round galaxy.
- If a round galaxy contains much dusts, it will become more flat. This means, for an elliptical galaxy which contains very few dusts, if the richness of dusts inside a current elliptical galaxy increases, the elliptical galaxy will gradually become more flat. The ways for an elliptical galaxy to increase its richness of dusts can include merger with nebula or galaxy which contains much dusts and, possibly, sudden outbreaks of supernovas inside the galaxy.
- If a flat galaxy contains much dusts, it will remain a flat galaxy or even become more flat.
- If a flat galaxy contains very few dusts, it will not become more flat. But depending on the specific interactions between celestial bodies inside the galaxy, the flat galaxy might remain as flat as it were, or it might become more round because there is not enough dusts to keep it flat and the inter-influences between celestial bodies might cause the celestial bodies to disperse around the space and cause the shape of the galaxy to be more round. Because apparently dusts help to make a round galaxy more flat, but it is possible that dusts also help keep a flat galaxy to remain flat(if this is true, it indicates that the celestial bodies inside a galaxy have a tendency to disperse around the center of the galaxy, so the shape of a galaxy has the tendency to become round). If a flat galaxy contains very few dusts, it might become more round because there is not enough dusts to keep it remain flat. Or we can put it this way: it is certain that a round galaxy containing much dusts will become more flat, while it is possible that a flat galaxy containing very few dusts will become more round.

The above can be summed up as the Law of Galaxy Shape:

Dusts Shape A Galaxy, i.e.:

The shape of a galaxy is determined by the richness of dusts it contains. The more dusts it contains, the more flat it is or will become; the less dusts it contains, the more round it is (or will become).

3. Discussion about Elliptical Galaxies:

Now we continue to discuss about elliptical galaxies. Elliptical galaxies accounts for 17% of total galaxies inside universe. Now we discuss the radiation pressure forces vs gravitational forces for elliptical galaxies (taking M87 as an example). For M87:

Its radius is r_{M87} =120000 light years

Its mass is $M_{M87} \approx 2.7\times10^{12} M_{sun} = 2.7\times10^{12}\times2\times10^{30}kg = 5.4\times10^{42}kg$

Its distance from the sun is R_{M87} =53.5 million light years

$F_{sun\text{-}M87}$=（$GM_{sun}M_{M87}$）/R_{M87}^2=（$6.67\times10^{-11}N\bullet m^2/kg^2\times2\times10^{30}kg\times5.4\times10^{42}kg$）/（$53,500,000\times9.4607\times10^{15}m\times 53,500,000\times9.4607\times10^{15}m$）$=2.812\times10^{15}N$

The projected area of M87 is:

$S_{M87}=\pi r_{M87}^2=3.14\times120000\times9.4607\times10^{15}m\times120000\times9.4607\times10^{15}m=4.0471\times10^{42}m^2$

The total area of the virtue ball at a distance 53.5 million light years from the sun is:

$S_R=4\pi R^2=4\times3.14\times$（$53,500,000\times9.4607\times10^{15}m\times53,500,000\times9.4607\times10^{15}m$）$= 3.218\times10^{48}m^2$

So the total radiation pressure force of the sun on the projected area of M87 is:

$F_{M87\ pressure}=F_{total\ pressure}\times S_{M87}/S_R$

$=1.33\times10^{21}N\times4.0471\times10^{42}m^2/(3.218\times10^{48}m^2)=1.673\times10^{15}N$

For the sun's light radiated towards the M87, if 40 percent of light is reflected, 10 percent of light is absorbed, then:

$F_{M87\ radiation\ pressure}/F_{sun\text{-}M87}=(40\%+10\%/2)F_{M87\ pressure}/F_{sun\text{-}M87}=0.45\times1.673\times10^{15}N/2.812\times10^{15}N=0.2677$

When we use the stars around the sun within 10,000pc^3 as average figure, the results will be:

$F_{M87\ radiation\ pressure}/F_{star\text{-}M87}=0.2677\times1140.98/357.055=0.8555$

When we also consider cosmic rays, the combined expansion forces vs gravitational forces will be:

$F_{expansion\ forces}/F_{gravitational\ forces}=F_{M87\ radiation\ pressure}/F_{star\text{-}M87}\times2=0.8555\times2=1.711$

This shows that, for M87 (and most other elliptical galaxies), the expansion forces (pushing forces) inside universe is larger than contraction forces (pulling forces/gravitational forces). But apparently the ratio is not very high. This means, for some elliptical galaxies, the expansion forces are larger than contraction forces. While, for some other elliptical galaxies, the expansion forces could be smaller than contraction forces.

4. Discussion about Nebulas:

Now we discuss the radiation pressure forces vs gravitational forces for nebulas(taking Crab Nebula as an example). For Crab Nebula:

Its radius is $r_{crab\ nebula}$ =5.5 light years

Its distance from the sun is approximately R=6500light years

Its mass is $M_{crab\ nebula}\approx4.7\times M_{sun}=4.7\times2\times10^{30}kg=9.4\times10^{30}kg$

$F_{sun\text{-}crab\ nebula}$=（$GM_{sun}M_{crab\ nebula}$）/$R^2$=（$6.67\times10^{-11}N\bullet m^2/kg^2\times2\times10^{30}kg\times9.4\times10^{30}kg$）/（$6500\times9.4607\times10^{15}m\times 6500\times9.4607\times10^{15}m$）$=3.316\times10^{11}N$

The projected area of crab nebula is:

$S_{crab\ nebula}=\pi r_{crab\ nebula}^2=3.14\times5.5\times9.4607\times10^{15}m\times5.5\times9.4607\times10^{15}m=8.502\times10^{33}m^2$

The total area of the virtue ball at a distance 6500 light years from the sun is:

$S_R=4\pi R^2=4\times3.14\times$（$6500\times9.4607\times10^{15}m\times 6500\times9.4607\times10^{15}m$）$= 4.750\times10^{40}m^2$

So the total radiation pressure force of the sun on the projected area of crab nebula is:

$F_{crab\ nebula\ pressure}=F_{total\ pressure}\times S_{crab\ nebula}/S_R$

$=1.33\times10^{21}N\times8.502\times10^{33}m^2/(4.750\times10^{40}m^2)=2.38\times10^{14}N$

For the sun's light radiated towards the crab nebula, if 10 percent of light is reflected, 10 percent of light is absorbed, then:

$F_{crab\ nebula\ radiation\ pressure}/F_{sun\text{-}crab\ nebula}=(10\%+10\%/2)F_{crab\ nebula\ pressure}/F_{sun\text{-}crab\ nebula}=0.15\times2.38\times10^{14}N/3.316\times10^{11}N=107.7$

When we use the stars around the sun within 10,000pc^3 as average figure, the results will be:

- the radiation pressure force towards crab nebula vs gravitational force towards it:

$F_{crab\ nebula\ radiation\ pressure}/F_{star\text{-}crab\ nebula}=107.7\times1140.98/357.055=344.2$

When we also consider cosmic rays, the combined expansion forces vs gravitational forces will be:

$F_{expansion\ forces}/F_{gravitational\ forces}=F_{crab\ nebula\ radiation\ pressure}/F_{star\text{-}crab\ nebula}\times2=344.2\times2=688.3$

This apparently shows that, for crab nebula(and most or all other nebulas), the expansion forces(pushing forces) inside universe is hugely larger than contraction forces(pulling forces/gravitational forces). Here, apparently the ratio is very high. This means, for all nebulas, the expansion forces must be much higher than contraction forces. For all the above mentioned discussions, it needs to be mentioned, the effect of interstellar gas is similar to the effect of dusts. But gas is usually transparent while dusts are not transparent, and the density of gas is less than the density of dusts, so, usually the effect of dusts is more important than the effect of gas with the same mass.

5. Conclusions:

- Generally speaking, cosmic rays and stellar radiations pressure forces inside universe push most spiral galaxies, some elliptical galaxies, and all nebulas to expand. Thus, in most part of the universe, the expansion forces are big enough to overcome the gravitational pulling forces, so most part of the universe should expand.
- In some part of the universe, the expansion forces are not big enough to overcome the gravitational pulling forces. Thus some part of the universe should contract.

- Dusts help determining the shape of galaxies: If a galaxy contains more dusts & gases, it tends to become flater. If a galaxy contains less dusts & gases, it tends to become rounder.

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