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Shiva Deb

REVIEW | THERIOTICAL PHYSICS

Shiva Deb

Author's signature

BIOBLIOGRAPHY

He has studied and minutely investigated the effects of Gravity and Gravitational Lensing for over eleven years. He is also interested in other areas of physics and his research areas includes electromagnetic radiation, special relativity, origin of the universe, heat transfer, atomic structure, energy distribution, solid state devices, frictional electricity, super conductivity. He is an Electronics and Communication Engineer by profession and has worked in various fields of engineering like digital and analog communication, antennae and wave progression, microprocessors and microcontrollers, microwave engineering etc. Further, he is also interested in biology and did a research about the behavior of tissues in living and recently dead organisms where he discovered the programmed nature of cells and their automatic behavior.

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Dark Core: A New Finding about the Mystery of Gravity

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Abstract

This paper explains a mysterious fact about Gravity which has been discovered after 11 years of research. Gravity is not the way Newton, Einstein or other physicists have thought over the years. Just like a magnet attracts iron dust towards itself, in the same way there is a mysterious object at the core of every planet and star which attracts every object that comes close to it. This paper explains about the nature of that mysterious object in details. And moreover, the attractive force of that mysterious object is what is normally called as gravitational force. Further, this paper also explains with some suitable pictures as to why stars over a large range of distances revolve around their galaxy's center at equal or increasing speed which is not similar to the orbital velocities of planets. Scientists today are struggling enough to explain this mystery with the help of some kind of imaginary matter known as "Dark Matter" which they have never found practically or detected experimentally. But this paper completely explains everything even without the help of "Dark Matter" and also includes proof about the authenticity of the theory.

Comparing a Spiral Galaxy as twisting of the fabric of space.

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1. Introduction

There are four fundamental forces of nature: Electromagnetic force, Strong force, Weak force and Gravitational force. Gravity is the weakest of the four, approximately 10^{38} times weaker than the strong force, 10^{36} times weaker than the electromagnetic force and 10^{29} times weaker than the weak force. At the macroscopic scale, gravity is quite a dominant force but at the microscopic scale there is no significant influence of it on the subatomic particles. There is no satisfying concept about gravity at the subatomic scale, and a theory of gravity consistent with quantum mechanics, a quantum gravity theory is still under research with no significant achievement. So, for decades gravity has been a big mystery for scientists and they have been trying to gather as much information as possible regarding it. This research paper is about a new finding of the mystery of Gravity. Although, macroscopically gravity is a dominant and easily understandable force but there are many natural phenomena where the modern theory and concept of gravity fails and there is no satisfactory explanation about it. Like, for example the rotational/orbital speeds of stars in galaxies do not follow the rules found in other orbital systems such as planets and moons in a solar system that have most of their mass at the center. Stars revolve around their galaxy's center at equal or increasing speed over a large range of distances. In contrast, the orbital velocities of planets in planetary systems and moons orbiting planets decline with distance. Scientists predicted that there must be a kind of hypothetical matter known as the *Dark Matter* that envelops the galactic disc and extends well beyond the edge of the visible galaxy and which accounts for the higher gravitational force and increase in the movement of stars over a large range of distances from the galactic center. However, as a matter of fact *Dark Matter* has never been detected experimentally and there is also no guarantee that it will ever be found practically. This paper explains some deep hidden facts about the formation of galaxies which scientists haven't noticed for decades and also provides explanation with proof for the higher rotational speeds of stars even without the help of *Dark Matter*. Also, many big questions about our universe have been answered in this paper.

2. Manuscript

Gravity is a natural phenomenon by which all things with mass - including planets, stars, and galaxies - are brought toward one another. Newton described gravity as a force which causes any two bodies to be attracted to each other, but Einstein described gravity not as a force, but as a consequence of the curvature of space-time caused by the uneven distribution of mass. But after years of thought and research it has been found that gravity is not the way Newton or Einstein has imagined, it has a big mystery that remained hidden for a very long time. To understand about that mystery let us start with the absolute basic and that is formation of a star. Let's see what scientists say about the formation of a star.

According to leading physicists and scientists, *"A star is formed when a large amount of gas (mostly hydrogen) starts to collapse in on itself due to its gravitational attraction."*.....But according to chemistry, it is not possible at all. Hydrogen exists in nature as H_2 molecule in the form of gas. And if it is in the gaseous state then it will expand, H_2 molecules will move away from each other, not come close to each other. This is the basic property of a gas [1]. It can be argued that it is the gravitational force between H_2 molecules that made them come close to each other. But if gravitational force between two H_2 molecules separated by a distance of just 1 cm is calculated, then it turns out to be 7.485×10^{-60} N, which is a force required to lift up 7.485×10^{-58} gram of weight on earth, almost a negligible force and cannot be considered as an attractive force. Also, it can be argued that there are heavily dense clouds in space called the nebulas, tons of hydrogen may be there. But still it is about a gas not any solid object. Gas molecules cannot stick to each other because gas molecules are very loosely packed. It is the property of a gas. Moreover, in everyday life, a lot of dense clouds can in the sky but they never form any spherical shaped small clouds in between them. Scientists say that gravitational force is a very weak force, and a weak force cannot combine gas molecules together and form a massive star. Moreover H_2 molecules never combine with each other on earth's gravity even under high pressure, what more to say about empty space where there is so less gravity and almost negligible pressure.

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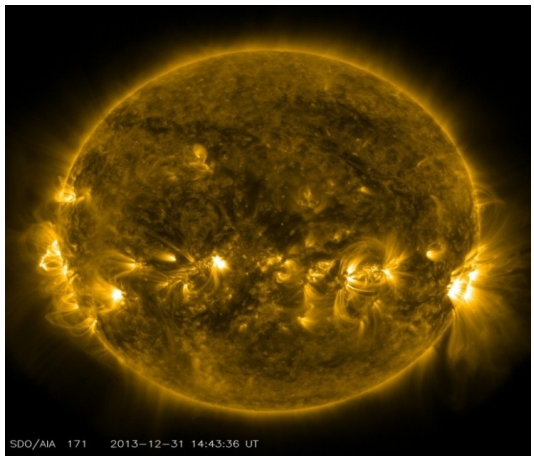

Fig 1 | Quiet Corona and Upper Transition Region of the Sun (Photo credit- NASA/SDO)

The above picture fig 1, is a filtered photograph of our sun. It can be seen clearly that it is nearly a perfect sphere. Its equatorial diameter and polar diameter differ by only 6.2 miles (10 km). The mean radius of the sun is 432,450 miles (696,000 kilometers), which makes its diameter about 864,938 miles (1.392 million km). The circumference of the sun is about 2,713,406 miles (4,366,813 km). The sun is mostly composed of the elements hydrogen (H) and helium (He). By mass the composition of the sun is 75 percent hydrogen and 25 percent helium [2]. Various metals make up less than 0.1 percent of the mass of the sun. The temperature of the sun's surface is about 10,340 degrees Fahrenheit (5,726 degrees Celsius) and the temperature of the core can reach more than 27 million degrees Fahrenheit (15 million degrees Celsius) which makes it the hottest celestial body of our solar system. But, it seems impossible to imagine that hydrogen molecules somehow combine with each other due to their own gravitational attraction and forms an extremely hot ball of fire just like our sun.

Let us understand how compressible hydrogen gas is. To exist as a liquid, H_2 must be cooled below hydrogen's critical point of 33K. However, for hydrogen to be in a fully liquid state without boiling at atmospheric pressure, it needs to be cooled to 20.28 K (-423.17 °F/-252.87 ℃) [3]. Liquid hydrogen is typically used as a concentrated form of hydrogen storage fig 2. As in any gas, storing it as liquid takes less space than storing it as a gas at normal temperature and pressure. However, the liquid density of hydrogen is very low compared to other common fuels. The density of liquid hydrogen is only 70.99 g/L (at 20 K), a relative density of just 0.07, so it is not a pure liquid [4]. And even with thermally insulated containers it is difficult to keep such a low temperature, hydrogen gradually leaks away.

Fig 2 | Liquid Hydrogen fuel tank (Image Credit- Tiia Monto)

It is also possible to produce solid hydrogen. Solid hydrogen is the solid state of hydrogen, achieved by decreasing the temperature below hydrogen's melting point of 14.01 K (-259.14 ℃). Solid hydrogen has a density of 0.086 g/cm^3 making it one of the lowest-density solids [5]. At low temperatures and at pressures up to around 400 Giga Pascals, hydrogen forms a series of solid phases formed from discrete H_2 molecules. Phase I occur at low temperatures and pressures, and consist of a hexagonal close-packed array of freely rotating H_2 molecules. Upon increasing the pressure at low temperature, a transition to Phase II is a broken-symmetry structure in which the H_2 molecules are no longer able to rotate freely. If the pressure is further increased at

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low temperature, a Phase III is encountered at about 160 Giga Pascals. Upon increasing the temperature, a transition to a Phase IV occurs at a temperature of a few hundred Kelvin at a range of pressures above 220 Giga Pascals [6][7].

We all know space is uniform. There cannot be a particular area where there is a very high pressure and very low temperature and so hydrogen molecules were forced to combine with each other. If there were oxygen molecules then hydrogen molecules would rather combine with oxygen molecules to form water (H_2O). It is also not that simple but still just saying.

Again, physicists continue their statements- *"As it contracts, the atoms of the gas collide with each other more and more frequently and at greater and greater speeds – the gas heats up. Eventually, the gas will be so hot that when the hydrogen atoms collide they no longer bounce off each other, but instead coalesce to form helium. The heat released in this reaction, which is like a controlled hydrogen bomb explosion, is what makes the star shine. This additional heat also increases the pressure of the gas until it is sufficient to balance the gravitational attraction, and the gas stops contracting. It is a bit like a balloon – there is a balance between the pressure of the air inside, which is trying to make the balloon expand, and the tension in the rubber, which is trying to make the balloon smaller. Stars will remain stable like this for a long time, with heat from the nuclear reactions balancing the gravitational attraction."*

Firstly, hydrogen gas requires very high pressure to contract. They will never contract due to their own gravitational force no matter how many tons of hydrogen gas may be there in space.

Secondly, if it is still assumed that hydrogen gas molecules may come close to each other due to their gravitational attraction and also starts colliding with each other, then the molecules will acquire high kinetic energy, and due to increase in kinetic energy they will acquire heat and immediately move away from each other avoiding their gravitational force, they will not come close and stick to each other without any external high pressure. To understand how this happens, let us discuss about how particles are arranged in the three states of matter.

Particles in a solid are tightly packed with each other, usually in a regular pattern. Particles in a liquid are close to each other but no regular arrangement. And particles in a gas are well separated from each other with no regular arrangement and they move freely at high speeds, fig 3.

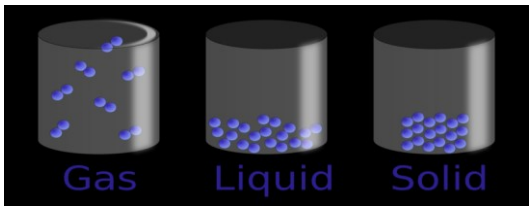

Fig 3 | States of Matter (Image Credit- Yelod)

Let's talk more about the properties of gases. Gases have no fixed shape and no fixed volume and lower density compared to other states of matter. Particles have a lot of kinetic energy. Gases are easy to compress and they occupy far more space compared to liquids and solids. They are expandable and they fill their containers. It can be assumed that the volume of a gas is equal to the volume of its container. There is another characteristic property of a gas and that is the pressure the gas exerts on its surroundings. The pressure of a gas becomes larger as more gas is added to the container [8]. So these are all the properties of gases.

So, firstly chemists say that gases expand and the particles of gases move freely at high speeds but then again physicists say that gases contract and the particles of gases come close to each other due to their own gravitational force. The two facts cannot be true at the same time, out of these two only one should be correct and the other should be completely false.

To understand the correct fact, let us talk about what we see in our everyday life. Normally we see gases expand, they move freely at high speeds and they never contract due to their own gravitational force or form a spherically shaped dense region of gas. So in the above case, if the first statement is correct then the second one should be false.

The process by which gases can be converted into liquid is called condensation. Many gases can be put into a liquid state at normal atmospheric pressure by simple cooling. Condensation can also produce water droplets on the surface of soda cans or

bottles of cold drinks. When warm air hits the cold surface, it reaches its dew point and condenses, this leaves droplets of water on the bottles or cans. Scientists say that the regions where stars are formed are extremely cold regions. And because of such low temperatures, gases bind together forming clumps of high densities. When the density reaches a certain point, a star is formed.

But one thing that should be noted is that it is not so simple that gas particles will bind together to form a high density region without the application of pressure. On earth due to atmospheric pressure, gases form liquids at low temperatures even without external pressure. But in space, there is no atmospheric pressure and without atmospheric pressure it is very difficult for a gas to convert itself into a higher density state.

But still, let us think that due to very low temperature and gravitational force between the particles, gases have been converted to higher density states in space. And that high density gas will have more gravitational force within them and because of which they will attract more and more particles and get compressed. So the volume of the entire region will decrease. According to Boyle's law, the pressure of a given mass of a gas is inversely proportional to its volume.

$P \alpha (1/V)$

So as the volume of the region decreases, the pressure increases. And as the pressure increases, the temperature also increases. Because according to Charles' law of pressure, the pressure of a given mass of a gas is proportional to its absolute temperature.

$P \alpha T$

Again, as the temperature increases, the volume of the gas also increases. Because according to Charles' law of volume, the volume of a given mass of a gas is proportional to its absolute temperature.

$V \alpha T$

So, we see that if the gas compresses because of gravitational force between them, the temperature increases and as the temperature increases the volume of the gas again increases. Therefore the net work done is zero, nothing new has been done, compression and then again expansion, everything remains the same.

Moreover, the square of the root mean square speed of the particles of a gas is directly proportional to its absolute temperature.

$V_{rms}{}^2 \alpha T$

So a slight increase in the temperature will cause the particles of the gas to separate from each other and they will run away with much higher speeds. So practically, it is not possible for a gas to automatically compress and form a densely packed spherical region, let alone be a star.

Thirdly, let us still assume that somehow hydrogen and also other gases compressed. Scientists say that the compressed hydrogen gas will be so hot that it will start nuclear fusion process and hydrogen atoms will merge with each other to form helium atoms. But nuclear fusion reaction does not start with a few degrees in temperature, more than 100 million Kelvin temperature is needed to start fusion. Gravitational force between hydrogen molecules is very weak and do not have so much strength that it will hold hydrogen molecules together at such high temperatures, hydrogen gas will explode like a bomb, it cannot remain as a "controlled hydrogen bomb". Let us ignore nuclear fusion, if a vessel containing hydrogen gas is heated up to just a few degrees, the vessel expands if it is flexible enough and if the vessel is not flexible enough then increase in temperature continuously will result in an explosion, what more to say about the gravitational force between molecules. Yes, it can be argued that a star has a lot of mass inside it for gravitational force to hold atoms or molecules together as gravitational force increases with mass. But if the gravitational force between two bodies of mass 100 kg separated by a distance of just 1 cm apart is calculated, then the answer comes out to be 6.67×10^{-3} N, which is a force required to lift up a 0.667 gm of weight on earth, not even 1 gm. So, it can be clearly seen that gravitational force is a very weak force.

If a bottle of compressed hydrogen gas or any other gas is taken in space and then open the lid of that bottle the gas molecules will escape out of that bottle with very high speed because there is no outward pressure from space to stop them. Gravitational force between individual hydrogen molecules is not sufficient enough to stop the gas from escaping the bottle.

Also, scientists predict that any electrical or magnetic disturbances between hydrogen molecules may have caused them to collapse with each other. It means that as hydrogen is in Group 1 of the periodic table so it may have some metallic properties,

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and because of which there may be a kind of magnetic attraction between hydrogen molecules. For that let us study a research about metallic hydrogen.

There was a thought among chemists to convert hydrogen gas into a solid metal. As hydrogen is in group 1 elements so scientists thought it should have metallic properties. Eugene Wigner and Hillard Bell Huntingdon first proposed in 1935, that under immense pressures a molecular hydrogen lattice will break apart into atomic hydrogen with electrons flowing freely through the material. Both agreed this state would only reveal itself if hydrogen was placed under a pressure of at least 25 Giga Pascal. Eugene Gregoryanz from the University of Edinburgh, UK along with his group conducted an experiment in a quest to convert hydrogen gas into some solid or semi-solid form. He said that researchers have already hit pressures 10 times greater than 25 G Pa but still there was no sign of hydrogen's metallic state. Gregoryanz's group was exploring hydrogen's states at room temperature by placing the gas between the flattened tips of two diamonds. The tips are slowly brought together in a diamond anvil cell, with the cell temperature held at 300K. Using this method, the team has achieved reported pressures of up to 388 G Pa, but there was no sign of any solid metallic hydrogen [9][10].

Finally, Gregoryanz explains that at such high pressures, metallic hydrogen may only exist as a superfluid - an exotic, frictionless state of matter. He further continues, *"All of the superconductors that we know are solid …….. and all superfluids are insulators, this liquid hydrogen would be a superconductor and superfluid at the same time—nothing like this has ever been observed."*

But recently, for the first time, it was claimed that metallic hydrogen has been created by squeezing it at extremely high pressures. Issac Silvera and Ranga Dias at Harvard University declared that they used the flattened tips of two synthetic diamonds to squeeze solid hydrogen at low temperatures until the atoms were so packed that they started to share electrons. The shared cloud of electrons indicated a transition into a metallic state, making the hydrogen shiny and electrically conductive. The pair managed to turn hydrogen metallic at an extremely high pressure of 495 Giga Pascals, which is beyond the pressure of Earth's core that is 360 Giga Pascals [11][12]]. But not every experiment has a happy ending.

Twenty-eight days after the paper was published, the sample of metallic hydrogen vanished. Issac Silvera expressed disappointment, speculating that his precious sample had gotten lost or simply vaporized back into gas. But the most interesting fact about this experiment is the amount of pressure applied which is 495 Giga Pascals. How it can be expected that hydrogen may show some metallic properties or have some magnetic attraction between molecules in empty space where there is so less pressure!! *Another important thing that should be noticed is that even at such extremely high pressures there is no gravitational attraction between hydrogen molecules, what more to say about hydrogen in empty space.*

Some great thinkers also say that it may the hydrogen bonding that has caused hydrogen molecules to stick to each other. But hydrogen bonding only occurs in certain molecules containing hydrogen like water and also in some organic molecules like the peptide bonds joining amino acids to form proteins, the bonds that hold the two strands of the double helix of DNA. Hydrogen molecules themselves do not form hydrogen bond. Moreover we are talking about gravitational force, not about chemical bonding.

So there is no way that hydrogen molecules will combine automatically with each other in empty space; not only hydrogen gas, any gas cannot combine automatically in space to form a massive star, this is not the property of a gas. But still, if scientists believe that hydrogen molecules combined with each other to form a massive star and also started a nuclear fusion process to produce heat and light then there must be a totally different story!!

May be deep inside the darkness of space, an **unknown, exceptional, mysterious, extremely attractive force** initiated in a particular region which compelled Hydrogen molecules present in that region to come close to each other and form a tightly packed spherical cloud of gas just like iron powder gets attracted if a magnet is placed nearby fig 4, they are forced to come closer. Without any magnetic force iron powder never comes close to each other automatically no matter how many kilograms of powder may be there.

Fig 4 | Ironpowder on Magnet (Image Credit- JanDerChemiker)

May be the core of each and every star, planet and even galaxy is not an ordinary core (*Core is said to be the centre, it is a region where the temperature and pressure are sufficient enough to ignite nuclear fusion*). May be the core is made up of some type of material that is not known to us till today or it is an invisible 'touchless material' that can never be detected by any material detector, or it is not a material at all, may be it is an exceptional force generated from the fabric of space that has the ability to attract matter towards itself. Dark core can be a suitable name for that mysterious object, dark in the sense that it is some unknown, extraordinary, exceptional force that attracts every matter particle towards itself but remained unnoticeable for a long time as it hides itself deep inside the darkness of space.

Every galaxy, every star and every planet must have a dark core inside. Our earth should also have a dark core exactly at its centre and thanks to the attractive force of the dark core that we are standing on earth and not floating in space. What we call as gravitational force of any planet is actually the attractive force of that dark core inside and the strength of gravitational attraction is also decided by the power of the dark core. Stronger the force of the dark core, stronger will be the gravitational force of that planet.

Now let's talk about the atmosphere of planets. Not every planet in this universe has an atmosphere of different gases surrounding it. It depends on how powerful the dark core is. If a planet has a powerful dark core inside, then it will have enough attractive force within it to hold even gases on its surface. As many planets can hold gases, so they form an atmosphere on their surface. But planets or moons of planets whose dark cores are not so powerful cannot hold gases and so do not form an atmosphere. Our moon also has a weak dark core and so its gravitational force is not strong enough to hold atmosphere onto it.

But every planet which has an atmosphere does not mean that it can hold hydrogen gas. Hydrogen being the lightest element easily escapes out in space and so it is not easy to hold as an atmospheric gas. To hold hydrogen gas on its surface a very powerful dark core is required. Our earth does not have that powerful dark core to hold hydrogen gas on its atmosphere but thankfully it can hold oxygen and water on its surface which is essential to sustain life. Planets like Jupiter which has a very powerful dark core can even hold hydrogen gas on its atmosphere.

Sir Isaac Newton introduced the law of gravity which is also known as Newton's law of universal gravitation. It states that every particle attracts every other particle in the universe with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres.

The equation for universal gravitation thus takes the form:

$$F \alpha \frac{m_1 m_2}{r^2}$$

Where F is the gravitational force acting between two objects, m_1 and m_2 are the masses of the objects, r is the distance between the centers of their masses, and G is the gravitational constant.

But in everyday life such a phenomenon is not seen, like for example a big aeroplane never attracts a person standing nearby, or a gigantic ship never attracts a small boat passing nearby or a train never attracts a passenger standing on the platform or a massive hill never attracts a small bird flying above it or a huge building cannot attract even a small piece of paper. May be the theory of gravity is partially true, may be only objects (like stars, planets and galaxies) which have that exceptional 'dark core' inside only attract objects towards it and others don't. And, maybe this is the reason why objects inside a spaceship (which is far away from earth's gravitational field) are never attracted by the walls of that spaceship, instead it floats freely as if it has no

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gravitational force at all. May be this is the reason why sand, dust, small particles and even massive rocks and stones that are kilometres long and wide float freely in space, they do not attract each other because they do not have that 'dark core' inside. And even, if it is considered that masses attract each other due to their gravitational force, that force is not sufficient enough to combine molecules of a gas like hydrogen and also start a nuclear fusion process.

Now, let's predict the most possible theory for the formation of stars and galaxies. It is true that hydrogen and also other gases and also particles were all densely spreader over a large area in space but they were not attracting each other. But then something strange happened, a mysterious, unknown force initiated in that region of space, which forced particles and gases including hydrogen to come close to each other just like a magnet attracts iron dust towards itself. As gases came closer and closer they got compressed more and more and at one time became so hot that they started a nuclear fusion process, which released tremendous amount of energy in the form of heat and light. The dark core inside became the centre of the star. Not only one dark core originated, trillions of dark cores emerged from the darkness of space and therefore formed all the planets and stars that is seen in our universe. Now, let us also predict about the birth of a solar system with the help of some diagrams.

Let's look at the picture below. Consider that iron powder is speeded all over a white sheet fig 5. Imagine that the powder is gases and dust particles speeded over a large area in space.

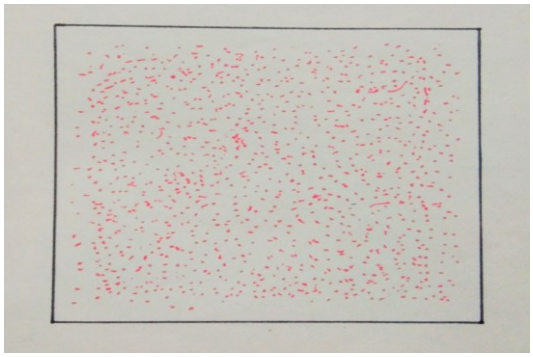

Fig 5 | Iron powder spreaded over a white sheet

Now, some spherical magnets of different sizes are placed on that white sheet fig 6. Let's consider these magnets as 'dark cores' forcing dust and gases to come closer and combine with each other. Also, let's consider the magnitude of attraction with respect to the size of the magnets, the one which is bigger will have more attraction than the smaller ones. The magnet named 'C' has the strongest attractive force and has the ability to move other magnets nearby.

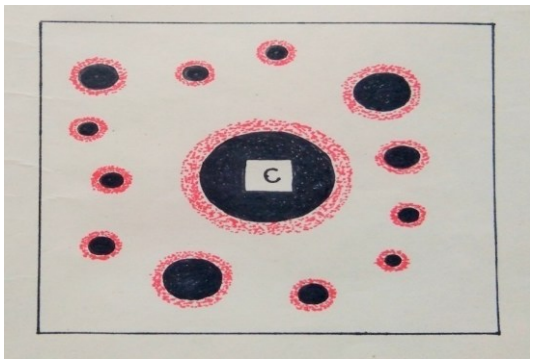

Fig 6 | Placing magnets of different sizes on the white sheet

So, the next thing that will happen is that iron powder will be attracted to all the magnets. The biggest magnet at the centre named as 'C' will attract more iron powder than the other small magnets.

Now, suppose the central magnet 'C' starts rotating on its own axis (say clockwise) fig 7. The iron powder attached to its body will also start rotating.

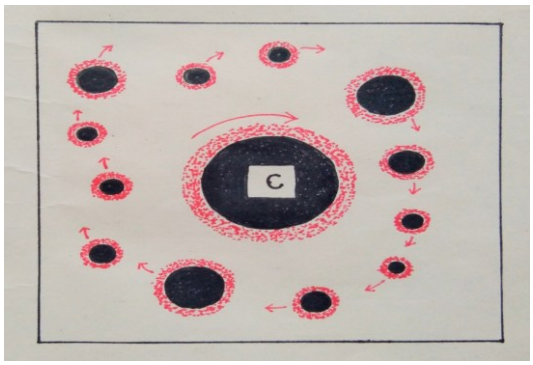

Fig 7 | Rotation of the magnets

Again, due to its strong attraction, the other small magnets will also start revolving around it, and thus form a solar system. Although, it looks very easy but practically it's not that simple. Let us see an example.

Earth revolves around the sun in an elliptical orbit, not in a complete circular motion. The revolution of earth around the sun takes 365.26 days. The earth's orbital path is not a perfect circle, instead it is an ellipse, which means that it is a slight oval in shape. This creates areas where the earth is sometimes farther away from the sun than at other times. The perihelion is the point in the orbit where it is nearest to its orbital focus. And aphelion is the point where it is farthest from its focus. Earth is about 147.1 million kilometres from the Sun at perihelion around January 3, and about 152.1 million kilometres at aphelion around July 4, a difference of about 5 million kilometres. Earth's orbit has an eccentricity of 0.0167. Earth orbital speed averages about 30 km/sec. The orbital eccentricity of an astronomical object is a parameter that determines the amount by which its orbit around another body deviates from a perfect circle. A value of 0 is a circular orbit, values between 0 and 1 form an elliptical orbit, 1 is a parabolic escape orbit and greater than 1 is a hyperbola.

If gravitational force from the Sun alone would have been responsible for the revolution of planets, then planets should have revolved around the Sun in a more circular orbit rather than an elliptical orbit just like a pebble attached to a string and rotated by your fingers. Our earth also should have revolved in a circular manner around the Sun, but it is observed that our earth revolves in an elliptical manner and importantly it has a farthest point called the aphelion and also a nearest point called the perihelion from the Sun. So, it can be predicted that there must a 'guidance path', an invisible track to tell planets how to revolve around the Sun, just like a train is guided by a railway track while moving. And therefore, planets never make any mistake for they follow that invisible path set by nature.

Consider a train running on an elliptical railway track fig 8, the motion of the train will always be elliptical.

Fig 8 | Elliptical railway track and its movement around its own axis

Now imagine, if the railway track itself starts rotating in a clockwise or anti-clockwise direction, then the motion of the train will be like the petals of a flower as shown above. Possibly, the same thing happens in case of Mercury's orbit. Mercury revolves around the Sun in an elliptical orbit, but it was noticed that the orientation of Mercury's orbit was processing, like the figure below fig 9.

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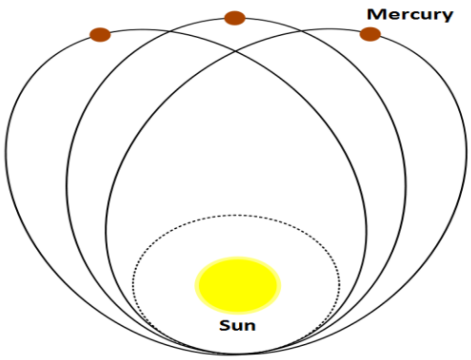

Fig 9 | Perihelion precession of Mercury (Image Credit- Dhenry)

Not just Mercury, the elliptical orbits of all planets in the Solar System processes around the Sun. The above statement that planets might follow invisible tracks and those tracks itself rotates slowly over time can be a possible explanation for the 'precession'.

Now, let us understand about the formation of galaxies. The process behind formation of galaxies is a bit complicated. And here again the dark core plays an important role. It can also be said as a 'dark force' because it may not be any kind of material substance; it is a mysterious force that attracts matter towards itself. A very powerful dark core or dark force not only attracts matter towards itself, it can even bend the fabric of space, and compel the space fabric (with all the stars present in that space fabric) to move along with it. To understand everything, let us first look at some pictures.

The picture below is a white napkin with some black dots on it fig 10. Consider all the black dots as stars and the napkin as fabric of space.

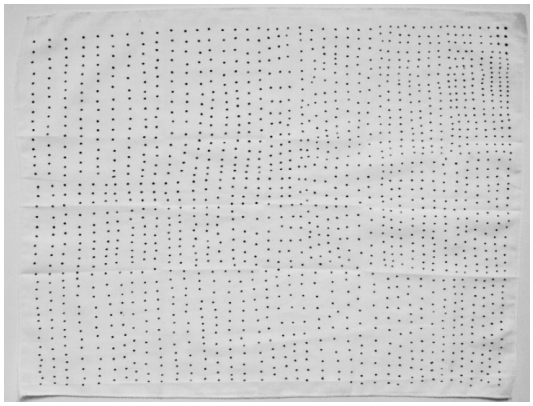

Fig 10 | A white napkin with some black dots on it

Now, a clip is placed exactly in the middle of the napkin fig 11. Consider this clip as the dark core or the dark force at the centre of a galaxy.

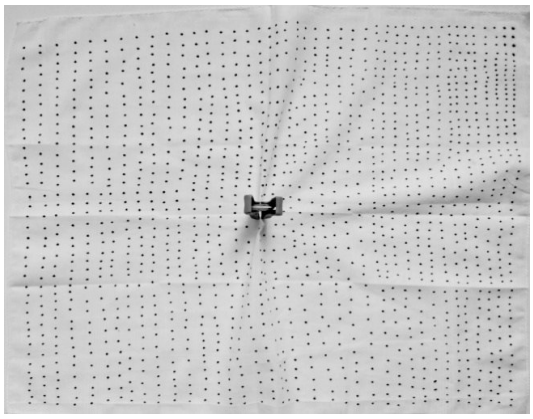

Fig 11 | A clip placed exactly in the middle of the napkin

Now, if the clip is rotated then the napkin along with all the black dots present there will also become twisted as shown in the figure below fig 12.

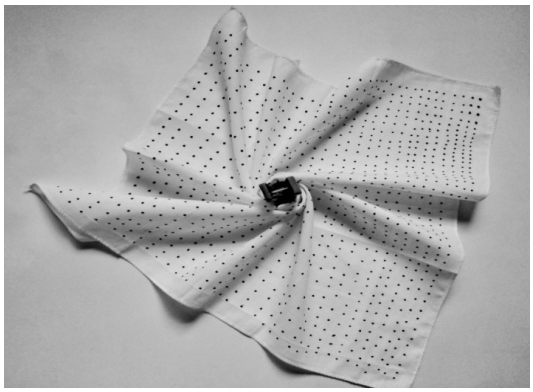

Fig 12 | The whole napkin gets twisted as the clip rotates around its own axis

And the most important thing is if the clip is rotated further the whole napkin (space fabric) will start rotating with the clip including dots (stars) closer to the centre and dots (stars) far away from the centre, near the edges. Now, if the clip is carefully removed, then the picture will look like this below fig 13.

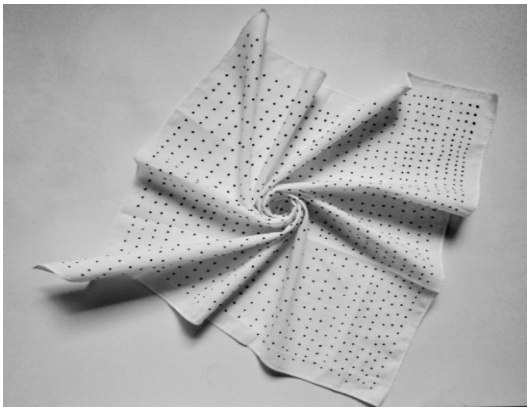

Fig 13 | Picture of the napkin after removing the clip

If the above picture is carefully compared with a spiral galaxy fig 14 then it appears quite the same.

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Fig 14| The Whirlpool Galaxy (Spiral Galaxy M51, NGC 5194) is a classic spiral galaxy located in the Canes Venatici constellation. (Image Credit- NASA, ESA, S. Beckwith (STScI), and The Hubble Heritage Team STScI/AURA))

The spiral arms matches a lot with the folds created while twisting the napkin if the arrangement is carefully noticed. The spiral arms of the galaxy are more circular because of the resistance that occurred while twisting the space fabric whereas the folds of the napkin appear straight because there was no resistance while twisting it, also the dark core of the galaxy moved from its position in the direction of rotation making the spiral arms a lot more circular. The powerful dark core or dark force situated exactly at the centre of the galaxy bends and twists the whole fabric of space along with all the stars present in that space fabric and as the dark core rotates the whole fabric of space also rotates along with it. This is the reason why stars over a large range of distances revolve around their galaxy's centre at equal or increasing speed, fig. 15 which is not similar to the orbital velocities of planets because orbital velocities of planets in planetary systems and moons orbiting planets decline with distance just like orbital velocity of Mercury around the Sun is 47.36 km/s while orbital velocity of Neptune is only 5.43 km/s [13], [14]. This phenomenon has been effectively researched by Vera Rubin, an astronomer at the Department of Terrestrial Magnetism at the Carnegie Institution of Washington in the late 1960s and early 1970s. She worked with a sensitive spectrograph that could measure the velocity curve of edge-on spiral galaxies to a greater degree of accuracy than had ever before been achieved. Together with fellow staff-member Kent Ford, Rubin announced at a 1975 meeting of the American Astronomical Society the discovery that most stars in spiral galaxies orbit at roughly the same speed [15], [16].

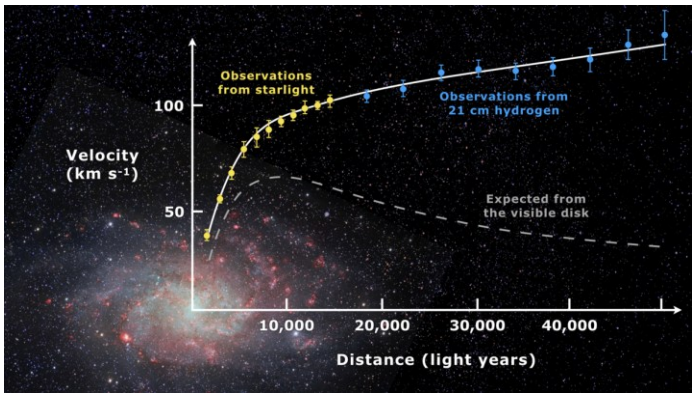

Fig 15 | Rotation curve of spiral galaxy Messier 33 (Image Credit- Mario De Leo)

Scientists gave a lot of explanations for this. They said that there must be some kind of mysterious matter known as the "Dark Matter" and a "dark matter halo" is a theoretical component of a galaxy that envelops the galactic disc and extends well beyond the edge of the visible galaxy. They argue that without the presence of large amount of invisible mass throughout the galactic disc, the rotational velocity of stars at large distances from the galactic centre would decrease, just as the orbital speeds of the outer planets decrease with distance from the Sun. But, as discussed earlier everything can be explained in a very simple manner

with the help of some suitable pictures and there is no requirement of so called "Dark Matter" to explain that. Also, as a matter of fact "Dark Matter" has never been detected experimentally and there is also no guarantee that it will ever be found practically.

Moreover, there are proofs that the predicted theory is correct and which is explained further. If some pictures of spiral galaxies are noticed carefully fig 16, then it can be seen that the centre of every spiral galaxy is bright.

Fig 16 | (Left) Galaxy Messier 101 (M101, also known as NGC 5457 (Credit-European Space Agency & NASA- Project Investigators for the original Hubble data: K.D. Kuntz (GSFC), F. Bresolin (University of Hawaii), J. Trauger (JPL), J. Mould (NOAO), and Y.-H. Chu (University of Illinois, Urbana)) (Right) Hubble view of barred spiral galaxy Messier 83 (Credit- NASA, ESA, and the Hubble Heritage Team (STScI/AURA) Acknowledgement: William Blair (Johns Hopkins University))

This happens because the number of folds of the space fabric near the centre is more, also the density of stars and gases increases as we move towards the centre. If a closer look is given to the napkin below fig 17, the same thing can be seen.

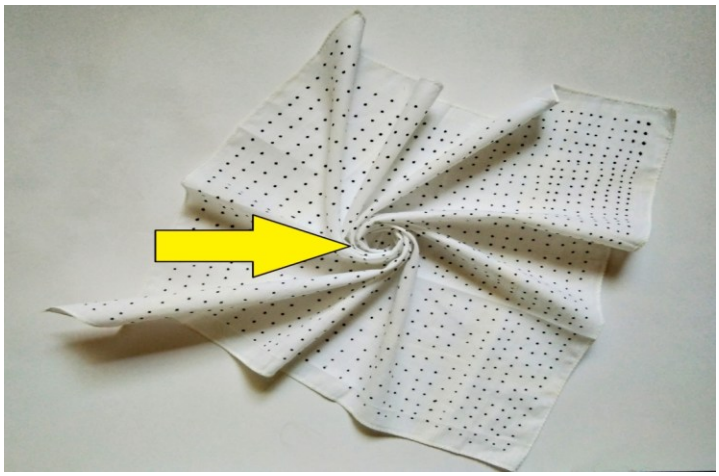

Fig 17 | Number of folds of the napkin near the centre is more compared to other areas

Now, the most important thing that should be discussed here is that the surface of a spiral galaxy is not like a flat disc, it is actually corrugated. Let's have a closer look at the surface of the napkin below fig 18, as it became twisted so the surface became wavy or corrugated.

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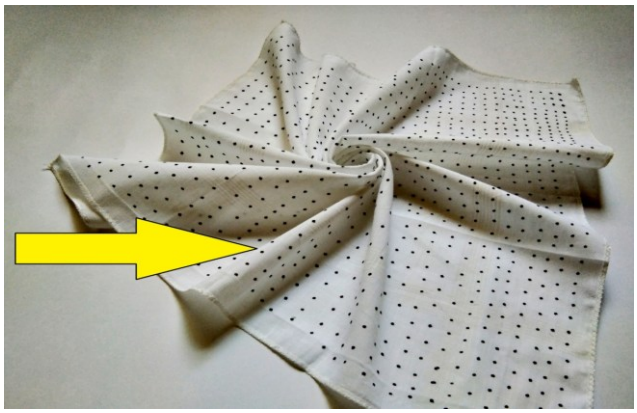

Fig 18 | Wavy or corrugated surface of the napkin

In the same way, as the fabric of space becomes twisted around the centre of a spiral galaxy, therefore the surface also becomes corrugated. Our milky way is also a spiral galaxy, and so the surface of the milky way is not flat, it is also corrugated, one layer up-one layer down, again one layer up-one layer down. And this has been discovered in the year 2002, but no one had a proper answer as to why it is corrugated.

In 2002, Heidi Newberg (Rensselaer Polytechnic Institute) and colleagues found several clumps in the density of stars at the disk's outermost edge, a clumpy structure now called the Monoceros Ring. Looking out along the disk with the galactic centre behind us, the structure is seen 30,000 light years from the Sun, meaning it's roughly 60,000 light years from the galactic centre. (The Sun is about halfway between the galactic centre and the disk's presumed edge).

Other astronomers later found another structure, called the Triangulum Andromeda Stream, beyond the Monoceros Ring. This one seems to lie something like 80,000 light years from the galactic centre, beyond where we think the disk ends. Yan Xu (now of the National Astronomical Observatories of China), Newberg, and colleagues have returned to the 2002 SDSS observations to look at an additional hint of structure that didn't seem to belong to either of these. The astronomers used stars' true magnitudes to determine how far away the stars had to be in order to look as faint as they do (and accounting for all the dust between us and them). Oddly, they found four separate structures: two of them the Monoceros and Triangulum Andromeda ones, plus two more lying between us and Monoceros. The closest is about 6000 light years out from the Sun, with each subsequent structure lying roughly 6000 light years beyond the previous one, almost like evenly spaced lumps fig 19 [17]. This shows that the surface of our Milky Way galaxy is not flat but corrugated.

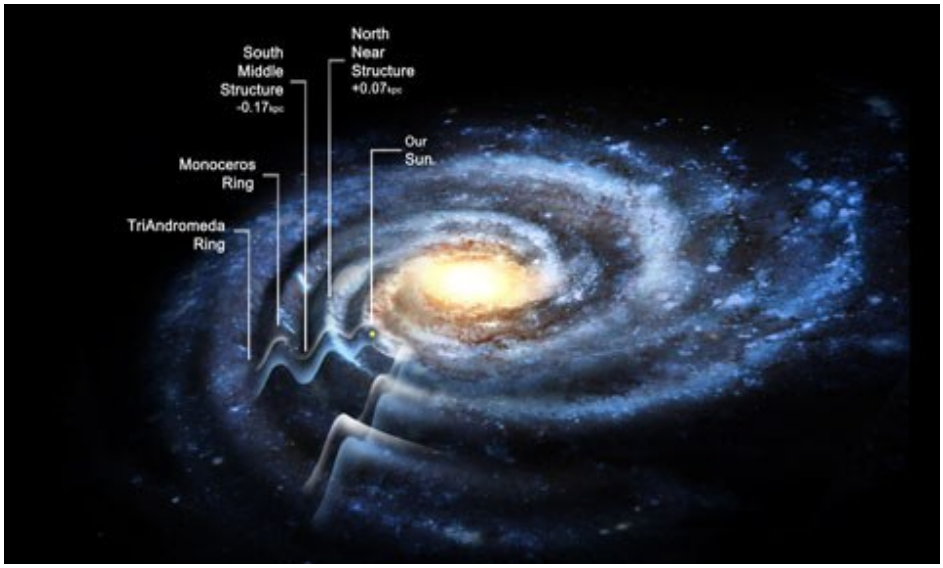

Fig 19 | Artist's impression of Ripples in Milky way Galaxy (Image credit- Rensselaer Polytechnic Institute)

This is an artist's impression of how the ripples of our Milky way galaxy look like. As already explained before, these ripples are caused because the fabric of space becomes wavy when it gets twisted by the dark core.

So far the discussion was only about spiral galaxies, now let's discuss about some other type of galaxies. The basic idea is the same; every galaxy has a dark core at its centre. If the dark core does not rotate on its own axis then an elliptical galaxy is formed. The photograph below, fig 20, shows a picture of an elliptical galaxy.

Fig 20 | Elliptical galaxy NGC 1316 (Image Credit- NASA, ESA, and The Hubble Heritage Team (STScI/AURA))

Also, one thing that should be noted here is that if the dark core does not rotate, then it contracts the fabric of space. Therefore, in an elliptical type galaxy the space fabric gets contracted around the centre. There may be a gigantic galaxy where there are very few stars or no stars at all (only gases), still the few stars or gases will not fly away or escape out in empty space, they will stay in that particular region because the dark core will contract the space fabric around it and also the strong attractive force of it will not allow anything escape out from that region. One example of it is the Galaxy named Dragonfly 44, fig 21.

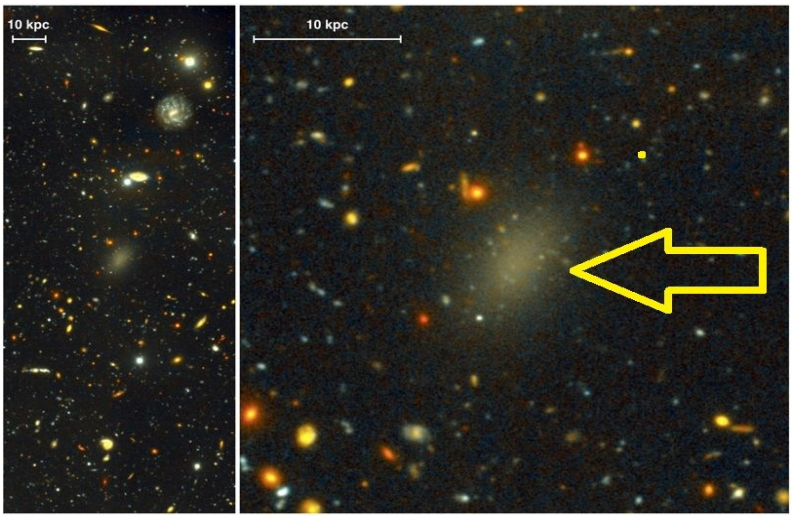

Fig 21 | Dragonfly 44 (Image Credit- Pieter van Dokkum, Roberto Abraham, Gemini Observatory/AURA)

This galaxy is about 300 million light years away from earth. This galaxy is very dim, it has very few stars. But when astronomers were observing it, they noticed that these stars are not drifting apart, they were staying together. And interestingly, this galaxy is about the size of our own galaxy, Milkyway. This proves that the dark core at the centre of this galaxy contracted the fabric of space around it and therefore holding together those few stars and gases and not allowing them to move away from that region.

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Now, if the dark core of a galaxy remains stable and motionless for a long time and then suddenly starts rotating then a barred spiral galaxy will be formed fig 22.

Fig 22 | Barred spiral galaxy NGC 1300 (Image Credit- NASA, ESA, and The Hubble Heritage Team STScI/AURA))

The above picture is the galaxy NGC 1300, if a closer look is given then it can be seen that the middle portion is like an elliptical galaxy and only the outer portion is spiral in nature, this happened because the dark core at the centre of this galaxy was stable and motionless in the beginning, therefore it formed an elliptical galaxy but later on the dark core started rotating around its own axis and so only the outer portion twisted to form a barred spiral galaxy.

Similarly, if the dark core of a galaxy rotates with various axis of rotation having different angles then a peculiar galaxy is formed, fig 23.

Fig 23 | Peculiar galaxy NGC 3256 (Image Credit- NASA, ESA, the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration, and A. Evans (University of Virginia, Charlottesville/NRAO/Stony Brook University))

There are many other types of galaxies, but the basic principle remains the same. All galaxies have dark cores at their centres and the rotation of the dark core determines whether the galaxy will be an elliptical galaxy or a spiral galaxy, also the size and density of a galaxy depends on the attractive force of the dark core.

So, it can be seen how dark core plays a very important role in the formation of stars, planets and galaxies. But the story is not yet over; dark core also plays an important role in the formation of different types of nebulas. A nebula is an interstellar cloud of dust, hydrogen, helium and other ionized gases. Exactly, at the centre of each nebula, there is a dark core, which holds different gases together and not letting them escape out of that region. The photograph below fig 24, is a ring nebula.

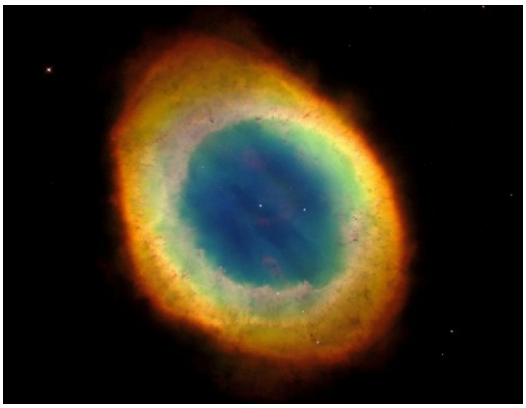

Fig 24 | Ring Nebula (Image Credit- The Hubble Heritage Team (AURA/STScI/NASA))

The dark core situated at the centre holds these gases together, gases near the centre are tightly packed, the density is more and hence the temperature is high, blue light near the centre indicates high temperature but as we move away from the centre, the density of the gases decreases and simultaneously the temperature also starts to decrease, the red light near the edges indicates decrease in temperature. So these type of nebulas are formed when the dark core at the centre is not rotating. But if the dark core rotates or rotated once then again it twists the fabric of space and nebulas like the Cats-eye nebula fig 25, are formed.

Fig 25 | Cat's-eye nebula (Image Credit- X-ray: NASA/CXC/SAO; Optical: NASA/STScI)

The above image can be compared with a helix ribbon as shown below, fig 26.

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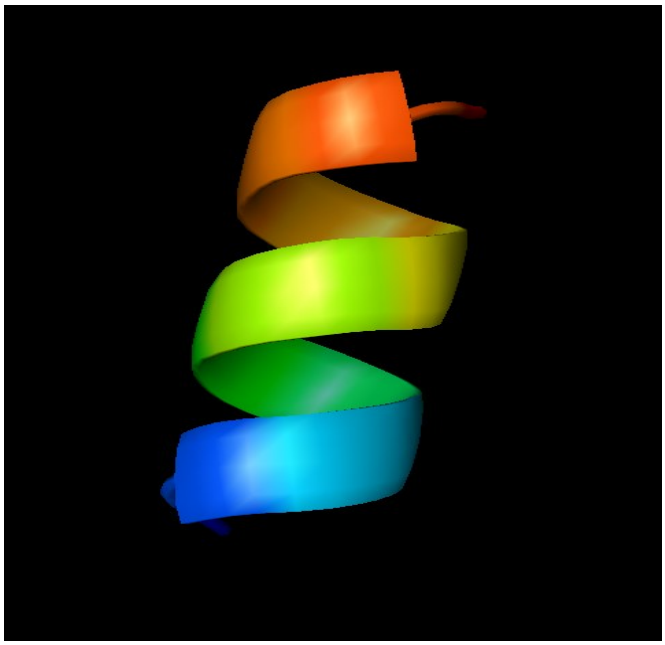

Fig 26 | Helix Ribbon (Image Credit – Trhuynh)

There are many other types of nebulas, but again the basic principle remains the same. Every nebula has a 'dark core' situated at the centre, and thanks to that dark core that ionized gases and dust particles remain within a fixed region of space and are not spreaded everywhere randomly.

So these are all about stars, planets and galaxies, till now only the names dark core or dark force have been mentioned but the nature of it has not been described yet. Well, the true nature of the dark core cannot be explained properly since very little is known about it. May be it is not any kind of material substance, may be it is a mysterious force generated from the fabric of space that has the ability to contract the fabric of space with all the objects present in that fabric and if it is a material substance then it should be a "touchless particle" that has the ability to attract matter particles but do not have the quality of "touch" and cannot be detected by any material detector.

So, till now gravity is explained in length and also about the 'dark core' which is present exactly at the center of every star and planet that pulls objects, particles and gases towards itself and that force is felt as gravitational force. But there is another thing that a 'dark core' pulls, and that is nothing but the fabric of space. Near the surface of a star, a planet or a galaxy, the fabric of space gets contracted and space becomes denser. This contraction and density of space depends on the strength of the 'dark core'. If the dark core inside is very strong and powerful like that of a galaxy, then the fabric of space will be highly contracted and space will be very dense. On the other hand, if the dark core is not so powerful like that of a planet or a moon, then the fabric of space will not be so much contracted and density of space will be low. To know how space contraction occur let's have a look at the picture below fig 27.

Fig 27 | Representing contraction of the space fabric with the help of a napkin and a bottle cap

Consider this round bottle cap in the middle as a star and the white napkin as the fabric of space. As we come closer to the star, space gets denser because the star continuously pulls the fabric of space towards itself and therefore gets contracted and it can also be seen in the picture above that the number of folds increases as we move closer to the surface of the star. Any object that occupies space will be affected by this contraction if it is inside that contracted space fabric. Infact, not just material objects, anything that is related to speed, distance and time will be affected by the contraction of this space fabric. Light, for example, which is not a material substance will also be affected because it is related to speed, distance and time. Unknowingly, scientists have been watching space contraction for decades but never realized it. Well, it is nothing but *gravitational lensing*.

The true fact about Gravitational Lensing will be explained in details, but first we have to make sure that gravitational lensing is not because of some Einstein's General Relativity stuff, it is because of the contraction of space fabric around the surface of a star or a galaxy, because of which space gets denser and the same principle known as refraction of light due to a denser medium is applied here.

And moreover, light can never be affected by gravity; it is something against the law of nature. If a tennis ball is thrown with a certain velocity and a certain angle with respect to the ground, it will form a parabolic path and fall back to the ground. But if a beam of light is fired in a similar manner, it will go straight up and never fall down, and the path will form a straight line, not a parabola. Again, if a coin is tossed in the air, it goes straight up with a high velocity but is slowed down gradually by gravity and after reaching a certain point it falls back to the ground; the same thing should also happen in case of light if light is affected by gravity, but it is seen that this is not the case because a laser beam fired towards a clear sky goes straight up and never comes down. Even subatomic particles like electrons which have real mass are very little affected by gravity, what more to say about light which is said to have no mass at all. Moreover, there are many stars that are nearly 100 times bigger than our sun so they must have tremendous gravity but still light rays are easily coming out of their surfaces, travelling a long distance and reaching our earth year after year, gravity isn't stopping those light rays. So, common sense tells us that light is not affected by gravity; therefore there is one option left for the distorted images of distant galaxies and that is nothing but refraction of light.

When a ray of light passes from a lighter medium to a denser medium it bends towards the normal, and this phenomenon is known as refraction of light. Like for example, a ray of light bends when it passes from air (lighter medium) to water or glass (denser medium) fig 28.

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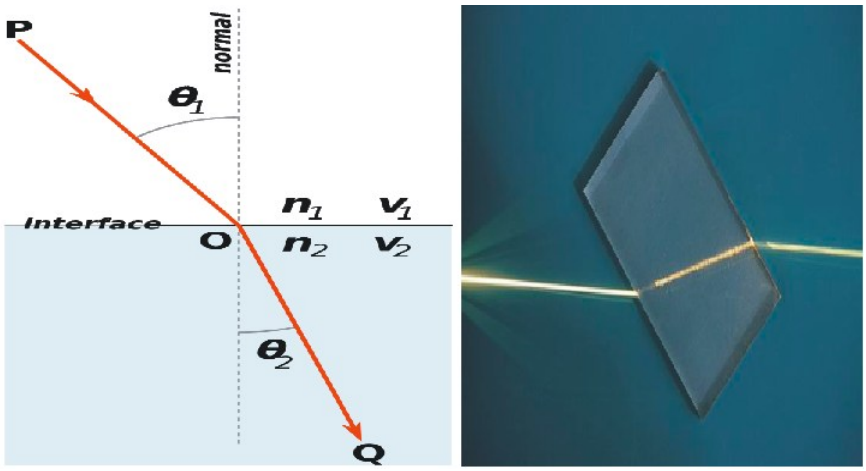

Fig 28 | (Left) [Snell's Law (Image Credit- Sawims, Oleg Alexandrov)]
(Right) [Refraction Photo (Image Credit- ajizai)]

The same thing happens near the surface of a star, fig 29.

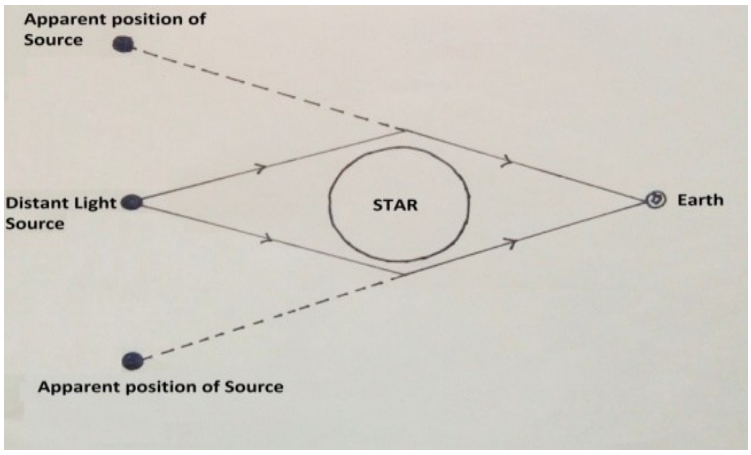

Fig 29 | Apparent position of light source due to the presence of a massive object in space

Let's have a look at the picture of this bubble very carefully, fig 30.

Fig 30 | Bubble (Image Credit- Alexas_Fotos)

Now, let us have a look at some real pictures of Gravitational Lensing, fig 31.

Fig 31 | (Left) HST-Smiling-Galaxy Cluster SDSS J1038+4849 (Credit- NASA/ESA Hubble Space Telescope), (Right) A Horseshoe Einstein Ring from Hubble (Credit- ESA/Hubble & NASA)

There is a great deal of similarity between the two pictures. First let us consider the bubble fig 30, even though the background is dark, still the bubble can be seen clearly, this is because light rays coming from a distance gets refracted and also reflected at the surface of the bubble. This bubble is a water-bubble, the refractive index of water is 1.333, which is more than air, so when light rays travels from a lighter medium (air) to a denser medium (water) it bends, forming a beautiful sphere of different colors. The same thing happens in case of gravitational lensing. The second photograph fig 31, shows a galaxy or cluster of galaxies and the blue arcs that is seen around are actually images of galaxies far behind the cluster that are distorted because of the contraction of space fabric around the clusters. Contraction of space fabric makes the region around the surface of a massive star or a galaxy very dense and when light rays coming from a distant source passes through that region, it gets bent because of the same principle known as refraction of light due to a denser medium. Therefore, the star or galaxy forms a spherical bubble or a thick spherical lens around itself.

If it was possible to view the fabric of space, then around the surface of a galaxy or cluster of galaxies the space fabric would have looked like a wave of water like the figure below, fig 32.

Fig 32 | Water Drop- Ripples of Water (Image Credit- Janeke88)

Although the wave of water travels outward away from the center, but in case of space contraction the wave will appear as if it is travelling inward towards the center because of the attraction of the dark core. If we notice carefully, the background image of the writings get distorted or stretched because of the wave, in the same way the background images of galaxies get distorted in case of gravitational lensing.

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Let us see one more picture of gravitational lensing where a clear distortion can be seen, fig 33.

Fig 33: | Gravitational lensing around the massive cluster of galaxies, Abell 68 (Credit- NASA and ESA)

It can be better said that a galaxy or cluster of galaxies surrounds itself a thick spherical lens of varying density which can form multiple images of the same object. An example that can be given is "Einstein's cross", fig 34.

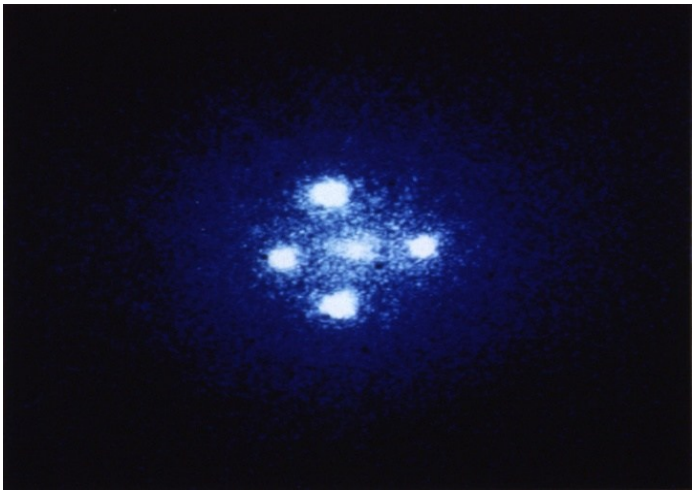

Fig 34 | Einstein cross (G2237 + 0305) (Credit- NASA, ESA, and STScI)

Light from a background quasar many billions of light years away is lensed by the presence of a massive galaxy to produce multiple images of the quasar, just like multiple images can be formed through a lens of varying density. The spherical lens consists of many layers of different densities, density increases as we move towards the center of a massive galaxy.

3. Conclusion

This paper tried to unlock every possible mystery about Gravity that remained hidden in the dark for a very long time. As a conclusive statement, it can be said that stars, planets and galaxies are not formed suddenly, randomly, accidentally or by chance simply by combination of gases and dust particles. They are formed only when there is a ***Rise of the Dark Force***.

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