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Formation and Evolution of Galaxies and Its Black Holes and Quasars

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Abstract: Galaxy formation and evolution is one of the most active research areas in astrophysics, so many people have studied this area. But since they didn't understand thoroughly the evolution law from satellite to planet then to star, their theories are very weak. In their theories, they proposed that large gas clouds collapsing to form a galaxy or more recently that matter started out in smaller clumps merged to form galaxy, which is incredible. Hence, the author of this paper, through studying the formation and orbit-variation of satellites, planets and stars, has put forward a new theory of galaxy formation and evolution, therefore revealing the hierarchical structure of galaxies and the formation and evolution of black holes and quasars.

Keywords: Galaxies: structure, galaxies: formation, galaxies: evolution, stars: black holes, stars: quasars.

1. Introduction

Galaxies represent the visible fabric of the Universe, therefore it is one of the most active research areas in astrophysics. As early as in 1601, Italy scientist Galileo first used his telescope to observe the Milky way, and he found that the white band of light was actually made up of countless stars. In 1785, *William Herschel* also studied the structure of the Milky Way and concluded that it was in the shape of a disk. but he incorrectly assumed the sun was in the centre of the disc, a theory known as Galactocentrism, which was eventually corrected by the findings of Harlow Shapley in 1918 [1]. Harlow Shapley used R. R. Lyrae stars to correctly estimate the size of the Milky Way Galaxy and the Sun's position within it by using parallax. He realized the Milky Way Galaxy was far larger than previously believed, and that the Sun's place in the galaxy was in a nondescript location [2]. By the 1920s, the Shapley model was recognized, but the traditional method to study the structure of the Milky way is optical method, which has its limitations. The radio and infrared techniques developed in recent decades have become a powerful tool for the study of galactic structure. Dutch astronomer Jan Hendrik Oort (28 April 1900 - 5 November 1992) was a pioneer in the field of radio astronomy, he has made significant contributions to the understanding of the Milky Way [3]. He determined that the Milky Way rotates and overturned the idea that the Sun was at its center. Although our view of the structure of stars and gas in galaxies has greatly improved over the last few decades with the exquisite images provided by our modern space- and ground-based observatories. Surprisingly there are many basic details of our own Milky Way and other external galaxies that are still unknown. Hence, the author of this paper, through studying the formation mechanisms and orbit-variation mechanisms of satellites, planets and stars, has put forward a new theory of galactic structure formation and evolution, revealing the hierarchical structure of galaxies and the formation and evolution of black holes and quasars.

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2. The Formation and Evolution of Galactic Structure

2.1 The Formation and Evolution of Planetary Systems

According to the Solar System's formation law [4], a star can produce several planets around it, and each planet can also produce zero or several satellites around it, therefore forming a planetary system, which is a hierarchical structure.

With the rapid rotation of the star, strong cyclones will be generated at the two poles and many regions of the star. These atmospheric vortices can absorb a large number of clouds and condense and compress these clouds in the process of sinking, but the original angular momentum of the star remains unchanged, which will gradually accelerate the rotation of the star and drive the revolution of the child planets to accelerate, making the child planet gradually move away from the parent star along a spiral line.

As the planet gradually moves away from the parent star, the gravitational attraction of the parent star to the planet gradually decreases, so that the rotation speed of the planet gradually increases. When the mass of the planet becomes very large and the rotation speed becomes very high by accreting the material near the orbit, strong cyclones will also be generated at the two poles of the planet. These atmospheric vortices can absorb a large number of clouds and condense and compress these clouds in the sinking process, but the angular momentum of the planet will remain unchanged, which will gradually accelerate the rotation of the planet and also the revolution of the satellite around the planet, therefore the satellite gradually moves away from the parent planet along the spiral line. It can be seen that the atmospheric compression produced by the cyclone of a parent star is the dynamic mechanism to accelerate the rotation of the parent star and the revolution of its child star around it.

2.2 The Formation and Evolution of Stars

2.2.1 The Beginning of a Star — A New Star

The formation of a star generally goes through the process from a satellite to a planet and then to a star. After the proto-star evolved from a satellite of small size and mass into an earth-sized planet, it generated some satellites, but it still revolved around its parent star, unceasingly accreted the nebula materials near the orbits to become larger and larger, and gradually moved away from its parent star with the frequent collisions of prograde planetesimals or the accelerating rotation of its parent star due to contraction [5]. Afterwards it met a series of impacts from some other planets running into it from behind, making it become a Jupiter-sized planet much farther away from its parent [6-8]. Since the Jupiter-sized planet's mass is very huge, it can attract various gas molecules to form a dense atmosphere, and produce strong polar vortices during its rotation. Moreover, this kind of polar vortex can generate strong spiral currents, therefore form strong dipole magnetic fields, as is shown in Fig. 1, which is captured by NASA's Hubble Space Telescope.

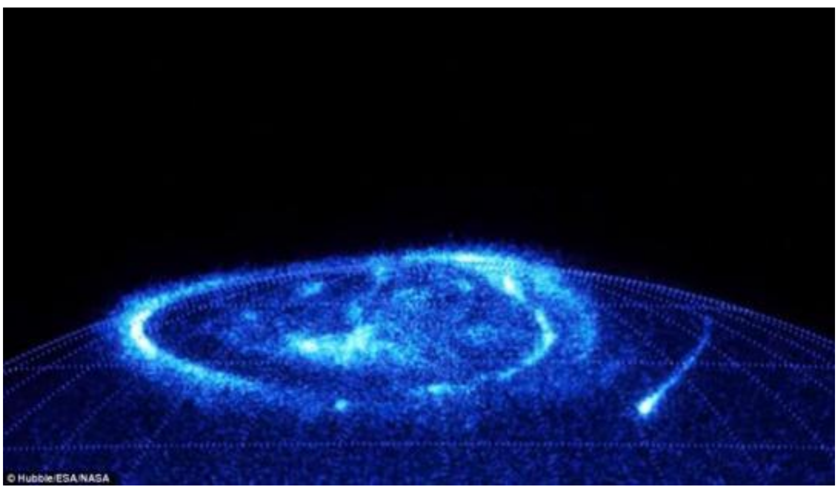

Fig. 1 The spiral current generated by Jupiter's arctic vortex.

Although Jupiter's mass is large enough to attract hydrogen in the atmosphere, making the mass ratio of hydrogen in Jupiter reach 75%, which is comparable to the mass ratio of hydrogen in the sun, yet Jupiter lacks oxidants, therefore cannot burn directly. According to scientists' estimate, only one giant has a mass 70 to 80 times that of Jupiter can it have enough gravity, pressure and temperature to cause fusion reaction between hydrogen elements. So the proto-star needs accreting enough interstellar material near its orbit to become a detonable star.

A series of strong polar vortices can be formed during the rapid rotation of the proto-star, as is shown in Fig. 2. This kind of vortex can continuously absorb hydrogen and other matter from the surrounding space to the proto-star, and they can also eject some material. Originally, the proto-star has at least two groups of vortices, located at the South pole and the North pole respectively, which can span troposphere and stratosphere. As plasma clouds swept in by a vortex of the proto-star sink faster and colder, after a long spiral path, at the bottom of the vortex, the velocity of the airflow is tens of times faster than that of scale 12 typhoon, so the cloud clusters have already condensed into ice, and the temperature in the vortex is much lower than that around it, hence from the distant place, the vortex looks like a small sunspot. But in fact, the central depth of the vortex can reach 200,000 kilometers, and its diameter can reach tens of thousands of kilometers.

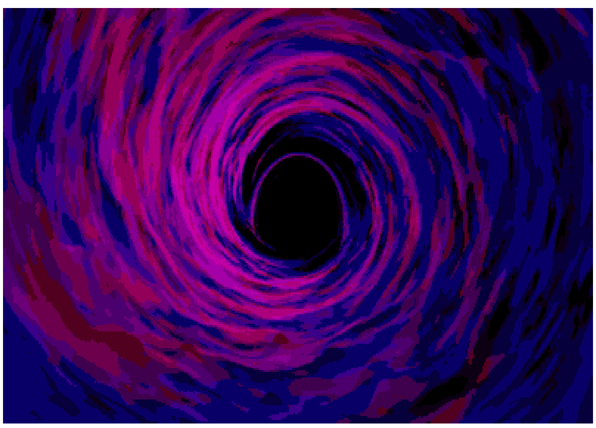

Fig. 2 Polar vortex on the proto-sar.

Since the clouds involved in a vortex are continuous and rotate downward rapidly in a spiral manner, a series of thick spiral cloud belts can be formed. In this kind of plasma cloud belts, the negative ions that get electrons are heavier than the positive ions that lose electrons, and then move down to the lower part of the cloud or even down to the bottom of the vortex along the spiral cloud belt. The lighter positive ions are gradually carried up to the upper part of the cloud or even up to the top of the vortex along the spiral cloud belt by the updraft, thus forming a current from the bottom of the vortex to the top of the vortex in the spiral cloud band. In addition, since the clouds along a spiral cloud belt are numerous and revolve rapidly, it is easy to have violent frictions and collisions among clouds, producing frequent electrical discharge or thunderstorms. Each electrical discharge or thunderstorm acts as an electrostatic motor, which can send currents to the upper portion or the lower portion of the vortex. Since a current from the bottom of the vortex to the top of the vortex has been formed in the spiral cloud belt, the dominant current in the spiral cloud belt is a current from the bottom of the vortex to the top of the vortex. Because this current flows continuously from the bottom of the vortex to the top of the vortex along the spiral cloud belt, thus forming a powerful dipole magnetic field with its magnetic north pole pointing towards the south pole of the proto-star and its magnetic south pole pointing towards the north pole of the proto-star, as is shown in Fig. 3.

In addition, since the coverage of a polar vortex on the proto-star is huge, the clouds involved in a polar vortex are numerous and revolve rapidly, when they get to the bottom of the vortex, it is easy to have violent frictions and collisions among clouds, and constantly generating violent lightning and releasing huge electric energy, making the temperature of the surrounding air rise rapidly to tens of thousands of degrees and the atmospheric pressure also rise to more than 1 MPa, so the gaseous hydrogen in the vortex changes into liquid metal hydrogen. This kind of liquid metal hydrogen are gradually cooled as they sink rapidly along the spiral path. At the bottom of the vortex, the clouds condense into huge metallic hydrogen crystals, and some crystals are even larger than one Earth, for example, famous astronomer Nassim Halamin recently found from an image of SOHO that a white earth-sized object flew out of a sunspot region in the Sun's arctic area [9], as is shown in Fig. 4.

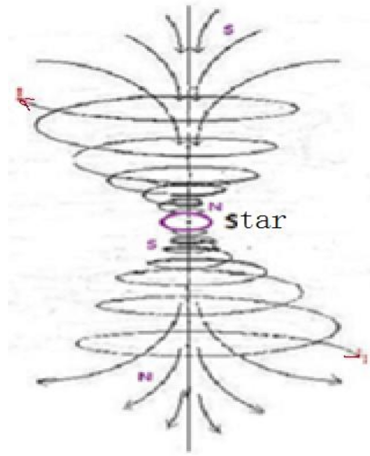

Fig. 3 Magnetic field of vortex.

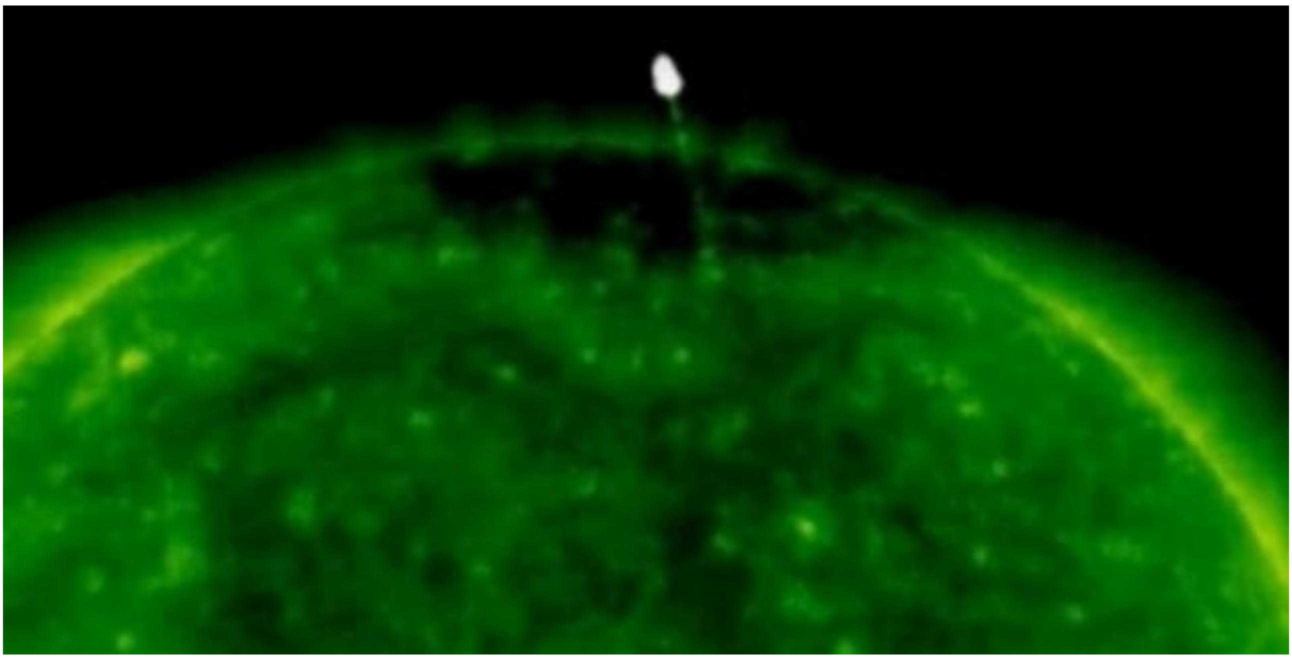

Fig. 4 An earth-sized object flew out of a sunspot region.

It is known that the internal temperature of Jupiter is about 280000 degrees and the internal pressure is about 40 million atmospheres. While the size and mass of the brown dwarf star that will become a star are almost equal to those of the sun, so its volume and mass are more than 1000 times those of Jupiter. Therefore, the internal temperature of this brown dwarf should be 280 million degrees, and the internal pressure should be more than 40 billion atmospheres. When the earth-sized metal hydrogen crystal hits the brown dwarf star, the explosion power of metal hydrogen is 50 times that of TNT explosive, which can increase the pressure nearby by dozens of times, exceeding 300 billion atmospheres. Hence, it can ignite the thermonuclear reaction of hydrogen to helium in the sunspot and cause a series of thermonuclear reactions beside the sunspot:

$$^{2}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He + ^{1}_{0}n \text{ +17.6Mev}$$

Once a thermonuclear reaction is ignited, a large amount of energy is released in a short time, causing instantaneous heating in local area, generating all kinds of electromagnetic radiation, even many bright spots with rapid enhancement suddenly appearing next to the sunspot, which is the so-called solar flare [10]. Because flares represent the eruption of solar thermonuclear reactions, there are violent explosions, which may change the structure of the sunspot or make it shrink or decay.

Generally, the formation and disappearance of a sunspot can only take days to weeks, and it can only attract a limited range of hydrogen, the hydrogen beyond this scope cannot be processed. So after the recession of a sunspot, without other sunspots to take over, the thermonuclear reactions ignited by this sunspot would cease. If the star has many planets that can spin around it rapidly, such as Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune in the solar system, they can help the star to produce a series of sunspots that spread all over the star, making the star produce light and heat continuously. Table 1 shows the ratio of the gravitation of the major planets of the solar system on the objects on the surface of the sun as well as the revolution periods of these planets. It can be seen that Jupiter has the strongest gravitation on objects on the surface of the sun, followed by the Earth and Mercury, but Mercury is the planet with the fastest revolution speed.

But among the eight planets in the Solar System, the orbital planes of Mercury, Venus, Earth and Mars do not span the north and south poles of the Sun, only the orbital planes of Jupiter, Saturn, Uranus and Neptune span the north and south poles of the Sun, as is shown in Fig. 5. Since Jupiter is the most massive of the last four planets and the closest to the Sun, it has the greatest effect on the atmospheric vortices called sunspots at the North and South poles of the sun. In fact, when Jupiter moves from high latitude to low latitude, it will attract polar vortices just like the moon attracts Earth waves. When Jupiter approaches a polar vortex, it can tilt, stretch, shear or break the polar vortex, even draw some sub-vortices out of the polar vortex. Drawn by Jupiter, these sub-vortices drift rapidly toward low latitudes along with cloud belt. When a sub-vortex absorbs enough cold air to become a long, large, heat resistant vortex, it descends from the stratosphere to the troposphere, becoming a successor sunspot at lower latitudes, this process can be called sunspot replication. With the sun’s rapid rotation and its planets around the sun, sunspots can be scattered by Jupiter and other planets from high latitudes to low latitudes and even near the equator, and then, the faster-orbiting Mercury, Venus, and Earth scatter sunspots from the North or South Poles along their orbits, taking them around the globe.

Table 1 Ratio of the major planets’ gravitation on the objects on the sun’s surface as well as the revolution periods of these planets.

planet	mass	average distance from the sun	Ratio of planet’s gravitation relative to Mercury’s gravitation	revolution periods (Solar rotation period = 25.05 d)
Mercury	3.3022×10^{23} kg	57909050 km	1	87.9691 d
Venus	4.8690×10^{24} kg	108209184 km	0.42228	224.7 d
Earth	5.9650×10^{24} kg	149597888 km	2.70684	365.24 d
Mars	6.4219×10^{23} kg	227925000 km	0.12554	686.980 d
Jupiter	1.9000×10^{27} kg	778547050 km	31.8327	11.8618 yr

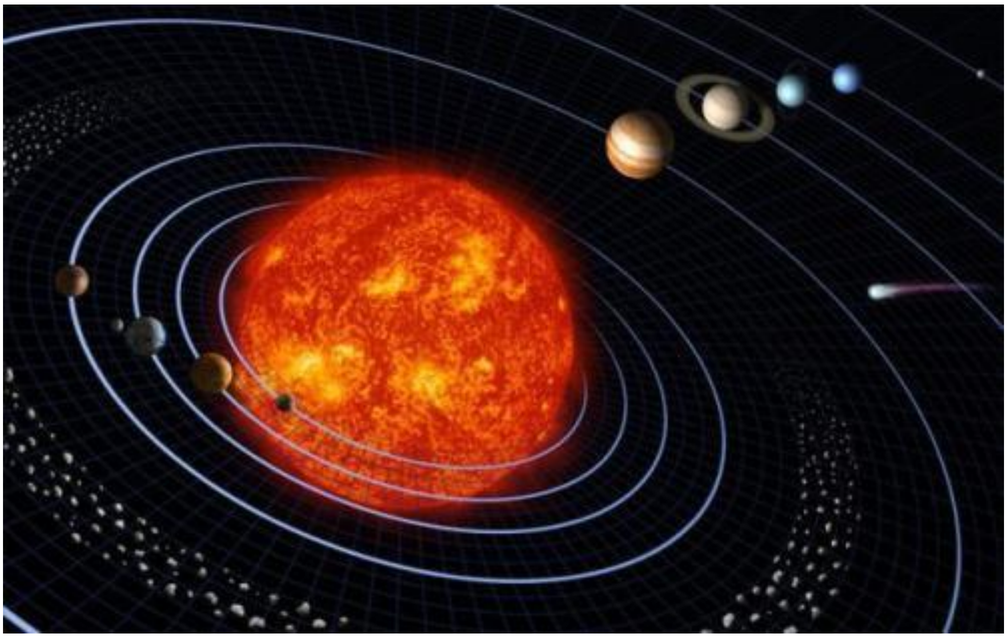

Fig. 5 Orbits of the eight planets in the solar system.

When sunspots surround the star, the star becomes a shining star, as is shown in Fig. 5, which has a surface temperature of 6000℃ and an internal temperature of 15 million ℃. It is almost a sphere interwoven by thermal plasma and magnetic fields, but in such a high temperature environment, solar atmospheric vortices can still be generated and active. That is because a sunspot can reach a depth of tens of thousands of kilometers, and a diameter of thousands to tens of thousands of kilometers, which consists of thousands of spiral cloud bands. The air mass involved in each spiral cloud band will turn faster and colder in the process of sinking. After a long spiral descent, the air flow at the bottom of the vortex is dozens of times faster than the speed of the Earth's 12 typhoon. Therefore, each spiral cloud band is a cold current vortex. A sunspot vortex composed of thousands of cold current vortices can restrain the internal energy of the star from being transmitted by convection, so the internal temperature of the sunspot vortex is low, which looks like a small sunspot from the distant Earth. However, in a sunspot vortex, sometimes there are Earth-sized metallic hydrogen crystals colliding, which ignites the thermonuclear reaction of hydrogen to helium and causes a series of thermonuclear reactions beside the sunspot.

With the fast rotation of the star and the constant revolution of planets, cyclones can be generated one after another. These cyclones can not only ignite the thermonuclear reaction on the star, but also absorb hydrogen and other interstellar materials in space to maintain the thermonuclear reaction on the star, so that the star can continuously generate light and heat. This is the main sequence stage of the star, which lasts for a long time.

2.2.2 Middle Aged Star — Red Giant

In the process of a star rotating around the center of its galaxy, it continuously absorbs the gas, dust and other interstellar materials near its orbit by virtue of the cyclones on it. These trapped materials are difficult to escape from the dense atmosphere of the star. Therefore, after long-term evolution, the mass of stars increases greatly, even several times the mass of the sun.

Although the galactic structure is stable for a long time, collisions between galaxies occur from time to time on the astronomical time scale. For example, in the process of Jupiter rotating around the sun, it constantly absorbs the "nebula" material near its orbit and becomes larger and larger, but Mercury is in the hot environment strongly irradiated by the sun, and its mass will hardly increase. In addition, with the increase of Jupiter's rotation speed, Jupiter's satellites can move away from Jupiter at a certain speed and their mass increases gradually. When Jupiter becomes a star, the mass of some Jupiter moons can reach or even exceed that of mercury, and their diameter is larger than that of mercury. When such Jupiter satellites tend to the sun, they may collide with some inner planets in the solar system, as shown in Fig. 6, causing these inner planets to fall to the sun, especially, when the satellite reaches the orbit of Mercury, because the orbit of mercury around the sun is petal shaped, as shown in Fig. 7, the Jupiter satellite is likely to collide with Mercury, and the collision is enough to knock mercury down to the sun and finally be swallowed by the fierce fire of the sun. After the star engulfs some inner planets, the stellar mass increases significantly, the stellar atmosphere also thickens greatly, the internal temperature of the star rises greatly, and releases huge energy, which makes the star tend to expand. After the innermost planet of the star is swallowed, because there is no innermost planet close to the star to quickly spread new cyclones, the star cannot absorb enough hydrogen to maintain the hydrogen polymerization reaction inside the star, breaking the balance between the radiation pressure of nuclear fusion and its own shrinking gravity. Therefore, the internal helium nucleus shrinks and becomes hot, and the hydrogen shell expands and cools outward. With the contraction of the internal helium nucleus, the rotation of the internal helium nucleus accelerates, and the hydrogen shell drifts outward under the action of centrifugal force, which makes the star expand rapidly into a red giant [11]. This process may last hundreds of thousands of years. The final result of helium fusion is the formation of a white dwarf in the center.

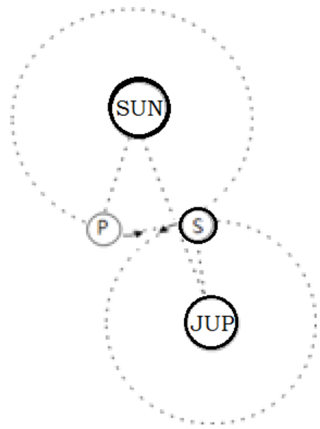

Fig. 6 Jupiter's satellite S collides with planet P in the solar system.

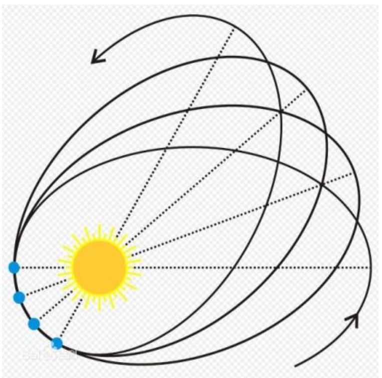

Fig. 7 Mercury's petal orbit around the sun.

2.2.3 Late Star — White Dwarf

After the red giant burns the innermost planet, because there is no innermost planet to quickly spread new cyclones that can absorb hydrogen and start thermonuclear reaction, the star cannot absorb enough hydrogen to maintain the hydrogen fusion reaction inside the star, and its internal temperature gradually decreases, which will break the balance between nuclear fusion radiation pressure and its own contraction gravity. As a result, the internal helium core shrinks and heats up, and the final core temperature will exceed 100 million degrees, so helium fusion begins again. However, when the helium core burns out, the central gravity of the star cannot be balanced by the radiation pressure generated by the hydrogen fusion or helium fusion, and the interior of the star shrinks. The contraction does not stop until the central gravity of the star is balanced by the electron degenerate pressure in the star center, forming a white dwarf, as shown in Fig. 8. Due to the small size of the white dwarf and the lack of inner planets that can quickly spread cyclones, there are far

Fig. 8 A white dwarf and its atmosphere.

fewer cyclones that can produce thermonuclear reactions on the white dwarf than on main sequence stars. In addition, with the reduction of the star's volume, the density of its surrounding atmosphere increases greatly, so the brightness of white dwarfs decreases, darkens and turns white [12]. In particular, when the cyclones at both ends of the rotation axis of the white dwarf are not facing the earth, people can hardly see the light emitted by the white dwarf. At this time, people mistakenly think that it is a black dwarf without light. However, because the contracted star still rotates continuously, and the cyclones at both ends of the rotation axis will certainly emit light, there is no black dwarf that absolutely does not emit light.

2.2.4 Rise From Dead — Supernova

Because a white dwarf or black dwarf is a star formed after the main sequence star engulfing the innermost planet, the mass of the white dwarf or black dwarf is significantly higher than that of the original main sequence star, and its atmosphere is also significantly thickened, but its volume is greatly reduced, even smaller than that of the moon, so its rotation speed is greatly accelerated and polar cyclones are greatly enhanced. If this kind of cyclone is not facing the Earth, people will not be able to detect its internal activities. However, if a planet around the star drags out a sub cyclone from the polar cyclone through gravity, and the sub cyclone just falls at a place (of the star) where Earth's people can see it, the people will be able to observe its activities. The sub cyclone can absorb a large number of clouds from such a thick atmosphere and quickly grow into a powerful cyclone, and then the large cyclone continuously sweeps a large number of heavy clouds from the deep and wide atmospheric space. These clouds go through a long spiral path to the bottom of the vortex and are compressed into huge metal hydrogen crystals. When this huge metal hydrogen crystal collides with the surface of the star violently, it will cause a violent explosion, generating a lot of heat and electric energy, reignite the thermonuclear reaction on the star, emitting a huge amount of energy and shine a very bright light, making the very dark or invisible star suddenly become an extremely bright supernova. The high brightness of supernovae can last for several weeks or even years, until it consumes a large part of the atmosphere accumulated by the star, it will gradually fade and become invisible. Supernova explosion is not the funeral of the star. When the atmosphere of the star becomes thick enough, supernova explosion may occur again, but it will take a long time. For example, iPTF14hls is an unusual supernova star that had erupted continuously for three years (as of 2017), as is shown in Fig. 9, and it had previously erupted in 1954 [13]. Therefore, there will be countless supernova explosions in the process of stellar evolution. In addition, giant objects falling from interstellar space to a white or black dwarf can also cause supernova explosions. A supernova explosion will make part of the falling object fly out at high speed, and then make the surface layer of the star melt and shrink into a thin onion layer [14].

2.2.5 The Later Stage of Stellar Evolution — Neutron Star

After a main sequence star is transformed into a white dwarf, its mass is significantly increased compared with that of the main sequence star, and its atmosphere is also significantly thickened, but its volume is greatly reduced, even smaller than that of the moon, so its rotation speed is greatly accelerated,

Fig. 9 Supernova iPTF14hls.

and its polar cyclones are greatly enhanced. In the process of the white dwarf rotating around the center of the galaxy, it constantly absorbs the gas, dust and other interstellar matter near the orbit by virtue of its strong polar cyclones, which makes its mass increase continuously, its gravitational force increases continuously, and the polar cyclones' involvement force and magnetic attraction increase continuously. Therefore, with the rotation of the white dwarf, a large number of clouds can be drawn into the polar cyclones and be compressed into huge metal hydrogen crystals at the bottom of the cyclones. When these huge metal hydrogen crystals collide with the stellar surface violently, they will not only directly produce huge pressure on the stellar surface, but also produce violent explosion, producing greater pressure, and even cause thermonuclear reaction or supernova explosion, making the star collapse, which leads to great changes in the material structure of the star. In this case, not only the shell of an atom is crushed, but also the nucleus is crushed. The protons and neutrons in the nucleus are squeezed out, and the protons and electrons are squeezed together to form neutrons. Finally, all the neutrons are squeezed together to form a neutron star [15].

When a star shrinks to a neutron star, its volume will be greatly reduced and its rotation will be greatly accelerated, so that the dipole magnetic fields produced by the polar cyclones of the neutron star will be greatly enhanced, making people think that the neutron star is a very strong magnet. In addition, a neutron star emits electromagnetic waves through polar cyclones, but it generally has some planets around it, under the action of planetary gravity, the polar cyclones of the neutron star will deviate from the rotation axis of the star, so each polar cyclone of the neutron star moves along an elliptical trajectory during the rotation of the star. Hence, when a polar cyclone that emits the electromagnetic wave is facing the earth, the earth people can receive the electromagnetic wave; when the polar cyclone deviates from the earth, the earth people cannot receive the electromagnetic wave. Therefore, the electromagnetic waves received by the earth people are intermittent, resulting in "lighthouse effect" [16], as is shown in Fig. 10.

2.2.6 The End of Stellar Evolution — Black Hole

In the process of a neutron star evolution to a larger mass giant, its polar cyclones continuously accrete the gas, dust and other interstellar matter near the orbit, making its mass and surface continuously increase. With the rotation of the neutron star, a large number of clouds can be drawn into the polar cyclones and be compressed into huge metal hydrogen crystals at the

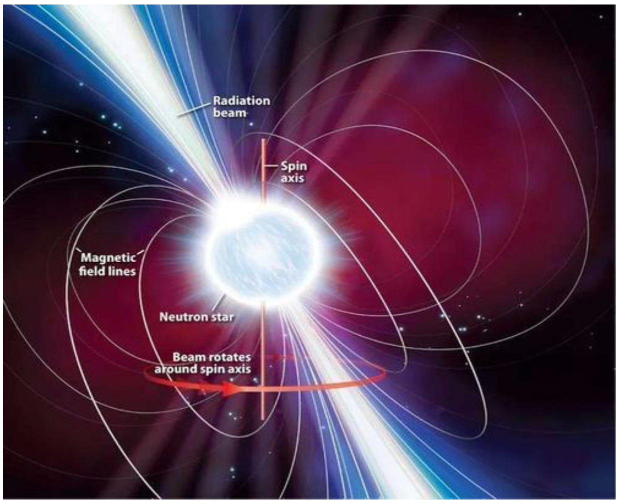

Fig. 10 A neutron star and its dipole magnetic fields.

bottom of the cyclones. When these huge metal hydrogen crystals collide with the stellar surface violently, they will not only directly produce huge pressure on the stellar surface, but also produce violent explosion, producing greater pressure, and even cause thermonuclear reaction or supernova explosion, making the star collapse further, which leads to the transformation of the atomic structure of the star surface into a neutron structure or a more dense structure.

In addition, during the expansion and movement of galaxies, collisions between galaxies occur from time to time. For example, a main sequence star (such as the sun) has multiple planets orbiting it (such as Jupiter and Saturn in the solar system). When the main sequence star evolves into a neutron star, one of its planets (such as Jupiter in the solar system) has also evolved into a main sequence star m, another planet P (such as Saturn in the solar system) and its satellite S (such as Titan) have also evolved into massive celestial bodies. With the increase of the rotation speed of the neutron star, its child star M moves away from the neutron star at a certain speed. With the increase of the rotation speed of giant planet P, P's satellite S also moves away from P at a certain speed, and the mass of S is getting larger and larger, making the shortest distance between S and M gradually decreases. Finally, there may be a collision between S and M, making M fall into the neutron star. Similarly, another planet of the neutron star may evolve into a main sequence star and later be knocked down on the neutron star. For example, on June 12, 2020, the American Astronomical Society reported that an international team of astronomers had observed the explosion process of a neutron star engulfing a star. The neutron star (No. “Sax j1808.4-3658”) continuously sucked away the material of a nearby star by virtue of its strong attraction. When the material plunder reached a certain degree, the star was drawn into the polar cyclones of the neutron star and eventually exploded. When the mass of a neutron star exceeds three times the mass of the sun, a black hole is formed [17], as is shown in Fig. 11.

Due to the great mass and strong gravity of the black hole, when a luminous celestial body enters its gravitational horizon, many gaseous, liquid and solid substances of the celestial body will be immediately absorbed by the black hole, so that the resources of the celestial body are insufficient to maintain its luminous effect and extinguish the light, which is the reason why “light cannot escape the black hole” [18].

2.3 The Structure of Galaxies

According to the formation and evolution law of planets and stars described above, a star may have multiple generations of progenitor stars, and it can also produce multiple planets orbiting it, some of which can produce some orbiting satellites. Therefore, a galaxy is usually a hierarchical structure composed of many celestial bodies, and the whole universe contains many such galaxies. In a typical galactic structure, the path from the galactic center as the root to a moon as a leaf may contain several black holes, 0-1 neutron star, 0-1 white dwarf, 0-1 red giant star, 0-1 main sequence star, 1 planet and 0-1 satellites.

The Milky way is a complex hierarchical structure composed of many generations of stars, including about 250 billion sun like stars. Through the study of the disk of the galaxy’s star clusters, astronomer Maria Geman found that the star clusters within the Milky way are older, while the outer stars are younger. Therefore, it can be inferred that the formation of the galaxy began from the inside, and then gradually evolved to a diameter of more than 100000 light-years. During its growth, the Milky way also swallowed many small galaxies. Objects from these small galaxies merged into the interior of the Milky way, making the mass of inner stars in the Milky way very huge [19].

There are many galaxies similar to the Milky way outside the Milky way, called extragalactic galaxies.

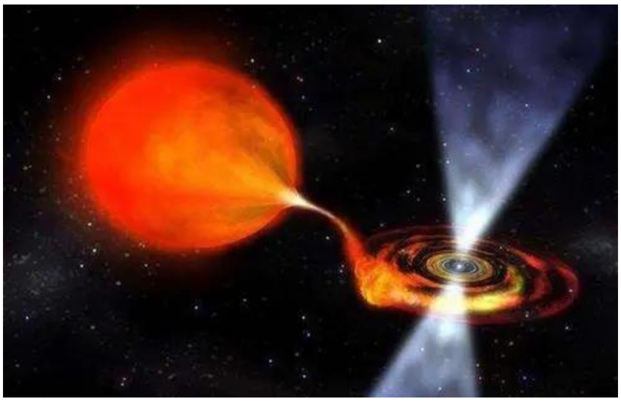

Fig. 11 A neutron star devours stars to become a black hole.

3. Formation and Evolution of Quasars

In the vast cosmic sky, there are countless galaxies like the Milky way, which rotate around the center of their galaxy clusters. Since most galaxies have more than two spiral arms, the central black hole of a galaxy cluster usually has more than two sub galaxies as spiral arms rotating around it, as shown in Fig. 12, where C is the central black hole of the galaxy cluster, S1 and S2 are the two child black holes rotating around C, that is, the central black holes of the two sub galaxies under C, and T2 is the child black hole rotating around S2. With the increase of the rotation speed of C, its child star S1 moves away from C at a certain speed, while with the increase of the rotation speed of S2, its child star T2 also moves away from S2 at a certain speed, and the mass of T2 becomes larger and larger. Finally, the orbit of S1 and T2 may intersect, resulting in the collision between S1 and T2, which greatly reduces the revolution speed of S1 around C, causing many celestial bodies of the child galaxy centered on S1 fall to C. Assuming that the child galaxy centered on S1 contains hundreds of millions of stars, when many stars in the child galaxy fall onto C, C becomes a black hole with hundreds of millions of solar masses, and the thickness of its atmosphere can reach hundreds of millions of times the thickness of the solar atmosphere. Therefore, the polar cyclones formed during the rapid rotation of C can emit extremely dazzling light, reaching the sum of

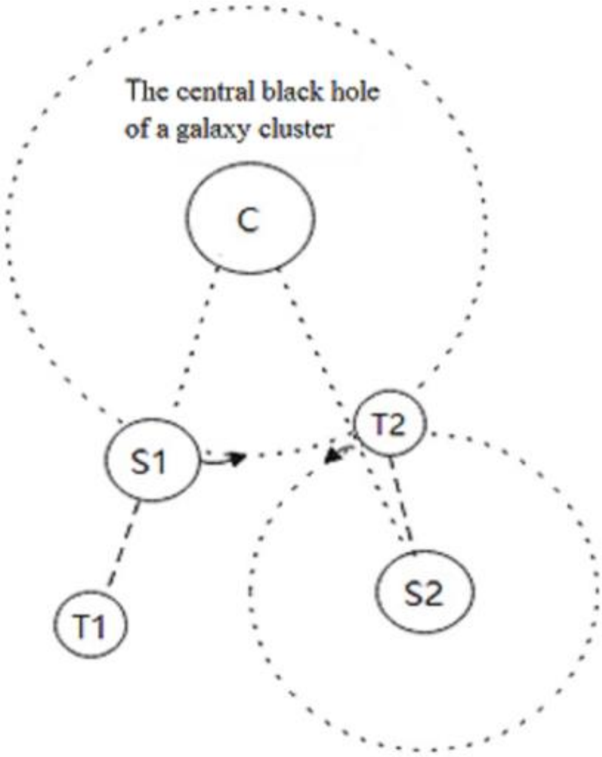

Fig. 12 Collisions between two galaxies and the formation of a quasar.

the brightness of hundreds of millions of suns and even a galaxy. For example, on March 3, 2015, a scientific research team led by Chinese astronomer Wu Xue-Bing found an ultra bright quasar with a distance of 12.8 billion light-years from the earth, 430 trillion times the solar luminosity and a central black hole mass of about 12 billion solar masses. This is the brightest and most massive quasar in the distant universe observed so far [20].

4. Conclusions

In the past, people always thought that a typical galaxy was composed of many stars embedded in the nebula and substances such as gas and dust surrounding the stars. It was unclear about the law of galaxy formation and evolution, so that black holes were mistakenly regarded as independent strange celestial bodies, which was difficult to grasp, even making people doubt the authenticity of its existence. Therefore, the author studies and discovers the formation and evolution laws of satellites, planets and stars, puts forward the scientific theory of galaxy formation and evolution, and reveals the hierarchical structure of galaxies and the existence and characteristics of black holes as the backbone nodes of galaxies, so as to make the formation and evolution of black holes and quasars known to the world.

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