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The Characteristics of Huge Empty Holes Based on the Cosmic Model without Singularity

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Abstract S-matter and s-galaxies in s-empty holes must be very scarce. A s-galaxy existing inside a s-empty hole must have the following characteristics. The s-galaxy is an emission galaxy; In addition to the cosmological red shift, the s-light emitted by the s-galaxy will also have a violet shift. The greater the density of the color singlets and the distance from the s-galaxy to the nearest boundary of the s-empty hole, is greater the violet shift. A spherical s-empty hole for s-light is equivalent to a concave lens. When the Milky Way and a s-galaxy are respectively on the two side of an oblong empty hole or inside a huge s-empty hole, an observer on the earth will observe the s-galaxy to be brighter than its real brightness. The luminous arc structure of galaxies which is near the central part of an elliptical clusters is explained. A cosmic island with an accelerating expansion cannot expand forever. There is no necessity that a galaxy will be torn apart during the expansion process of the cosmic island. The expansion rate of a s-empty hole is higher than that of a s-galaxy. The s-empty holes in a s-cosmic island with an accelerating expansion occupy more space than the s-galaxies in the s-cosmic island.

Keywords: *huge hole, cluster of galaxies, color singlets, cosmic island, red shift, violet shift*

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1. Introduction

Many huge empty holes have been found. In 1980, for example, a empty hole of 100 million light-years was found in the Perseus supercluster of galaxies. In 1981, a huge empty hole whose volume is 1.025 cubic light-years was discovered in the constellation muff. There are few or no normal bright galaxies in these huge empty holes. For example, the huge empty hole in the constellation Mugiuchi is a spherical empty hole more than 300 million light-years across, and no normal bright galaxies have been found inside, but emission galaxies have been found. An international team of scientists has found that the empty holes also cause the stars behind them to light up. In January 1987, a very large luminous arc was found in each of the three distant clusters of galaxies. These arcs are more than 30; 000 light-years across and over 300, 000 light-years long. Each arc is a segment of a circle centered in a bright elliptical cluster of galaxies. The universe is made up of huge empty holes and superclusters of galaxies.

Based on the cosmological model without singularity, this paper qualitatively proves the characters of huge empty holes.

Model [1] puts forward a new basic hypothesis that the universe is composed of s-matter and v-matter which are completely symmetric before symmetry breaking, and whose contributions to Einstein tensor are opposite to each other. As an example, the symmetry group is taken as $SU_S(5)\times SU_V(5)$. There is only the coupling of the s-Higgs field and the v-Higgs field between s-particles and v-particles. The masses of the s-Higgs particles and the v-Higgs particles are all very large and the coupling coefficient is positive, so that the interaction can be ignored at low temperatures. From this it can be concluded that there are two sorts of symmetry breaking, i.e., $SU_S(3)\times U_S(1)\times SU_V(5)$, $\langle\Omega_s\rangle\neq 0$ and $\langle\Omega_v\rangle=0$, or $SU_S(5)\times SU_V(3)\times U_V(1)$, $\langle\Omega_s\rangle=0$ and $\langle\Omega_v\rangle\neq 0$. As a result, when s-breaking occurs, i.e. $\langle\Omega_s\rangle\neq 0$ and $\langle\Omega_v\rangle=0$, the s-elementary particles must acquire their corresponding masses, and form visible s-atoms, s-molecules and s-galaxies; however, the masses of the v-elementary particles must be zero, and can only form the color singlets at lower temperatures. In addition to the known universal gravitation, there is no other interaction among these v-color singlets so that they cannot form atoms, molecules, or stars, but can only dispersively distribute in space as the dark energy, and they have the effect of dark energy on the evolution of the universe. It is impossible to detect the v-color singlets in the universe with s-breaking, because there is only the repulsive force with the same strength as the universal gravitation between the s-matter and the v-color singlets. Here the interaction via the Higgs particles and may be ignored. Therefore, this hypothesis is compatible with known theories and experiments.

Based on this model, the following results have been obtained.

A. The premise of the Hawking theorem is no longer valid in this model, so this model has no singularity.

B. There is the highest temperature in the universe.

C. The cosmological constant and the effective cosmological constant are both zero, and based on this, the evolution of the universe is explained

D. The covariant definition of localized energy conservation in the general relativity is given;

E. The universe consists of infinite v-cosmic islands, infinite s-cosmic islands and transition zones. Each cosmic island is made up of huge empty holes and galaxies. It is impossible to communicate any information between a s-cosmic island and a neighboring v-cosmic island, so that every observer in a cosmic island thinks that his own cosmic island is the whole universe. The cosmological principle holds firm for the universe as a whole, but it is not strictly valid for a cosmic island.

F. The gravity between two distant galaxies predicted by this model will be less than that predicted by general relativity, because there is a lot of v-color singlets between the two galaxies.

G. S-huge empty holes in a s-cosmic island are not empty, but full of v-color singlets. This is because there is the repulsive force between s-matter and v-color singlets, the v-color singlets can form a huge briquette, i.e. a huge empty hole, due to the gravitational force among them, and the v-color singlets cannot be detected by s-observers.

2. The Characters of Huge Empty Holes

Obviously, when s-galaxies, s-particles or s-light move or is stationary in the dispersive v-color singlets, the higher the density of the v-color singlets, the more repulsive force of the v-color singlets act on them. The distribution of s-color singlets and the distribution of s-matter interact with each other.

As mentioned above, a s-empty hole is full of v-color singlets. Therefore, there is the repulsive force of the empty hole on s-light, s-matter and s-galaxies.

According to the above, v-empty hole has the following characteristics.

2.1. The Density of s-matter in a s-empty Hole

Due to the repulsive force between s-matter and the v-color singlets, the higher the density of the v-color singlets is, the less s-matter is, and vice versa. Therefore, s-matter and s-galaxies in a s-empty holes must be very rare. In a s-galaxy, the density of v-color singlets must also be small.

2.2. The Characteristics of a s-galaxies in a s-empty Hole

A small amount of s-galaxies, s-gas and s-dust can also exist in a s-empty hole, because the distribution of the v-color singlets is very dispersive. Let there be a s-galaxy G in a s-empty hole C the s-galaxy G must have the following characteristics.

A. Due to the pressure of the color singlets on the s-galaxy G, the density and temperature of the s-galaxy G should be higher than those of the same galaxy outside s-empty holes, so the s-galaxy will emit higher energy rays. That is, the s-galaxy G is an emission galaxy.

B. Due to the repulsive force between s-matter and the v-color singlets, the light emitted by s-galaxy G inside a spherical empty hole will have violet shift in addition to the cosmological redshift. Let the shape of empty hole C be spherical, the density ρ_V of the v-color singlets in C be uniform, the violet shifts of s-light emitted by G be z, and the distance from G to the nearest boundary of empty hole C be s, then the bigger s and ρ_V are, the bigger z will be.

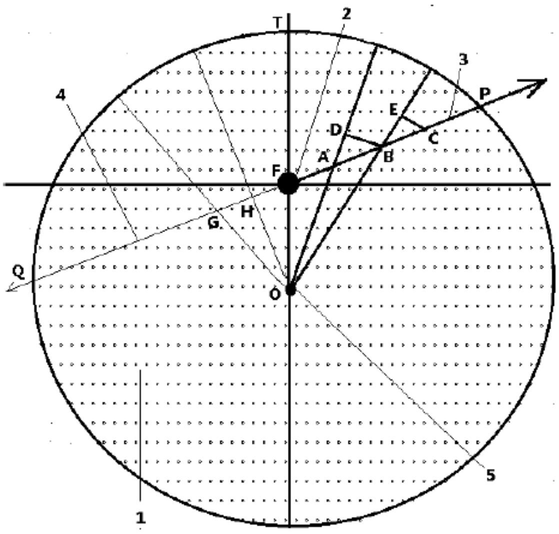


Figure 1. is the schematic diagram of the violet shift of the s-light emitted by the s-galaxy inside a spherical s-empty hole

In the Figure 1 is the v-color singlets with the uniform density in the spherical s-empty hole; 2 is the s-galaxy; 3 and 4 are the s-light emitted by the s-galaxy; 5 is the centre of the s-empty hole.

As a rough approximation, we consider the work done by the color singlets in the spherical s-empty hole on the light in Newton's framework, as shown in diagram 1. The force of such a sphere with its radius r and density ρ_V on the unit mass on the spherical surface is

$$\vec{f} = \frac{4\pi}{3} G\rho_V \frac{r^3}{r^2}\frac{\vec{r}}{r} = \frac{4\pi}{3} G\rho_V \vec{r} \tag{1}$$

where G is the gravitational constant. Ignoring advanced small quantities, from diagram 3 it is obtained from diagram 3 that the color singlets in the spherical s-empty hole do micro work on the light from A to C to

$$\begin{aligned} dW_{AC} &= \frac{4\pi}{3} G\rho_V \left[\overrightarrow{OA}\cdot\overrightarrow{AB} + \overrightarrow{OB}\cdot\overrightarrow{BC}\right] \\ &= \frac{4\pi}{3} G\rho_V \left[OA\cdot AB\cos(DAB) + OB\cdot BC\cos(EBC)\right] \\ &= \frac{4\pi}{3} G\rho_V \left[OA\cdot AD + OB\cdot BE\right] \\ &= \frac{4\pi}{3} G\rho_V \left[r_A dr_{AD} + r_B dr_{BE}\right]. \end{aligned} \tag{2}$$

From (2) it is obtained that the color singlets in the spherical s-empty hole do work on the light from F to P to be

$$\begin{aligned} W_{FP} &= \int_F^P \vec{f}\cdot d\vec{l} = \frac{4\pi}{3}G\rho_V\int_F^P \vec{r}\cdot d\vec{l} \\ &= \frac{4\pi}{3}G\rho_V\int_F^P r\cos\theta dl \\ &= \frac{4\pi}{3}G\rho_V\int_F^T r dr = \frac{2\pi}{3}G\rho_V\left(FT\right)^2 \\ &= \frac{2\pi}{3}G\rho_V s_{FT}^2 = W_{FT}. \end{aligned} \tag{3}$$

When the light spreads from F to Q, the work from F to H and from H to G done by the color singlets on the light are cancelled out. Therefore, the color singlets in the spherical s-empty hole do work on the light from F to Q to be

$$W_{FQ} = W_{GQ} = W_{FP} = W_{FT}. \tag{4}$$

Thus, if a s-galaxy $\tilde{G}$ is outside s-empty holes and the distance from the earth to is the same as that from the earth to G, the observed red-shift of the light emitted by G on the earth will be less than that by the galaxy $\tilde{G}$ on the earth.

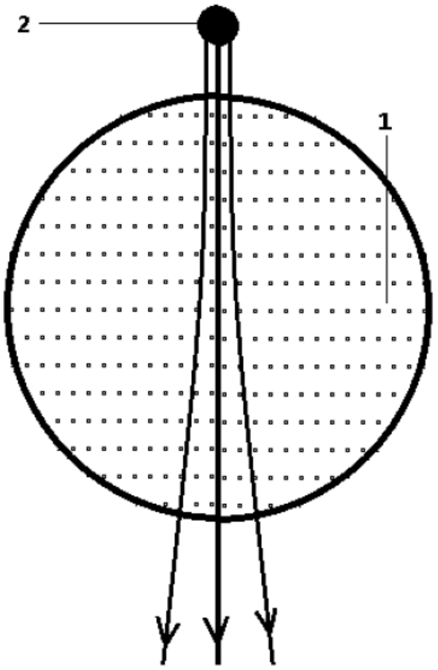
2.3. Effect of Distribution of v-color Singlets on Observation of s-galaxies

Due to the repulsive force of v-color singlets to s-light, the different distributions of the v-color singlets will lead to different observation results. The density distribution of the v-color singlets and the distribution and shape of the s-cluster of galaxies affect each other.

A. The v-color singlets away from the s-galaxy can form a huge briquette, i.e. a huge s-empty hole in spherical shape due to the gravity among them. Due to the repulsive force between s-matter and the s-color singlets, such a spherical s-empty hole with uniform density of the s-color singlets is equivalent to a concave lens for s-light, as shown in diagram 2. If a observer on the earth observes the s-galaxies behind the spherical s-empty hole, he will see fewer s-galaxies than real s-galaxies, and the light coming from the s-galaxies will be dimmer.

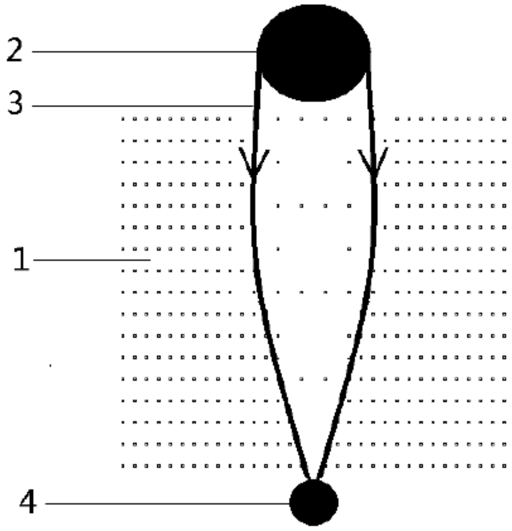
B. When the distance of the Milky Way G_M and a s-galaxy $\tilde{G}_M$ is smaller, and G_M and $\tilde{G}_M$ are respectively on the two side of an oblong empty hole or inside a huge s-empty hole (in a v-color singlet sea), then an observer on the earth will observe the s-galaxy to be brighter than its real brightness. The reasons is as follows.

Due to the repulsive force of G_M and $\tilde{G}_M$ on v-color singlets, the density distribution of the v-color singlets in the region between G_M and $\tilde{G}_M$ must be as follows. The density on the line L_M connecting G_M and $\tilde{G}_M$ is least, the higher the density in such a zone when the larger distance from the zone to the line L_M is, as shown in diagram 3A. That is, the density distribution of the v-color singlets between G_M and $\tilde{G}_M$ has the shape of a concave lens, as shown in diagram 3B. The larger repulsive force of the v-color singlets on the s-light is, when the larger density of the v-color singlets is. Therefore the effect of such a s-empty hole on s-light is equivalent to that of a convex lens, and its optical path diagram is shown in diagram 3B. The result is different from that of the spherical s-empty hole only because the shapes of the two s-empty holes are different from each other.



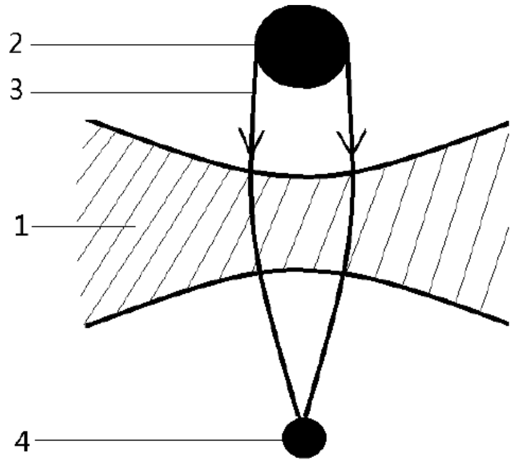
In the Figure 1 is the v-color singlets with the uniform density in the spherical s-empty hole; 2 is the s-galaxy outside the empty hole.

Figure 2. Is the schematic diagram that the spherical s-empty hole is equivalent to a concave lens for the s-light emitted by the s-galaxy outside the s-empty hole



In the Figure, 1 is the v-color singlets distributing in the s-empty hole; 2 is the luminous s-galaxy; 3 is the light coming from the s-galaxy; 4 is the earth

Figure 3A. is a schematic diagram of convergence of the s-light through s-empty hole.



In Figure 3A. In the Figure 1 is a schematic diagram of the uniform density distribution in the concave lens shape which is equivalent to the real density of the color singlets in Figure 3A; 2 is the luminous s-galaxy; 3 is the light coming from the s-galaxy; 4 is the earth.

Figure 3B. is the schematic diagram of the uniform density distribution of the v-color singlets which is equivalent to the real distribution of the density in the s-empty hole

2.4. The Influence of v-color Singlets on the Distribution and Shape of Cluster of s-galaxies

A sufficiently large s-matter system, such as a cluster of s-galaxies or a s-galaxy, must be directly under the pressure of the v-color singlets. If the s-cluster is stationary relative to the v-color singlets, the s-cluster will be spherical. If the s-cluster is moving relative to the v-color singlets, the s-cluster will be elongated.

Here, the v-color singlets can be regarded as a gas, while the s-cluster can be regarded as a liquid at rest or moving in the gas. There is a repulsive force between the gas and the liquid. This force makes the liquid to be spherical or elongated. When the liquid rotates, the liquid can also become a pie shape due to its own gravity and the pressure of the v-color singlets. Unlike this liquid, the density of the v-color singlets inside the s-cluster is not absolutely zero.

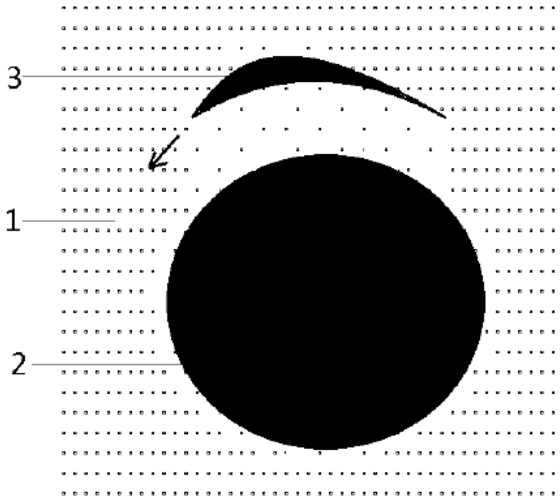
Because of the repulsive force between the v-color singlets and s-matter, these s-clusters are distributed only at the junctions of the s-empty holes. If there was no v-color singlets, such distribution of the superclusters or clusters of galaxies could not exist.

Suppose there is an elliptical cluster C_C of s-galaxies and a s-galaxy. G_C. is near the centrical part of C_C. There must be v-color singlets around the centrical part of C_C, although there is a repulsive force between s-matter and v-color singlets, the v-color singlets can still exist around the centrical part of the s-cluster C_C because the following reasons.

a. There are relatively lesser s-matter M_C in the central part, so the repulsive force of the central part to the v-color singlets is relatively smaller;

b. The shell layer of the centrical part is thicker and its pressure on the centrical part is greater, so the v-color singlets are not easy to escape.

As mentioned above, the density of v-color singlets near the connecting line of G_C and the centrical part of C_C is lesser due to the repulsive force of M_C and G_C on the v-color singlets. G_C can rotate around the central part of C_C due to the gravity of the central part of C_C. The v-color singlets cannot rotate around the central part of C_C because of the repulsive force of M_C on the v-color singlets. Consequently, the v-color singlets exerts pressure on G_C in circular motion. This force makes G_C has an arc structure, and the center of the arc is inside C_C, as shown in diagram 4. Thus, this luminous arc is discovered in 1987 is explained.



In the Figure 1 is the v-color singlets with the uniform density in the spherical s-empty hole; 2 is the s-galaxy; 3 and 4 are the s-light emitted by the s-galaxy; 5 is the centre of the s-empty hole.

Figure 4. is the schematic diagram of the violet shift of the s-light emitted by the s-galaxy inside a spherical s-empty hole.

2.5. The Pressure of a s-empty Hole on Its Neighboring s-galaxies

A s-empty hole exerts pressure on the neighboring s-galaxies. This effect and the gravitational effect of dark matter inside the s-galaxies are additive, and both are not easily distinguished.

It can be known from [4] that the universe is composed of infinite s-cosmic islands, infinite v-cosmic islands and infinite transition zones. There is interaction between the transition zone and the cosmic island neighboring it. The transition zone is around the cosmic island and exerts pressure on the cosmic island. Therefore, the cosmic island cannot expand forever. When the matter density of the cosmic island is small enough due to expansion, the pressure of the transition zone on the cosmic island will be greater than the pressure of the cosmic island on the transition zone. At this case, the expansion of the cosmic island will stop and new evolution will take place.

Due to the pressure of the empty holes on a galaxy during the expansion of the cosmic island, it is not necessary that the galaxy will be torn apart due to expansion of the cosmic island.

2.6. The Expansion Rate of a s-empty Hole and Space Volume Occupied by the Empty Holes

It can be seen from [1] that the accelerated expansion of space is caused by color singlets. For a s-cosmic island with accelerated expansion, the average density of v-color singlets in a s-empty hole must be higher than the average density of v-color singlets in the s-cosmic island, and more significantly higher than the average density of v-color singlets in a cluster of s-galaxies. Therefore, the expansion rate of a s-empty hole is larger than that of cosmic island, and even larger than that of a cluster of s-galaxies.

In a s-cosmic island with accelerated expansion, the space occupied by the s-empty holes in the cosmic island must be larger than that occupied by the clusters of s-galaxies in the cosmic island. This is because of the following two reasons.

The average density of s-matter in the s-galaxies must be greater than the average density of v-color singlets in the s-empty holes, because s-matter can form clusters, while v-color singlets can only be dispersively distributed in space.

The average density of v-color singlets in the whole s-cosmic island must be higher than that of s-matter in the whole s-cosmic island with accelerated expansion.

3. Conclusions

Based on the universe model without singularity, this paper qualitatively proves that a huge empty hole has the following characteristics.

S-matter and s-galaxies in s-empty holes must be very scarce. A s-galaxy existing inside a s-empty hole must have the following characteristics. The s-galaxy is an emission galaxy; In addition to the cosmological red shift, the s-light emitted by the s-galaxy will also have a violet shift. The greater the density of the color singlets and the distance from the s-galaxy to the nearest boundary of the s-empty hole, is greater the violet shift. A spherical s-empty hole for s-light is equivalent to a concave lens. When the Milky Way G_M and a s-galaxy $\tilde{G}_M$ are respectively on the two side of an oblong empty hole or inside a huge s-empty hole (in a v-color singlet sea), an observer on the earth will observe the s-galaxy to be brighter than its real brightness. The luminous arc structure of galaxies which is near the central part of an elliptical clusters is explained. A cosmic island with an accelerating expansion cannot expand forever. There is no necessity that a galaxy will be torn apart during the expansion process of the cosmic island. The expansion rate of a s-empty hole is higher than that of a s-galaxy. The s-empty holes in a s-cosmic island with an accelerating expansion occupy more space than the s-galaxies in the s-cosmic island.

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