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# The Universe's Large Black Hole Problem

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Given the universe's total visible mass and assuming that basic gravitational theory is correct and is the only long-range force acting on the universe, the universe should be a large black hole. The assumption that there is additional matter in the universe as proposed by the dark matter hypothesis worsens this large black hole problem. Even under the big bang model the universe should have been a black hole the instant the mass-energy came into existence and it should still be a black hole today. The universe is not a black hole of any type known to science. This tells us that the force responsible for accelerating expansion is dominant or gravity weaker at long distances making universal scale black hole formation impossible. The universe's large black hole problem means that we must reconsider the physical mechanisms and underlying forces responsible for gravitation, accelerating expansion and the actual force underlying the dark matter problem.

## 1. The Problem

If we consider a commonly cited total mass figure for the visible universe of $10^{56}$ grams we can determine the Schwarzschild radius for a black hole with that mass. That black hole would have an event horizon radius of 1.485 x$10^{26}$ meters or approximately 15.7 billion light years.[1][2] This, of course, assumes that gravitation is the only long-range force at work.

It is interesting that this is very similar to the radius of the visible part of the universe, which is normally given as approximately 13.7 billion light years in order to be consistent with the big bang model. Consequently, the entirety of the visible part of a big bang type universe would reside inside a black hole. Note that in order for the event horizon to be 13.7 billion light years the total mass would be 8.7 x $10^{55}$ grams.

We have additionally long known that there is not enough mass in our galaxy and similar spiral galaxies to explain the attraction of the outermost stars due to gravitational theory alone. Similarly, there is not enough mass to explain the attractive forces within most galactic clusters. The most popular hypothesis to solve these problems is that there is some kind of dark matter present to explain this attraction as an additional gravitational effect. The alternative to a dark matter hypothesis is that there is a force missing from the standard model that is responsible.

In order to explain spiral galaxies using the dark matter hypothesis approximately 90% of all matter would need to be dark matter. So, if we use this estimate to approximate the total mass of the visible universe including dark matter, it would be on the order of $10^{57}$ grams. A $10^{57}$ gram universe would have a black hole event horizon of 1.485 x$10^{27}$ meters, or approximately 157 billion light years.

Alternatively, we can consider what the maximum amount of visible matter would be if 90% of all matter is dark matter and the universe is a black hole with a 13.7 billion light year radius event horizon. In that case the maximum total visible mass of the universe would be 8.7 x $10^{54}$ grams. This is below most commonly accepted mass estimates.

This problem is further complicated when we note that deep space mapping, such as with the Hubble telescope, continues to show that the density of galaxies in visibly darker regions of space increases the longer we collect light from that region. In other words when we spend sufficient time collecting light from a dark looking region of space, we find it is full of distant galaxies rather than being empty. This means that the galactic density of the universe may be significantly greater than the $10^{56}$ gram figure.

## 2. Are We in a Black Hole?

Under the most common interpretations of general relativity theory the matter within a black hole is expected to collapse into a singularity. Our observations of the visible universe are inconsistent with us being in a singularity. It is also inconsistent with us being on any type of small compact matter object, such as a neutron star, that we might expect to find in the middle of a black hole. We can be certain that we are not in a black hole as described by general relativity.

We can consider the possibility that we are in a classical black star type black hole as first predicted by John Michell.[3] But because the inward velocity at the event horizon is the speed of light there would still be a relativistic inward collapse of all matter in the black hole toward the center of mass. Classically this should lead to formation of a large neutron star at the center of the black hole universe.

That does introduce a relativistic problem as light and any object moving at or near the speed of light experiences clock slowing. As such the internal clocks of all bodies of matter within a black hole are essentially frozen in time from the perspective of an outside viewer far away from the event horizon. Within the black hole, light originating from other galaxies should be highly blue-shifted as all galaxies accelerate towards a central position at near the speed of light. This is not what we observe. Based on our observations it is very clear that we are not inside a black hole as described by Newtonian gravitation or general relativity theory.

Note that within quantum field theory the mass-energy of space as calculated by Wheeler and Misner is $10^{94}$ grams per cubic centimeter.[4] So, if the energy of the quantum field caused gravitation, a single cubic centimeter of space would create a black hole $10^{68}$ meters in diameter. This is about $10^{42}$ times larger than the visible universe. Obviously, the total energy of the quantum field does not have a gravitational effect of this magnitude on either light or matter.

## 3. The Acceleration Problem

The light from most galaxies is red-shifted instead of highly blue-shifted as expected if we were inside a black hole. This is commonly accepted as evidence that they are moving away from us. It has also been shown that red-shifting is changing in a way that indicates that galaxies are accelerating away from us. This acceleration is in opposition to gravity.

Acceleration means there is a force of some kind as force equals mass times acceleration, $\boldsymbol{F = ma}$. For universal accelerated expansion to exist the force behind it must be greater than the attractive force due to gravity. This also means that Newtonian gravity must be a composite force made of two or more forces. So, if we assume that gravity works as theorized over intergalactic scales of distance, the force behind accelerating expansion is more powerful than the most powerful black hole in the universe, the universe itself.

This unidentified force is commonly called dark energy. This unfortunate naming often leads to persons who are not physicists failing to recognize that it refers to a force that is not identified by the standard model. It is also clear that the missing force is not quantum field energy acting gravitationally as sometimes hypothesized as that would lead to universal collapse to a small object.

While popular literature highlights the power of black holes, the underlying force is still many orders of magnitude weaker than electromagnetic forces. So, it is possible for there to be a force responsible for accelerating expansion that is stronger than gravity.

Two important questions are; how is the gravitation force stronger than the force responsible for accelerating expansion over the scale of solar systems, galaxies, and galactic clusters, and how is the force behind accelerating expansion stronger than gravity over distances between galactic clusters.

There are three possible general solutions. One solution is that the gravitational force becomes weaker at long distances. The second is that the accelerating force becomes stronger at long distances. And, the third is a combination of the first two possibilities.

The idea of a force gaining strength with distance is at best counterintuitive. At worst it is a physical and scientific impossibility as it violates the principle of conservation of energy. So, gravity must become weaker at very long distances.

If we consider a basic two-body gravitational problem starting with two bodies in space stationary with respect to each other, there is no physical principle of action within the standard model that explains the what pushes the bodies together and how. There has never been an accepted explanation of the physical cause of acceleration within Newtonian gravitational theory or general relativity. We need to understand the physical principle of action responsible for gravitational acceleration before we can understand how the gravitational force diminishes with distance.

## 4. Big Bang Black Hole Problem

The idea that a body containing $10^{56}$ grams of mass or the equivalent mass-energy produces a black hole with a radius of 15.7 billion light years creates a big problem for the big bang model. Once the mass energy of the universe exists in a region of space with a radius less than 15.7 billion light years it will instantly be a black hole. If it were to start as a singularity or small point it would not be able to expand beyond its initial boundaries.

A separate expanding force that is stronger than gravitational attraction is required to make a black hole expand. But if such an expanding force was stronger than gravity at small distances then we would not have any solar systems or galaxies. We cannot even invoke the hypothesis that gravity becomes weaker with distance to solve this problem.

The black hole problem invalidates the big bang model starting at a point. Since black holes also form out of masses as small as three solar masses the big bang model does not even work with relatively small amounts of matter distributed throughout space unless smaller than three solar masses.

The big bang model attempts to get around this problem by invoking a fictional type of space, or non-space, that does not contain a quantum field. In such a fictitious space it is thought that the boundaries of a black hole could expand into nothingness. Such a type of space has never been observed and is not consistent with the known physics of the universe. Under a big bang model the universe must start as a black hole and must still be a black hole today. This is known to be false.

## 5. Conclusion

The standard model of the universe faces a serious difficulty due to the fact that the universe is massive enough that it should form a large black hole. This assumes that there is no other long-range force at work and that the gravitational force retains its inverse square law proportionality at great distances. It is clear that we are not inside a black hole as described by either Newtonian theory or general relativity.

When we factor in the hypothetical dark matter solution to the problem of gravity being too weak to explain spiral galaxies and galactic clusters, the universe's black hole problem becomes even worse. In a universe with gravitationally acting dark matter the inward acceleration of all matter would be greater. Included a hypothesis of gravitationally quantum field energy makes things much worse.

The universe's large black hole problem invalidates the big bang model as well, since a big bang type universe would start as a black hole and remain a black hole. The universe is not a black hole, thus invalidating the big bang model. Another force would also have to exist to explain the expansion of a big bang universe as no expansion of a black hole could occur if gravity is the only force at work.

It is clear from the universe's large black hole problem that gravitation becomes weaker at distances between galactic clusters, thus allowing the force responsible for accelerating expansion to dominate at those scales of distance. This long-range accelerating force is necessary to explain accelerating expansion and avoid the large black hole problem. We need to identify this force which is not currently part of the standard model.

The black hole problem also means it is likely that there is another unidentified force responsible for what is incorrectly called the dark matter problem. Additionally, we must determine the underlying principle of action behind gravitational acceleration so that we can understand how the gravitational force causes acceleration and diminishes at great distances.

Then in an effort to come up with a theory of everything we must ultimately determine how each of these three forces are interrelated such that they are aspects of a single force.

## References


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