

Exploring the Existence of Extraterrestrial Civilizations with the Liquid Universe Model

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Abstract: According to the liquid universe model, some of our existing ideas about extraterrestrial civilizations may need to be revised to some extent. Considering that the development of biological civilization needs to last for a relatively long time, for example, from the formation of protein on the earth to the age of dinosaurs, to the emergence of humans, it has continued for billions of years. And this time beginning was shortly after the birth of the planet. Therefore, the appearance of life on a planet is closely related to the life of the entire galaxy. Considering the liquid universe model, there are two cases. One is that the center of the galaxy is a black hole, which will continuously absorb the surrounding masses. The other is a white hole, which constantly throws masses to the outside. A common feature of both cases is that the outer masses of the galaxy exist for a long time, while the inner masses of the galaxy exist for a short time. Combining the time required for the evolution of living things, it can be judged that if advanced biological civilization is to be evolved in a galaxy, the more proliferating planets should be closer to the periphery of the galaxy, the longer the development time, the higher the civilization. According to such a conclusion, it means that at least in the Milky Way, the biological civilization on Earth should be in a very advanced position. This article also briefly discusses the various ways of detecting extraterrestrial civilizations, and gives some suggestions for the detection of extraterrestrial civilizations.

Keywords: Universe model; Extraterrestrial civilization; Black hole

Аннотация: Согласно модели жидкой вселенной, некоторые из наших существующих представлений о внеземных цивилизациях, возможно, должны быть в некоторой степени пересмотрены. Учитывая, что развитие биологической цивилизации должно длиться относительно долго, например, от образования белка на земле до эпохи динозавров, до появления людей, оно продолжается в течение миллиардов лет. И это время начало было вскоре после рождения планеты. Поэтому появление жизни на планете тесно связано с жизнью всей галактики. Рассматривая модель жидкой вселенной, есть два случая. Во-первых, центр галактики - черная дыра, которая будет постоянно поглощать окружающие массы. Другая - белая дыра, которая постоянно выбрасывает массы наружу. Общей особенностью обоих случаев является то, что внешние массы галактики существуют в течение длительного времени, в то время как внутренние массы галактики существуют в течение короткого времени. Сочетая время, необходимое для эволюции живых существ, можно судить, что если в галактике должна развиваться развитая биологическая цивилизация, то чем больше распространяющихся планет должно быть ближе к периферии галактики, тем дольше время развития, тем выше цивилизация. Согласно такому выводу, это означает, что, по крайней мере, в Млечном Пути биологическая цивилизация на Земле должна находиться в очень продвинутом положении. В этой статье также кратко обсуждаются различные способы обнаружения внеземных цивилизаций и даются некоторые

предложения по обнаружению внеземных цивилизаций.

1 Liquid universe model

The liquid universal model ^[2, 3] is a cosmological model constructed on the assumption of the existence of virtual space-time ^[1]. The existence of virtual space-time means that there will be an exchange of mass and energy between real space-time and virtual space-time. When a black hole exists, the real space-time will continue to have a mass flow to the virtual space-time, transform into the mass of the virtual space-time, and form a more powerful energy of the real space-time. And if the white hole exists, the mass of virtual space-time will continuously flow to real space-time. On the other hand, in the liquid universe model, the range of gravitation is limited ^[4], which leads to the way of mass movement in galaxies, which is mainly caused by the "viscosity" traction formed by the gravitational force within the limited range. And constantly flowing in or out of the core of the galaxy. This results in different planets' lifetime in different regions of the galaxy. Planets or stars that are near to the core of the galaxy have a short lifespan and can provide civilization with a short time to evolve, so it is not suitable for the evolution of advanced extraterrestrial civilizations. The outer periphery of the galaxy, which is far away from the core of the galaxy, can provide a longer time for the creatures to evolve to a higher civilization. Therefore, if you need to find advanced extraterrestrial civilizations, you should mainly look for it from the planetary system around the galaxy.

2 Biological civilization in the Milky Way

2.1 Existence of advanced biological civilization in the Milky Way

Since the Earth is in the Milky Way, we can have richer data to analyze the biological civilization in the Milky Way.

First of all, the Milky Way is a typical spiral galaxy. Therefore, there may be a huge black or white hole in the center of the galaxy. If the center of the Milky Way is a black hole, the surrounding star system will be continuously drawn into the black hole. In this way, the closest planets to the galaxy core will be absorbed into the black hole first. As the closer to the black hole, the larger and faster the energy changes around the star system, this leads to the life civilization in this star system will soon be destroyed if it has not developed the ability to resist energy changes in the environment. The possibility of evolving a more advanced civilization than the earth is very small. If the center of the Milky Way galaxy is a white hole, as the white hole continues to release mass, the farther away from the Milky Way's core, the longer the stellar system has existed, which also means that only the outermost planets of the Milky Way galaxy have a greater possibility to evolve a highly

developed biological civilization.

Figure 1 shows the location of the Earth in the Milky Way.

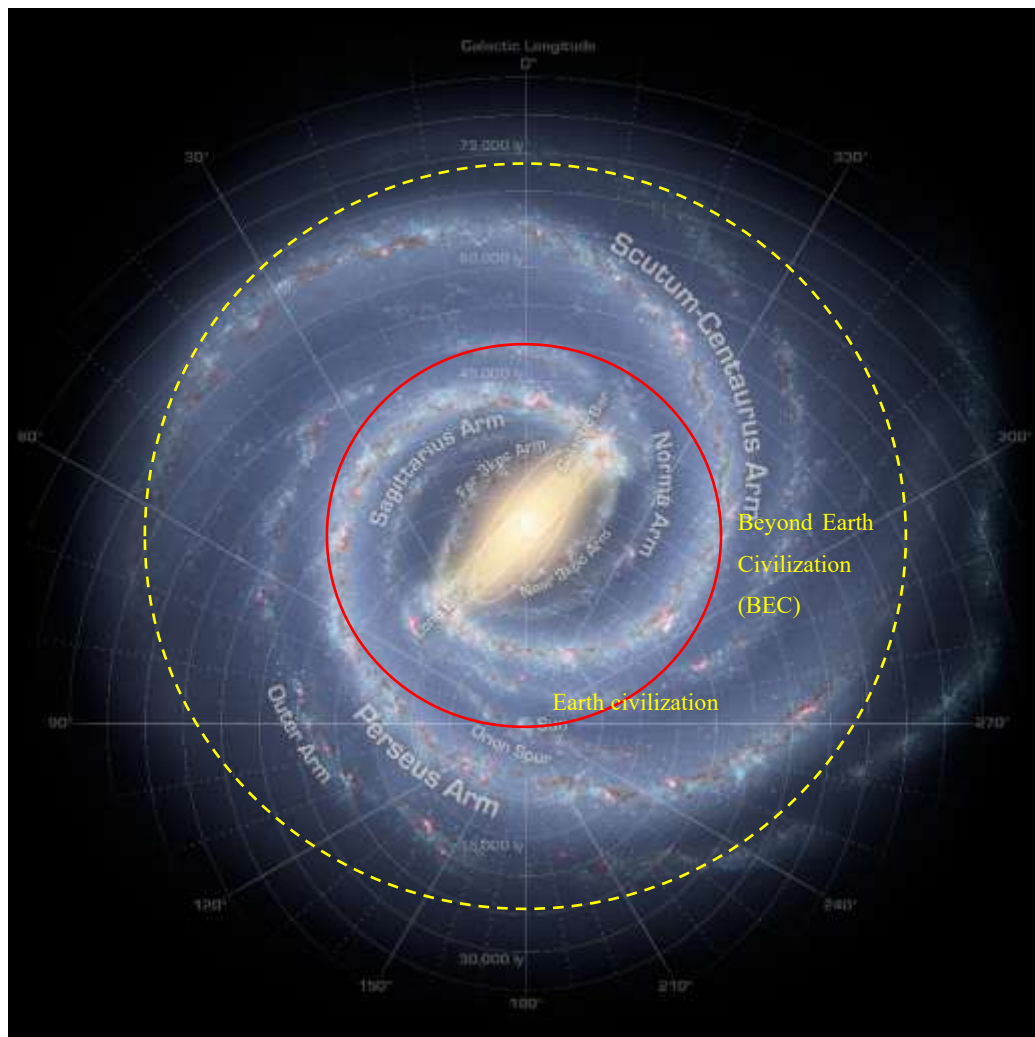


Figure 1 Location of the Earth in the Milky Way

(Source: NASA/JPL-Caltech/R. Hurt. <https://solarsystem.nasa.gov/resources/285/the-milky-way-galaxy/>)

As can be seen from Figure 1, the solar system is located on the periphery of the Milky Way, which is the position of the red circle in the figure. However, due to a farther range than the solar system, there is a very large area from the red circle to the yellow dotted circle. For the sake of convenience, this area that beyond earth civilization is referred to here as the BEC area. There are a large number of stars and planets in this area, and these star systems may have a longer lifetime than the solar system, so the possibility of generating extra-terrestrial civilizations that are more advanced than earth civilizations is higher. Therefore, when looking for an extraterrestrial civilization that is more advanced than the earth, we should start searching from this area. After all, only extraterrestrial civilizations that are more advanced than the earth can emit more powerful electromagnetic waves or other civilization signals.

2.2 If the center of the Milky Way is a black hole

If the center of the galaxy is a black hole, the masses will be constantly attracted to the black hole. The early mass generation can be caused by the cooling of high-temperature cosmic gas (elementary particles), or it can be ejected by other white holes. In this way, the ages of all galaxy materials in the BEC region in Figure 1 are about the same. Therefore, under this condition, the length of civilization development of all galaxies in the Milky Way is basically the same.

However, the closer to the core of the Milky Way galaxy, the greater the energy change, so the area inside the red circle in Figure 1 is more unstable. Of course, unstable energy changes may also synthesize proteins earlier. As a result, the geological structure in the planets and the atmosphere can be changed significantly, which has led to a faster alternative way of life and civilization. For example, from dinosaurs to humans. The drastic changes in the geological structure and climate of the earth led to the extinction of dinosaurs, which in turn evolved into smarter humans. And if the environmental energy of the entire planet is very stable, it may also lead to a longer survival time for dinosaurs and limit the emergence of more intelligent creatures.

Another question is how long does it take to develop a highly developed civilization? If after several billion years of accumulation, the degree of civilization has only reached the level of the current earth civilization, the closer to the core of the Milky Way galaxy, the greater the change in energy, which will increase the possibility of the civilization being completely destroyed. The core civilization may have been destroyed before it has developed enough to escape. Therefore, if the center of the galaxy is a black hole, only those extraterrestrial civilizations near the periphery of the BEC region can develop to a higher level.

2.3 If the center of the Milky Way is a white hole

If the center of the galaxy is a white hole, the material is ejected from the core of the galaxy. In the BEC region, the closer to the yellow dotted line in Figure 1, the longer the evolution of the biological civilization generated, and the possibility of a highly developed biological civilization is bigger. Of course, even for white holes, the BEC region also faces the problem that the core is a black hole, that is, the energy inside the red circle is more unstable.

In addition, in the case of white holes, there is also a problem of the length of civilization development. Even those galaxies that are far away from the core cannot reach a highly developed level of civilization without obtaining a long enough history of development.

3 What extraterrestrial civilizations can be detected

Of course, even the creatures on a planet have evolved to a highly civilized stage. However, since it is impossible to emit signals detected by detection instruments on the earth, this civilization is also meaningless to humans.

There are currently four types of interactions known to us: strong interactions, weak interactions, electromagnetic interactions, and gravitational interactions.

Among them, electromagnetic interaction has been widely used in the transmission and reception of radio waves. And it can be used for a wide range of information transfer on the planet. Therefore, in various plans for detecting extraterrestrial civilizations, the detection of electromagnetic waves is the most commonly used method.

The detection of electromagnetic waves can be received by large-scale radio telescopes on the ground. Data analysis can be done through high-performance computers or redundant network computing functions provided by the Internet. The University of California's SETI @ home program already exists. The plan uses the surplus computing power of personal computers on the Internet to analyze radio wave signals from galaxy space received by radio telescopes around the world, in the hope of obtaining some regular anomalous signals to confirm the existence of extraterrestrial civilization.

Another project, called the Darwin Project, is a direct acquisition of light from various planets in a galaxy through optical telescopes. The planet itself does not emit light, and only a highly civilized society like Earth has the ability to create light sources that can be observed in space. Therefore, if such artificial light is observed on extraterrestrial planets, it can prove the existence of extraterrestrial civilization.

Of course, in terms of the current development of earth civilization, various radio wave signals emitted by humans can already reach the edge of the solar system. By using these radio wave signals, humans can control the traveler spacecraft and obtain the signals sent back by the traveler spacecraft. If given enough time, other galaxies outside the solar system should be able to receive these radio wave signals if there are extraterrestrial civilizations similar to humans. The current situation can basically prove that Alpha Centauri has at least no extraterrestrial civilization consistent with the current human civilization on Earth. Otherwise, radio telescopes on Earth should be able to receive the radio wave signals they emit to detect outer space. Of course, at further distances, since the radio wave signals emitted by many biological civilizations are not specifically used to communicate with other galaxy civilizations, the signals are so weak that the current radio telescopes on Earth do not have high enough sensitivity to perform Distinguish. Optical signals are weaker, and relying on optical telescopes to observe abnormal light on planets in other star systems may require more advanced optical observation techniques.

In addition to detecting radio waves and optical signals, indirect methods can also be used to detect extraterrestrial civilizations. For example, analyze the spectral data in the atmosphere of an extraterrestrial planet to analyze the atmospheric composition of the planet. If an atmospheric structure similar to Earth is obtained, it is possible to determine whether the planet is suitable for human habitation and whether there are extraterrestrial civilizations similar to Earth on a relatively high probability. Although this method cannot obtain more specific information about civilizations, the sensitivity of current observation instruments on the earth can help us to obtain some important information about extraterrestrial civilizations. With the development of technology in the future, further exploration of extraterrestrial civilizations can be made more purposeful and targeted.

In addition to using electromagnetic interactions to detect extraterrestrial civilizations, other interactions can also be considered. For example, we have made great progress in the detection of gravitational waves. If extraterrestrial civilizations have developed to use gravitational waves for communication, detecting gravitational wave signals beyond our current theoretical interpretation can serve as an important proof of the existence of extraterrestrial civilizations. But at least for now, humans do not have the technology to receive such gravitational waves.

As for the strong interaction, its working distance is very short, so it cannot be used for long-distance communication. However, if various high-energy particles are generated through strong interactions, and such high-energy particles can be emitted in the form of cosmic rays, they may also be used to transmit signals from extraterrestrial civilizations.

Weak interactions are the most important interactions in nuclear reactions. Neutrinos in weak interactions can travel very far with little energy attenuation. There is also a lot of evidence that neutrinos have the ability to oscillate. Therefore, in theory, it should be possible to modulate the neutrino oscillation and modulate the signals of extraterrestrial civilizations into the neutrino propagation process. This will be more reliable than the signals transmitted by electromagnetic interactions. However, the current problem is that because the detection of neutrinos is very difficult, the data obtained is only a very small part of the sample. Because of this, the current human research on neutrinos is mainly about how to detect them. As for using them to communicate, there is still a long way to go.

Of course, if we look at the problem from a higher level like the entire universe, the entire universe is a flowing liquid, just like we see flowing water. Although ions in water have only a limited range of interactions, at a more macro level, we can easily control the flow of water. So, from this reasoning, at a more macro level of the universe, is there an interaction that completely transcends the speed limit of light? If there is, then it will allow us to connect two points in the universe space that currently seem completely unconnectable and then transfer information quickly between points. This should be a problem that can be explored theoretically.

4 Suggestions for the detection of extraterrestrial civilizations

As the detection of extraterrestrial civilizations is very difficult, the current technical conditions are not sufficient. Therefore, the formulation of various theories is instructive. This article analyzes the existence of extraterrestrial civilizations based on the liquid universe model, and can give us some suggestions for detecting extraterrestrial civilizations.

First, the detection of extraterrestrial civilizations should focus on areas of civilization that are more advanced than the earth. Because only such areas can produce various signals observed in galaxy space.

Second, the detection of extraterrestrial civilizations can focus on the periphery of the BEC area. Because in these locations, it is more likely that there is a biological system that is more advanced than the development of earth civilization. Consider electromagnetic signals first, and then develop neutrino, cosmic ray, and gravitational wave detection technologies.

Third, new interaction mechanisms in the universe need to be explored. These mechanisms can surpass the existing four major interaction mechanisms of electromagnetic, strong, weak, and gravitational force, so that information can be transmitted faster at any two points in the universe.

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用液体宇宙模型探讨地外文明的存在方式

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摘要: 按照液体宇宙模型, 我们现有的一些有关地外文明的观念可能需要做一定程度的修正。考虑到生物文明的发展需要持续比较长的时间, 比如地球上从蛋白质形成到恐龙时代, 再到人类的出现持续了几十亿年。而这个时间正是行星诞生不久出现的。因此一颗行星上的生命出现与整个星系的寿命是密切相关的。考虑到液体宇宙模型中, 有两种情况, 一种是星系中心是黑洞, 则会将周围的质量不断吸收进去。另一种是白洞, 会不断向外部抛射质量。这两种情况都有一个共同的特点, 就是星系外围质量存在的时间长, 而内围质量存在的时间短。结合生物的演化所需要的时间, 可以判断如果要在一个星系中进化出先进的生物文明, 繁衍生命的行星应该是越靠近星系的外围, 发展时间越长, 文明程度越高。按照这样的结论, 也就意味着, 至少在银河系, 地球上的生物文明应该是处于一个非常先进的地位。本文也简单探讨了一下地外文明探测的各种方式, 并对地外文明的探测给出一些建议。

关键词: 宇宙模型; 地外文明; 黑洞

1 液体宇宙模型

液体宇宙模型是在虚时空^[1]存在的假设基础之上构建出来的宇宙学宇宙模型^[2,3]。虚时空的存在意味着实时空和虚时空之间将存在质量和能量的交换。当黑洞存在的时候, 实时空就会不断有质量流向虚时空, 转换成虚时空的质量, 并形成实时空更强大的能量。而如果白洞存在的时候, 则虚时空的质量会不断流向实时空。另一方面由于在液体宇宙模型中, 万有引力的作用范围是有限的^[4], 这导致星系中质量的运动方式, 主要由星系之间有限作用范围的万有引力所形成的“黏滞力”牵引, 而不断流入或者流出星系核心。这样就导致星系中不同区域的星系物质寿命是不同的。离星系核心较近的行星或者恒星寿命较短, 能够提供给文明进化的时间也很短, 因此不适合进化出先进的地外文明。而离星系核心较远的星系外围则能够提供更长的时间让生物进化到更高度的文明, 因此如果需要寻找先进的地外文明主要还是从星系外围的行星系统中进行寻找。

2 银河系中的生物文明

2.1 银河系先进生物文明存在的范围

由于地球处于银河系中, 因此我们可以有更丰富的数据来对银河系中的生物文明进行分析。

首先银河系是一个比较典型的螺旋星系。因此银河系中心可能存在一个巨大的黑洞或者白洞。如果银河系中心是一个黑洞, 则外围的恒星系会不断被牵引吸收进黑洞。这样离银河系核心最近的恒星系会最先被吸收进黑洞。由于离黑洞越近, 恒星系的周围的能量变化越大且速度越快, 这导致该恒星系中的生命文明如果没有进化出超越抵抗环境中能量变化的能力, 则很快就会被毁灭掉, 进化出比地球更先进文明的可能性就很小了。如果银河系中心是一个

白洞，则由于白洞不断释放质量，离银河系核心越远的区域，恒星系存在的时间越长，这也意味着只有银河系外围的行星才有更大的可能性进化出高度发达生物文明。

图 1 显示了地球在银河系中的位置。

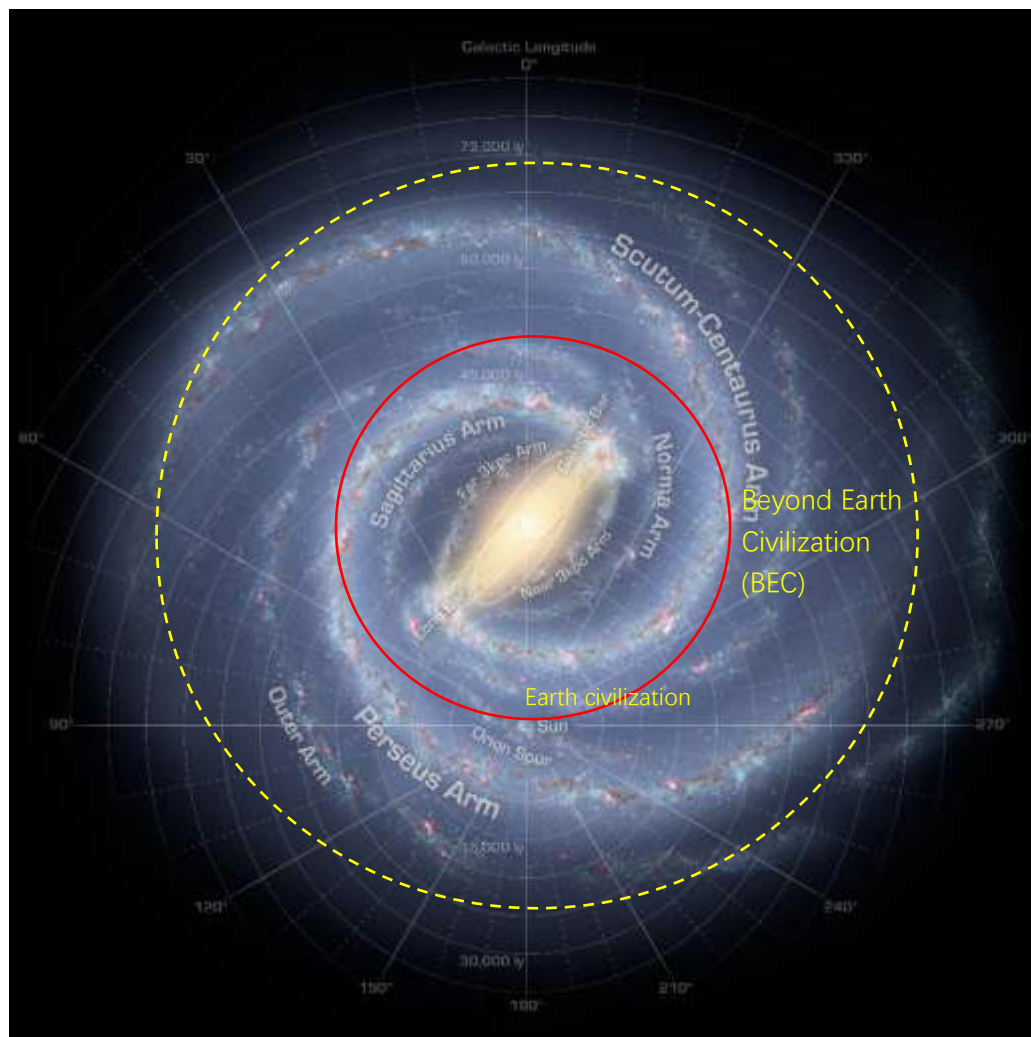


图 1 地球在银河系中的位置

(Source: NASA/JPL-Caltech/R. Hurt. <https://solarsystem.nasa.gov/resources/285/the-milky-way-galaxy/>)

从图 1 可以看出，太阳系位于银河系的外围，即图中红色圆圈的位置。不过由于比太阳系更远的范围，从红色圆圈到黄色虚线圆圈还有非常大的区域存在。为方便起见，这里将这种有可能超过地球文明的区域简称为 BEC 区域。在这个区域中存在大量的恒星和行星，且这些恒星系的寿命都可能会比太阳系要长，故产生比地球文明更先进的地外文明的可能性就会比较高。因此在寻找比地球更先进的地外文明的时候，应该从这个区域开始进行寻找。毕竟只有比地球更先进的地外文明才有可能发出更强大的电磁波或者其他的文明信号。

2.2 如果银河系中心是一个黑洞

如果银河系中心是一个黑洞，则质量将被不断吸引进黑洞。而早期质量的产生则可以是高热宇宙气体（基本粒子）冷却而形成的，也可能是抛射出来的。这样图 1 中的 BEC 区域所有星系物质的年龄都差不多，因此这种条件下，银河系中所有星系的文明发展时间长度基本上都是一致的。

不过由于越靠近银河系核心，则能量变化越大，因此 BEC 区域中靠近红色圆圈的区域更加不稳定。当然不稳定的能量变化也有可能更早地合成出蛋白质出来。导致行星上面的地质结构，大气层产生较大幅度的变化，从而引起生命文明更快的交替方式。比如从恐龙进化到人类。由于地球上地质结构以及气候的大幅度变化导致恐龙的灭绝，进而进化出更聪明的人类。而如果整个行星的所处的环境能量变化非常稳定，则也可能导致恐龙这种生物可以有更长时间的生存时间，并限制更高智慧的生物出现。

另一个问题就是高度发达文明的发展需要积累多长的时间？如果经过几十亿年的积累，文明程度也只是达到现在地球文明的程度，则越靠近银河系核心的区域，能量变化越大，这导致该文明被完全毁灭的可能性增大，因此那些靠近银河系核心的文明可能还没有发展到足够能够逃脱出来的命运就已经被毁灭掉了。因此银河系中心如果是黑洞的条件下，也只有那些靠近 BEC 区域外围的地外文明才有可能发展到更高级的阶段。

2.3 如果银河系中心是一个白洞

如果银河系中心是一个白洞，则物质从银河系核心被抛射出来，在 BEC 区域中，越靠近外围的黄色虚线，则所产生的生物文明进化时间越长，孕育出高度发达的生物文明的可能性越大。当然即便是白洞，BEC 区域也同样面临核心为黑洞那样的问题，即靠近红色圆圈的区域能量更加不稳定。

另外白洞的情况也存在一个文明发展时间长度的问题。即便是那些已经远离核心的恒星系，如果没有获得足够长的历史发展时间，也是无法达到高度发达的文明程度的。

3 什么样的地外文明可以被探测

当然即便是一个行星上的生物已经进化到了高度文明的阶段。但是由于是无法发射出被地球上的探测仪器探测到的信号，则这种文明对于人类来说也是没有意义的。

目前我们已知的相互作用有四种，分别是强相互作用、弱相互作用、电磁相互作用和引力相互作用。

其中电磁相互作用已经被广泛应用在无线电波的发射与接收方面。用来在地球上进行广泛的信息传递。因此在探测地外文明的各种计划中，电磁波的探测是最常使用的一种方式。

电磁波的探测可以通过地面大型射电望远镜来进行接收。数据分析则可以通过高性能计算机

或者是互联网提供的富余网络计算功能来完成。目前已经有加州大学的 SETI@home 计划。该计划利用互联网上的个人计算机富余计算能力来分析世界各地射电望远镜所接收到的来自星系空间的无线电波信号，以期能够获得一些有规律的异常信号，以证实地外文明的存在。

另一个计划叫做“达尔文计划”，是直接通过光学望远镜获取星系中各种行星发出的光线。行星本身并不会发光，只有像地球这样的高度文明社会才具备制造宇宙空间可以观察到的光源的能力。因此如果在地外行星上观察到了这种人工光线，即可证明地外文明的存在。

当然就目前地球文明发展情况来看，人类所发射的各种无线电波信号已经可以达到太阳系边缘。通过这些无线电波信号，人类能够对旅行者飞船进行控制，获取旅行者飞船发送回来的信号。如果给予足够长的时间，太阳系外的其他星系如果存在类似于人类的地外文明，应该可以接收到这些无线电波信号。目前的情况基本可以证明半人马座 a 至少不存在与目前地球上人类文明相一致的地外文明。否则地球上的射电望远镜应该可以接收到他们所发射的探测外太空的无线电波信号。当然如果更远的距离，由于很多生物文明所发射的无线电波信号并不是专门用来跟其他星系文明进行交流的，故信号太弱，以至于目前地球上的射电望远镜没有足够高的灵敏度来进行分辨。而光学信号则更弱，依靠光学望远镜来观察其他恒星系中的行星上异常的光线，可能需要更先进的光学观测技术。

除了探测无线电波信号和光学信号之外，也可以使用间接方法来探测地外文明。比如分析地外行星大气层中的光谱数据，来分析该行星中的大气成分。如果获得了跟地球类似的大气结构，则可以在比较大的概率上来确定该行星上是否适合人类的居住以及是否存在类似于地球的地外文明。这种方法虽然无法获得更具体的文明信息，但是以目前地球上观测仪器的灵敏度，可以帮助我们获得更大范围的地外文明的一些重要信息。在今后技术发展的情况下，能够让地外文明的进一步探测更加有目的性和针对性。

除了利用电磁相互作用来探测地外文明之外，还可以考虑其他的相互作用，比如目前我们在引力波的探测方面获得了很大的进展。如果地外文明已经发展到利用引力波进行通信的话，则探测超出我们现在理论解释的引力波信号可以作为地外文明存在的一种重要证据。但至少目前来看，人类还没有掌握接收这种引力波的技术。

而至于强相互作用，则它的作用距离很短，因此无法用来进行远距离的通信。但是如果通过强相互作用产生了各种高能粒子，而这种高能粒子又能够以宇宙射线的形式发射出来，则也有可能用来传递地外文明的信号。

弱相互作用是核反应中的最重要相互作用。弱相互作用中的中微子可以在能量衰减很少的情况下传递的很远。现在也有很多的证据表明，中微子存在振荡的能力。因此理论上也应该可以对中微子的振荡进行调制，将地外文明的信号调制到中微子的传播过程中。这将比电磁相互作用所传递的信号要更加可靠一些。不过目前的问题在于由于中微子的探测很困难，所获得的数据只是样本中极少的部分，是否能够并以此来断定确实就是中微子振荡效应还是值得商榷的。正因为如此，目前人类对中微子的研究主要还是在如何探测方面，至于将其利用起来进行通信还有很长的路要走。

当然如果我们从整个宇宙这样的更高层次来看问题，整个宇宙就是一个流动的液体，就如同我们看到流动的水一样。尽管水中的离子只有很有限范围的相互作用，但是在更宏观的层面，

我们却可以很方便地控制水的流动。那么由此推理，在一个宇宙更宏观的层次上来看，是否存在一个完全超越光速限制的相互作用的存在，让我们能够将目前看起来完全不可联系的宇宙空间两个点连接在一起，这两点之间能够很快速地传递信息？这应该是也是理论上可以进行探索的问题。

4 地外文明探测的一点建议

由于地外文明的探测非常困难，目前的技术条件也不太足够。因此各种理论的提出都是有启发性的。这里在液态宇宙模型基础上分析了地外文明的存在情况，可以给我们探测地外文明提出一些建议。

第一，地外文明的探测应该将注意力集中在比地球更加先进的文明区域。因为只有这样的区域才能够制造出在星系空间被观测到的各种信号。

第二，地外文明的探测可以将主要的精力放在 BEC 区域的外围。因为在这些位置存在比地球文明发展程度更高的生物系统可能性更大。优先考虑电磁信号，然后也可以发展中微子、宇宙射线、引力波等信号的探测技术。

第三，需要探索宇宙中的新的相互作用机制。这些机制能够超越现有的电磁、强、弱、引力等四大相互作用机制，从而能够更快速地在宇宙中任意两点传递信息。

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