The reason for the change in the gravitational constant

Zhi Cheng
gzchengzhi@hotmail.com

Abstract

The gravitational constant may be constantly changing. Although the relevant evidence is not very sufficient at present, from the existing experimental results, the gravitational constant is the least accurate constant among all the constants. This also shows that the gravitational constant may change with the change of space-time. This paper attempts to explore the possible reasons for the change of the gravitational constant. This work is also based on the results of some of my previous works. But this paper mainly discusses on the basis of the fluid model of dark matter. According to the fluid model of dark matter, dark matter in the entire universe is a gaseous fluid state. And this fluid naturally has various thermodynamic properties. Which involves pressure, temperature and volume, and so on. If the temperature or pressure of the dark matter fluid is affected, the viscosity coefficient of the dark matter fluid will change. In the dark matter fluid model, it is assumed that the viscosity coefficient of the dark matter fluid is a parameter that is completely consistent with the gravitational constant. Therefore, if the viscosity coefficient of the dark matter fluid increases or decreases, it will directly cause the gravitational constant to increase or decrease in this part of space-time. This paper analyzes the difference in temperature in different space-time locations of the solar system, and points out that in the location close to the sun, due to the relatively high temperature, the temperature of dark matter in this part of the natural world will also be relatively high. If the dark matter fluid is a gas, the higher the temperature, the higher the viscosity coefficient. Combined with some previous analyses, we can see that the dark matter fluid should mainly exist in the form of gas. This is because from the results of these analyses, the gravitational constant should be larger the closer you are to the sun.

1 Introduction

I have been particularly interested in the change of the gravitational constant in the past two years, and have also established various models to analyze [1~9]. Among the possible reasons for the change of the gravitational constant, I think one of the larger effects is the change of space-time. In these articles, I also regard space-time as a matter with a certain volume. Therefore, where there is mass, space-time will be larger, and where there is no mass, space-time will be smaller. According to this result, we can see that the gravitational constant may be relatively large in the large space-time. In a space-time with a relatively small mass, the gravitational constant will also be relatively small. From this I deduce that for a planet as large as Jupiter in the solar system, it may have a significant impact on the measurement of the gravitational constant on Earth. Of course, when measuring the gravitational constant on the earth, the problem of the perihelion and aphelion of the earth will also be involved. If the earth is closer to the sun, the gravitational force of the sun at the location where the measuring instrument is located on the earth will be stronger, and the gravitational constant measured naturally may also be larger.

I did some more detailed analysis on this and got some results. Then I compared these results with the published gravitational constant measurement values [1~8], and corrected the existing errors, and found that such a model still has the effect of improving the accuracy to a certain extent. Unfortunately, the effect of improving the accuracy is not particularly good, and at the same time, new errors are generated due to the introduction of the bright model.

In order to obtain more data to support my model, I also sent my model paper to an academic institution for gravitational measurement. As a result, the other party only sent me the data I needed for reference, but did not comment on my views.

Nonetheless, I feel they have given me enough information, so I am very grateful for their replies. From their simple replies, I can see the following information. The first is that they must have received my paper, so they can be reassured about the entire email system. Now that they have received my paper, they must also understand my point of view. However, they did not comment on my point of view, which also shows that my point of view is very different from their existing point of view related to the gravitational constant. Since there are differences, they can't make any valuable comments. In the end, I haven't seen any new gravitational field number measurement results in open academic journals for so long since I got their reply. This also shows that they have indeed conducted a lot of related experiments, but there is no experimental evidence to support my model. Naturally this means that my model may not be supported by experimental observations. This is certainly not a bad thing, after all it shows that there are still some problems with my model. Appropriate improvements to these problems should lead to better models.

At present, according to my newly established model [9], dark matter is a kind of fluid. And the matter we can see now, including the matter of galaxies like the Milky Way, is actually produced by the turbulence of dark matter fluid. This does not actually contradict my previous finite space-time model, because turbulence still has a boundary after all, so the boundary of this turbulence is actually equivalent to the space-time boundary in my previous model.

And if the turbulence is larger, it may cause the pressure inside the turbulence to be larger, which in turn causes the temperature inside the turbulence to change. This pressure and temperature change is an important reason for the change of the viscosity coefficient of the fluid.

However, since we have now determined that the gravitational constant is related to the viscosity coefficient of the dark matter fluid, we can infer the possible changes of the gravitational constant from the change of the viscosity coefficient of the dark matter fluid.

In a star system, such as the solar system, the temperature distribution at each point in its space-time can be observed. Therefore, at a position close to the sun, its temperature will be relatively high at this time, which means that the temperature of the dark matter fluid is high. If the fluid is a liquid, high temperature will cause the viscosity coefficient of the liquid to decrease. However, from the previous analysis. The closer you are to the sun, the larger the gravitational field should be. So dark matter fluids may exist in gaseous form. In the gas state, the higher the temperature, the greater the interaction within the gas molecules, which in turn leads to an increase in the viscosity coefficient of the gas. Therefore, in the position close to the sun, the increase in the temperature of the dark matter fluid will cause the viscosity coefficient to increase, resulting in a larger gravitational constant measured close to the sun.

2 The temperature gradient of the solar system

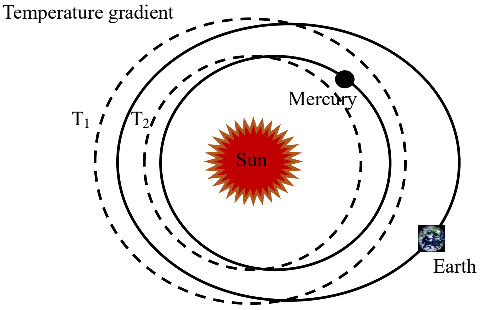

Figure 1. The distribution of dark matter temperature in the solar system

In Figure 1, we can see that the temperature distribution in the solar system is gradient due to the existence of the sun. The dashed circles in it represent isotherms. Two isotherms are involved, corresponding to the temperatures T_1 and T_2 respectively. If the dark matter is in the state of gas, the higher the temperature of the dark matter, the higher the viscosity coefficient of the dark matter fluid. If the viscosity coefficient of dark matter is proportional to the gravitational constant, the closer the position to the sun, the greater the gravitational constant. That is, the temperature T_1 is less than T_2 in the figure. Therefore, the gravitational constant at the position of the T_2 isotherm in the figure is greater than that at the position of the T_1 isotherm.

Let's draw the orbits of Earth and Mercury again. Mercury's orbit lies at the location of the T_2 isotherm. The Earth's orbit is at the location of the T_1 isotherm. That is to say, the gravitational constant at the position of Earth is smaller than that at the position of Mercury.

On the other hand, we can also notice that the orbits of both Mercury and the Earth are elliptical. Therefore, the gravitational constant measured when Mercury or the Earth is at perihelion is larger than the gravitational constant measured when Mercury or the Earth is at aphelion.

In the literature [6], I made a calculation, if the gravitational constant of Mercury's perihelion is a little larger than that of aphelion, then it can solve the little error of Mercury's perihelion offset after the correction of general relativity.

Next, we can analyze if there is a difference in the gravitational constant between the perihelion and the aphelion of the earth. Unlike literature [1], the influence of Saturn is not considered here. At the same time, no specific calculation is made for the difference in the gravitational constant.

In addition, we have to be clear that the temperature of the sun is not the same as the temperature of dark matter. We now know that vacuum is a very good thermal insulator. So it is impossible for the sun to transfer this heat directly to the dark matter fluid without other radiation.

That is, the temperature of the sun is not equal to the temperature of dark matter. The main reason for this is that dark matter does not participate in electromagnetic interactions.

But we can still reasonably assume that there is at least a gravitational interaction between dark matter and the sun. Maybe there are other interactions that we don't know about. These interactions then have the potential to transfer the temperature of the sun to the dark matter fluid. This causes the temperature of the dark matter fluid to rise.

Considering that the closer you are to the sun, the stronger the interaction between the dark matter fluid and the sun, it can be inferred that the closer you are to the sun, the higher the temperature of the dark matter may be. And the farther away you are from the sun, the cooler the dark matter is likely to be.

Another thing worth noting is that it is precisely because the uncertainty of the interaction between dark matter and visible matter such as the sun is very large, which also leads to the interaction between dark matter and visible matter such as the sun at different times. great uncertainty. Therefore, at different times, the viscosity coefficient of the dark matter fluid may vary widely. This should explain why the gravitational constants measured at many different times vary so much.

3 The position of the Earth's perihelion and aphelion

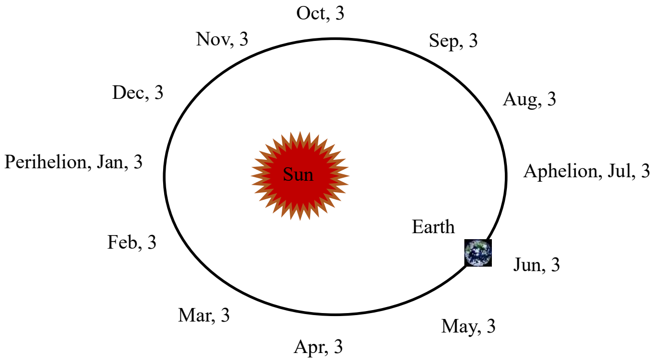

Figure 2. The perihelion and aphelion of earth

Figure 2 gives the dates corresponding to the Earth's perihelion and aphelion. It also roughly marks the position of the Earth in orbit in different months.

3.1 BIPM-01 and BIPM-14

The first measurements by Quinn et al. were from October 1 to October 30, 2000 [11]. The result of the measurement is $6.67559 \times 10^{-11} m^3 kg^{-1} s^{-2}$.

The second measurement was from August 7 to September 7, 2007 [12, 13]. The result of the measurement is $6.67545 \times 10^{-11} m^3 kg^{-1} s^{-2}$.

The relative position between the Earth and the sun when Quinn et al. measured twice can be represented in Figure 3. It can be seen that the position of BIPM-01 measured for the first time is closer to the sun, so the measured gravitational constant will be larger.

However, because the time interval between the results of these two measurements is too long, there may be some accidental factors in the difference between the two results.

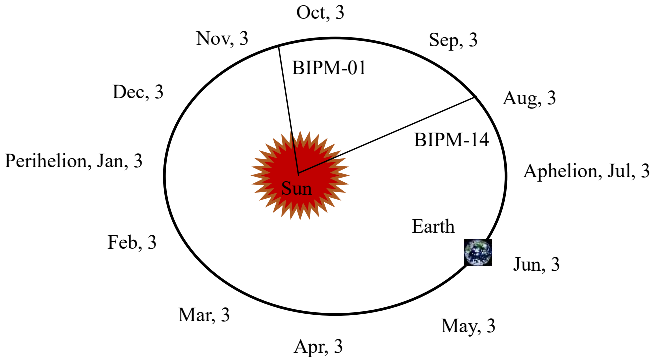

Figure 3. Measurement date of BIPM-01 and BIPM-14

3.2 JILA-10

The experiments of Parks et al. were mainly completed from May to June 2004 [14], and their measurement results were $(6.67234 \pm 0.00014) \times 10^{-11} m^3 kg^{-1} s^{-2}$. During the measurement process from May to June, the earth is gradually moving towards the aphelion, so the measured value will gradually decrease. In Parks' paper [14], Figure 2 in the paper shows the series of data measured during this time. It can be seen that the value of the gravitational constant measured in June shows a significant downward trend.

3.3 UCI-14

The measurement times of Newman et al. are 9-11/2000, 12/2000, 3-5/2002, 3-5/2006 [15]. The measurement in 2004 was discarded because the noise signal was too large. Newman used three torsion balance fibers. 9-11/2000 used the first fiber (Fibre 1), 12/2000, 3-5/2002 used the second fiber (Fibre 2), 3-5/2006 used the third fiber (Fibre 3).

Although the second fiber was used in 12/2000, the number of experiments was only more than one hundred times, so the second fiber was mainly used in 3-5/2002.

The locations of the three measurements are shown in Figure 4.

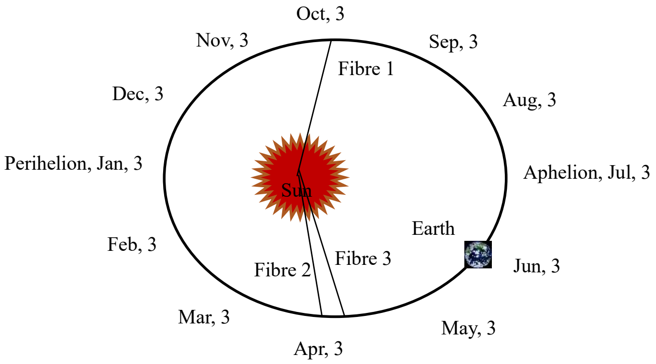

Figure 4. Measurement date of UCI-14

From this result, the distance between the earth and the sun is approximately equal in the average measurement time of the three times. Therefore, the actual measured results should be roughly the same. However, the actual measurement results are:

Fibre 1: $6.67435(10) \times 10^{-11} m^3 kg^{-1} s^{-2}$.

Fibre 2: $6.67408(15) \times 10^{-11} m^3 kg^{-1} s^{-2}$

Fibre 3: $6.67455(13) \times 10^{-11} m^3 kg^{-1} s^{-2}$

It can be seen that the difference is quite obvious. This difference may be related to the long-time span of the three measurements. If the dark matter fluid is very unstable, then the instability of this dark matter fluid will also lead to a relatively wide range of changes in the viscosity coefficient of the dark matter fluid in different years.

4 Detailed analyses of HUST-09 and HUST-18

Since HUST-09 [16, 17] and HUST-18 [18] are both very high-precision gravitational constant measurement experiments. At the same time, the data given in HUST-09 is also very detailed, so here is a detailed analysis of the data of HUST-09. Through the analysis of these high-precision data, it should be able to give more convincing evidence.

The first experiments were conducted from March 21, 2007 to May 20, 2007, and April 19, 2008 to May 10, 2008 [16, 17].

The second experiment was from August 25, 2008 to September 28, 2008, and October 8, 2008 to November 16, 2008.

We can also note that the equipment used in the two experiments is the same, so it is expected that the systematic errors generated by the two experiments should have approximately the same variation law.

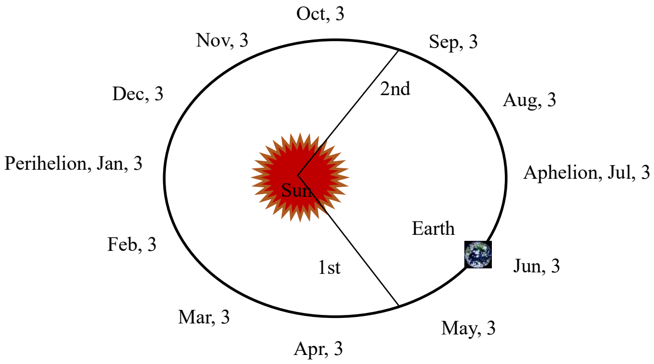

Figure 4. Measurement date of Hust-09

The actual situation is that the value of the gravitational constant measured by the first experiment is:

$$(6.67352 \pm 0.00019) \times 10^{-11} m^3 kg^{-1} s^{-2}$$

The gravitational constant measured in the second experiment is:

$$(6.67346 \pm 0.00021) \times 10^{-11} m^3 kg^{-1} s^{-2}$$

From the average position of the measurements, the average of the gravitational constants of the two measurements should be roughly equal. The error is small. However, since the time span of each measurement is very long, in the process of measurement, the value of the gravitational constant measured for the first time should gradually decrease. The value of the gravitational constant measured in the second measurement should be gradually increasing. But if such experimental data really exists, the HUST-09 team should publish it. The fact that no such data has been published indicates that the group should not have observed this increasing and decreasing regularity of the gravitational constant.

In addition, from the tables corresponding to their two experimental results, the results of Table VI and Table VII in the paper [17] show that, from March to May, and from August to November, the measured period is decreasing. . It shows that the measured gravitational constants are all increasing continuously. It appears that the errors in their measurements are mainly systematic errors. That is, the gravitational constant measured at the beginning of their experiment will be too small. Then, with the continuous running-in of the test device (or the aging of fiber, etc.), the measured gravitational constant will continue to rise.

If the gravitational constant is constant, then the systematic errors of the two measured curves should have equal slopes.

Considering that when the earth moves toward the aphelion, the gravitational constant gradually decreases, and vice versa. Therefore, the slope measured in the first experiment should be smaller than that in the second experiment.

From the data fitting results of FIG.42 and FIG.43 in paper [17], this is indeed the case.

The result of the first experiment Far, the slope of With masses is 0.000525439, and the slope of Without masses is 0.000350952.

The result of the second experiment Far, the slope of With masses is 0.000581389, and the slope of Without masses is 0.000493226.

The results of the first experiment Near, the slope of With masses is 0.000508772, and the slope of Without masses is 0.000299048.

The result of the second experiment Near, the slope of With masses is 0.000663889, and the slope of Without masses is 0.00038871.

It can be seen that the slope of the second experiment, whether it is Near or Far, the measured slope of the change of the gravitational constant is significantly larger than that of the first experiment.

This may also indicate that the gravitational constant of the first measurement has continued to decline. The gravitational constant of the second measurement continued to rise.

In addition, it should also be possible to exclude the problem of the interval between two experiments, the system error after a certain period of time, and the change of the instrument with the running-in of the instrument or the aging of the fiber. According to the operating law of the instrument, with the continuous running-in of the instrument, factors such as fiber aging [19] should become more stable, so the measured data should be more stable. The systematic error should be smaller.

However, what we can see from these data is that the slope of the second experiment is significantly larger than that of the first experiment, and the slope of the fitted straight line shows that the second experiment has a larger systematic error.

For HUST-18, the gravitational constants measured by the angular-acceleration-feedback method mainly have three sets of data, namely AAF-I of 2014.12-2015.01. AAF-II of 2016.04-2016.06 and AAF-III of 2017.09-2017.11. For the sake of comparison, the three results I reproduced in Figure 5 in this article.

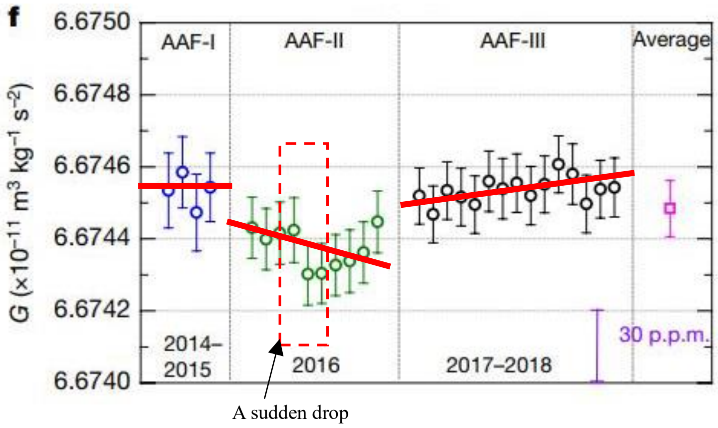

Figure 5. The results of Hust-18

The time for three measurements corresponds to Figure 6.

It can be seen that the gravitational constant measured by AAF-I should be the largest. The gravitational constant measured by AAF-II should be the smallest. The value of the gravitational constant measured by AAF-III is between AAF-I and AAF-II.

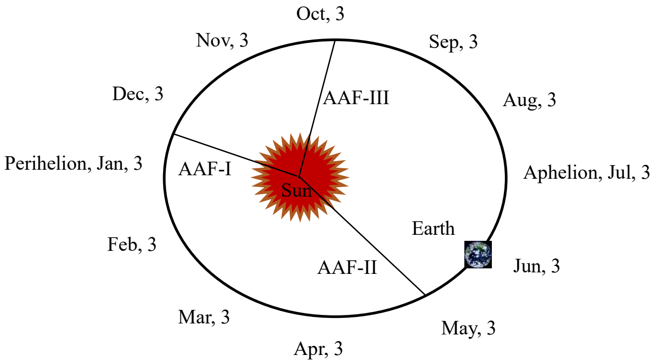

Figure 6. Measurement date of Hust-18

From the results of Fig. 2(f) of the related paper [18] (which is believed to have corrected the systematic error), the actual measurement results of AAF-I and AAF-III are almost equal. The measured value of AAF-II is significantly smaller than the results of the other two measurements. As shown in Figure 5.

In addition, in terms of the time sequence of measurement, AAF-I is close to perihelion when measured. Therefore, the data measured in this month are less affected by systematic errors, and the data is relatively stable.

The value of the gravitational constant measured by AAF-III should gradually increase. This is consistent with the result of Fig.2(f) of the paper.

Theory predicts a gradual decline in the value of the gravitational constant measured by AAF-II. From Fig.2(f), there is indeed a clear drop in this data. Such as the data changes in the red dashed box in Figure 5 of this paper.

5 Conclusion

From the analysis results of this paper, the main reason why the measurement accuracy of the gravitational constant is so low is that the gravitational constant itself is constantly changing. This change may be related to a variety of factors. This paper assumes that the mass of the galaxy is the energy of the turbulence formed by the dark matter fluid. Therefore, the gravitational constant may be directly related to the viscosity coefficient of the dark matter fluid. Changes in the temperature and pressure of the dark matter fluid could lead to changes in the gravitational constant.

The temperature of the dark matter fluid is mainly affected by solar radiation. However, since dark matter does not participate in electromagnetic interactions, the conduction of solar radiation temperature is mainly related to the gravitational interaction of dark matter with the sun and other planets. In regions with stronger gravity, the energy of solar radiation will be more easily transferred to dark matter, causing the temperature of dark matter to rise.

If one considers that dark matter is a gas, as the temperature of the dark matter fluid rises, the viscosity coefficient of dark matter rises, leading to a rise in the gravitational constant. Then in the solar system, the closer you are to the sun, the greater the gravitational constant will be. Because our experiments to measure the gravitational constant are usually carried out on Earth. And there is a distinction between aphelion and perihelion on the earth, so according to this gravitational constant theory, it can be predicted that at the perihelion position of the earth, the gravitational constant will measure the maximum value. At the aphelion, the gravitational constant will be at a minimum. Considering that many measurements will last for several months or even longer, the measured data is usually from January to July, and the gravitational constant will be measured larger and larger. From July to December, the measured gravitational constant will get smaller and smaller.

By comparing several typical measured values of the gravitational constant with time records, we can find that such a law basically still exists. In particular, we performed a more detailed analysis of HUST-09 and HUST-18. Although in HUST-09, the data records measured in March-May and August-November all show that the gravitational constant seems to be increasing with the passage of measurement time. However, after careful analysis, I found that if the systematic error is eliminated, it can be clearly seen that the gravitational constant measured from August to November is continuously increasing. The gravitational constant measured from March to May keeps decreasing. This is in line with the predictions of the new theory.

The data analysis for HUST-18 also showed the same pattern.

Through the analysis of this paper, we can also have another different understanding of time and space. In relativistic space-time, time and space are not absolute. Changes such as contraction and expansion of time and space may occur as the speed of movement varies. This kind of relativistic space-time view is difficult to understand. However, if we apply the assumption that visible matter is the turbulence of dark matter fluids, we can find that since turbulence is all limited, the space-time we can observe is naturally limited. Because the turbulence of the dark matter fluid determines the size of the visible space-time. The size of this visible matter space-time also determines the scope of gravitational action.

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