A micro interpretation for the generation of gravity: the consistent spin direction of clustered quarks in two objects

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Abstract

Today, although two main physical theories of Newton gravity law and General Relativity could mathematically measure gravity, the scientific community has still not figured out how gravity is generated at the micro perspective. Instead of seeking some particle that serves as the medium to spread the gravity, we argue the underlying mechanism of gravity is similar to another contactless force of magnetic force. The difference lies in the fact that the key particle which plays the dominant role in generating gravity is the spin direction of clustered quarks rather than electrons.

Keywords: gravity; spin; quark; electron.

Contents

1 The general principle of phenomena measure

In order to figure out how gravity is generated, a practical option is to find out the principle for how we could measure it. First of all, we cannot directly perceive reality itself but various phenomena, which are generated via the interaction between observers' sensors[2] and reality. Any phenomena, either perceived or non-perceived, can be taken as an intersection of several finite properties simultaneously fixed at a certain degree. In short, denote $A_i, i = 1, 2... k$ are all finite properties. For any phenomenon denoted as P, there are some fixed degrees of A_i, denoted as a_i, then

$$P \approx \bigcap_i \{A_i = a_i\} \tag{1}$$

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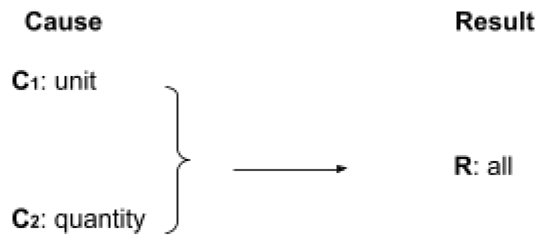
[2] Sensors here refers to not only the natural sensor, e.g. eyes, ear, but also the technique aids or tools that extend the perception scope of observers, e.g. telescope, microscope, etc.

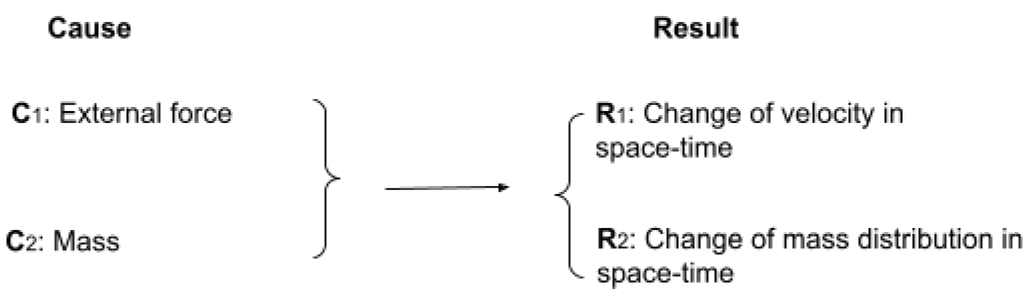
Further, we can also perceive one phenomenon occurring after another. If this occurrence always happens without exception, it constitutes a causal relation. For example, based on ‘any big things is constituted by smaller things’, a causality about quantity can be abstracted as below. To differentiate with other causal relations, we denote it as causality Ⅰ and A→B represents that B is the result of A.

causality Ⅰ



Similarly, when we push something in daily life, some change can be observed in either the object’s speed or its motion direction, which can be unifiedly described as ‘change of velocity in space-time’. However, this is an unrigorous causality because it does not describe all the possible situations. If we increase the strength of the force to a certain degree, the object may be either deformed but still as an integrity or shattered into pieces, which can be unifiedly described as ‘the change of mass distribution in space-time’. Thus, two causes of ‘force’, ‘mass’ and two results of ‘change of velocity in space-time’ and ‘change of mass distribution in space time’ constitute a rigorous causality that completely reflects all relevant situations that could possibly occur in reality, denoted as causality Ⅱ.

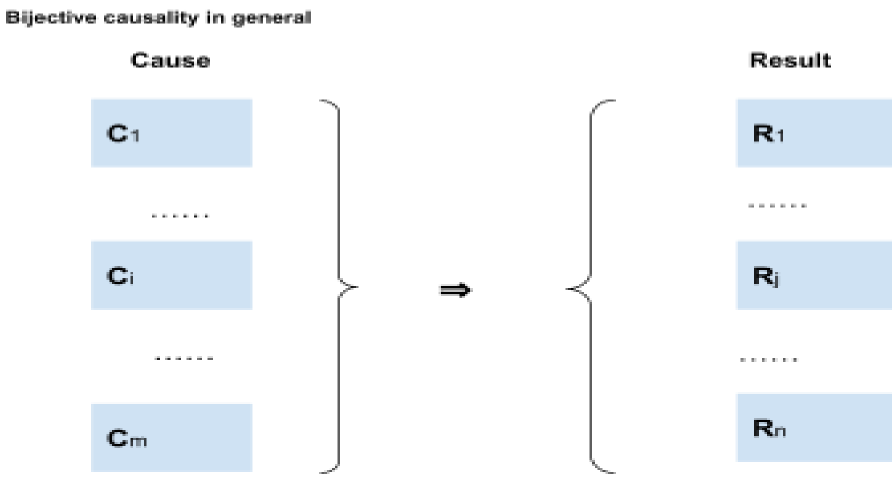
causality Ⅱ



No matter for causality Ⅰ or Ⅱ, It is noted that there is a sufficient and necessary relationship between all causes and all results. For example, in causality Ⅱ, R_1, R_2 covers all the possible results for C_1, C_2 while C_1, C_2 constitutes all the possible causes for R_1, R_2. If viewing a property as a set and any degree of the property as an element of the set, a bijective mapping can be regarded to exist from C_1,

C_2 to R_1, R_2. To be specific, any given degree of C_1, C_2 would result in a unique degree of R_1, R_2 while for any degree of R_1, R_2, we can always find a certain degree of C_1, C_2 as the corresponding cause. For convenience, we call such a causality as 'bijective causality'. For differentiation, we use '⇒' to represent a bijective causality. Especially, a causality and a bijective causality involving m causes and n results can be simply denoted as m→n and m⇒n.

Now Let us consider how a mathematical equivalence between different physical properties derives from such a bijective causality. For a general bijective causality $C_1, C_2 \ldots C_m \Rightarrow R_1, R_2 \ldots R_n$, lowercase c_i, r_j are denoted as the degree of the cause C_i and result R_j.



In this m⇒n bijective causality, suppose the property C_{i_0} is the measure target property that we want to measure. Given the causality is bijective, any degree of C_{i_0} could be uniquely determined as long as all other m+n-1 properties in the causality are fixed at a certain degree. In other words, any degree c_{i_0} of the measure target property C_{i_0} is uniquely determined by the array $(\ldots, c_i, \ldots, r_j, \ldots), i \neq i_0, i = 1, 2, \ldots m, j = 1, 2, \ldots n$. But, considering c_{i_0} does not determine an unique array $(\ldots, c_i, \ldots, r_j, \ldots)$, we cannot assume a rigorous equivalence between them, which means

$$c_{i_0} \neq \{(\ldots, c_i, \ldots, r_j, \ldots), i \neq i_0, i = 1, 2, \ldots m, j = 1, 2, \ldots n\}$$

However, if we introduce some mathematical operator(s) to calculate m+n-1 components of $(\ldots, c_i, \ldots, r_j, \ldots)$ to a single mathematical result according to the positive or negative relation between c_{i_0} and each component, then c_{i_0} would determine a unique mathematical result. Hence, we can assume a rigorous equivalence below

$$c_{i_0} = \{\otimes\ (\ldots, c_i, \ldots, r_j, \ldots), i \neq i_0, i = 1, 2, \ldots m, j = 1, 2, \ldots n\} \quad (2)$$

In above, $\otimes\ (x_1, x_2, \ldots x_s)$ is denoted as the single mathematical result after implementing the mathematical operator(s)$\otimes$ on the array's components $x_1, x_2, \ldots x_s$.

Due to the arbitrary of c_{i_0}, by going through all degrees of C_{i_0}, we have

$$C_{i_0} = \{\otimes\ (\ldots, C_i, \ldots, R_j, \ldots), i \neq i_0, i = 1, 2, \ldots m, j = 1, 2, \ldots n \tag{3}$$

Obviously, (3) is the consequence of viewing all m+n-1 causes and results other than C_{i_0} as variables. Here, if, at the start, we select part but not all m+n-1 properties, denoted as$\ldots C_k \ldots R_s \ldots$, and make some constant assumption by fixing each of them to any constant degree $c_k, \ldots r_s$, then by repeating the above process, we have

$$C_{i_0} = \{\otimes\ (\ldots c_k, \ldots C_p, \ldots, R_q, \ldots r_s \ldots)\} \tag{4}$$

For (4), by splitting the variable properties and constant properties, we have

$$C_{i_0} = \{\otimes\ (\ldots C_p, \ldots, R_q, \ldots) \cup (\ldots c_k, \ldots r_s \ldots)\} \tag{5}$$

For a specific array of constant degrees $c_k, \ldots r_s$, according to (1), suppose we can find some phenomenon that satisfies:

$$P \approx \bigcap_{k,s} \{C_k = c_k, \ldots, R_s = r_s, \ldots\} \tag{6}$$

and each variable property $C_p, \ldots, R_q$ of this phenomena P have been previously measured, by putting (6) into (5), then

$$C_{i_0} = \{\otimes\ (\ldots C_p, \ldots, R_q, \ldots) of\ P\ \} \tag{7}$$

In above, $P \approx \bigcap_{k,s} \{C_k = c_k, \ldots, R_s = r_s, \ldots\}$

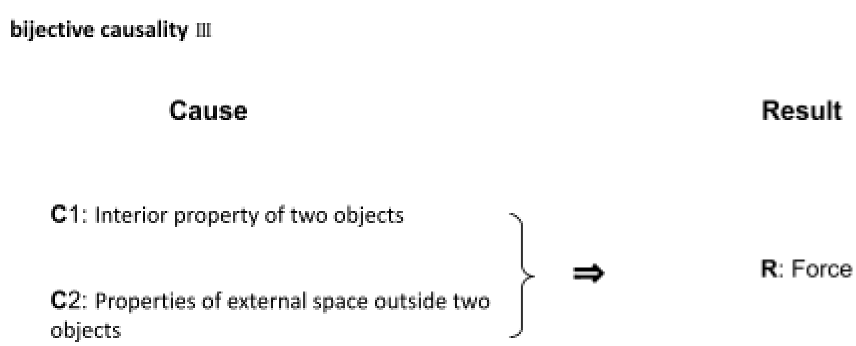
In fact, '$\otimes\ (\ldots C_p, \ldots, R_q, \ldots) of\ P$ ' can serve as the reference for measuring C_{i_0}. Firstly, for the phenomenon P , $C_p, \ldots, R_q$ can be viewed to be previously measured, which means we can reach a consensus on the degree for each of them. Also, the definition of any mathematical operator is comprehensively accepted and agreed by us, so the mathematical result of several previously-measured properties $\otimes\ (\ldots C_p, \ldots, R_q, \ldots)$ can also make different observers reach a consensus. Besides, any specific phenomena P does not generate any disagreement among different observers because it is impossible for all normal observers to perceive different results on a phenomenon. Therefore, $\otimes\ (\ldots C_p, \ldots, R_q, \ldots) of\ P$ as a whole reaches a consensus for different observers and hence can serve as the reference for measuring C_{i_0}.

In history, all physical properties can be viewed to be indirectly measured under the frame of (7). Especially, if we view an indirect measure method as a physical law or a physical equation, C_{i_0} and $C_p,\ldots, R_q$ are equation's variables and $\bigcap_{k,s}\{C_k = c_k,\ldots, R_s = r_s,\ldots\}$ appears to be some physical constant.

2 The principle behind the measurement of gravity

Obviously, gravity, as the object's external performance perceived by us, can only be treated as the result rather than cause for mass. Unfortunately, in causality Ⅱ, force does not play the role of result but the cause. Hence, we need to construct a new bijective causality, denoted as Ⅲ, about what leads to the generation of a force. The Standard Model can be viewed as an attempt to describe such a bijective causality. However, the incompatibility with gravity implies the causality behind this model does not cover all the situations about force phenomena in reality. Hence, the causality Ⅲ expressed by the standard model is not bijective although it reaches a rather micro hierarchy. Logically speaking, what makes this model has such a shortage lies in that it firstly focuses on how to express the bijective causality Ⅲ from a rather precise hierarchy and then considers how to make the causality bijective. Here, we change such a logic to the opposite by firstly considering how to build a causality Ⅲ that is at least bijective even at a rough level and then consider how to make it more precisely.

Undoubtedly, any force cannot exist without two objects. Two objects divide the whole space into two sections: interior space of two objects and external space outside two objects. Accordingly, what could potentially lead to the generation of a force can be regarded to be related with two physical properties: interior property of two objects and properties of external space outside two objects. In this view, we can abstract a bijective causality Ⅲ.



However, such a bijective causality is vague and general. To make the above causality more precisely, we need to make a concrete analysis of C_1 and C_2 in causality Ⅲ. For C_2, the distance between two objects is obviously an important physical property of external space outside two objects. Denote R_{max} as two objects' farthest distance[3] where we can perceive a force between them. In other words, once the distance of two objects exceeds R_{max}, the force cannot be perceived. Given R_{max} increasing from zero to infinite covers all the possibilities of distance for two objects, all types of force generated during the increasing process of R_{max} can be viewed to cover all the situations of force, which means the 'bijective' is satisfied. In this view, by summarizing the common requirements for the object's interior property to generate each type of force, we can construct a more precise bijective causality Ⅲ.

- When R_{max}=0, we can perceive the contact force(only repulsive), e.g. push, clash, friction. According to the definition of R_{max}, R_{max}=0 implies that the repulsive force occurs when at least two particles of two objects try to huddle together at the exact same position. According to the Pauli exclusion principle, such an effect can only happen if two particles are both fermions. In other words, the contact force can only be generated if fermion exists in both objects. Considering fermion refers to the particle whose spin is half-integer, the requirement for the object's interior property to generate a contact force can be viewed as 'the magnitude of spin'. From a rough perspective, considering the mass of any fermion is nonzero, it implies as long as two objects have nonzero mass, the contact force can be generated.
- When R_{max} gradually increase from zero to positive, the next force we can perceive is the Casimir effect(attractive or repulsive[1]). This type of force can be detected even between two electroneutral metals[2] or Metalloids[3]. Although metals or Metalloids are electroneutral, it implies the two objects cannot be completely insulative, which means, compared with the above contact force, there are some other extra requirements on the object's interior property: the difficulty for the free motion of an object's interior electrons. In other words, the requirement for 'the magnitude of spin' is inadequate to generate any force between two contactless objects unless 'motion freedom' also reaches a certain degree. From a rough perspective, the minimum requirement to generate a contactless force can be viewed as the electrical property of both objects reaches a certain degree although such a degree is quite low.
- As the R_{max} further increase, we can perceive the magnetic force(attractive or repulsive). Considering magnetism is the consequence of the consistent degree for clustered electrons' spin direction[4], except for the requirement on 'the magnitude of spin' and 'motion freedom', 'the direction of spin' is also indispensable to generate a force with a larger[4] perceivable

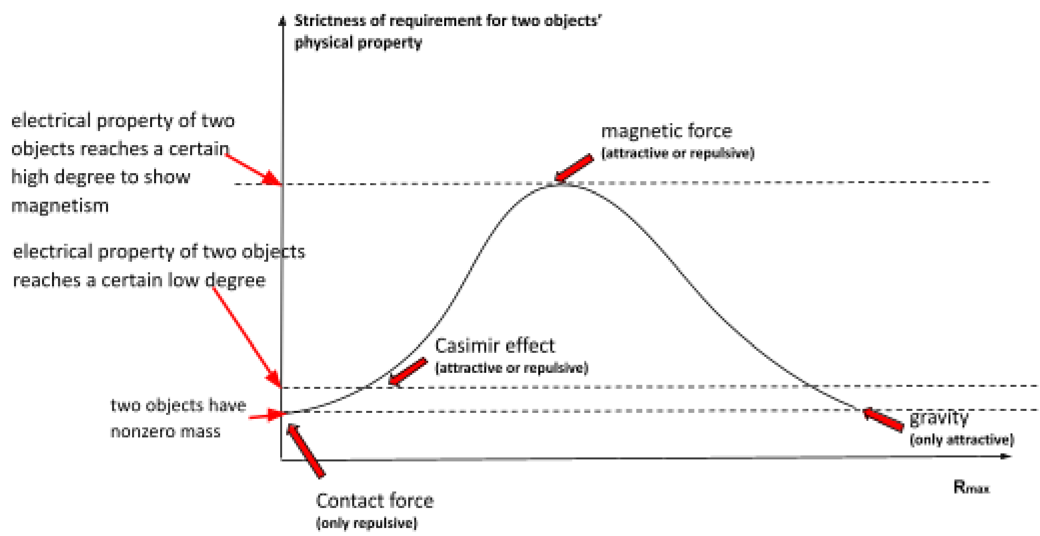
[3] Distance here refers to the minimum distance between any two particles of two objects.
[4] The perceivable distance range of magnetic force is obviously larger than the Casimir effect.

distance range. Roughly speaking, this extra requirement can be understood as that two objects' electrical properties need to reach a certain higher degree to show magnetism.

- Gravity(only attractive) is the last type of force that can be perceived by us when R_{max} increase to a larger range. The requirement for generating gravity goes back to being the same with the contact force, which only requires that fermion exists in both objects or roughly speaking, two objects' mass are nonzero[5].

If we temporarily forget the names given to differentiate above four types of force phenomena but treat them just as general force without distinction, the above discussion tells us that a bell-shaped curve relationship exists between R_{max} and the strictness of requirement for the objects' interior properties so as to perceive a general force, shown in below Fig. 1.

Fig. 1. Relationship between Rmax and the strictness of rough requirement for two objects' physical properties to perceive a force



R_{max} : two objects' maximum distance where we can perceive a force between them

From the above discussion, the generation of any force can be roughly regarded to be relevant with only three object's interior properties and one exterior property, which are two objects' mass, electrical property, magnetism and their distance. Thus, we obtain a more precise 4⇒1 bijective causality Ⅲ, denoted as Ⅲ(a):

[5] This is only a rough perspective because nonzero mass is only the necessary condition of fermion rather than a sufficient condition. From the view of energy, some bosons have non-zero mass.

4⇒1 **Bijective causality** Ⅲ(a)

Cause		Result
C_1: Electrical property of two objects C_2: Magnetism of two objects C_3: Mass of two objects C_4: Distance between two objects	⇒	**R**: Force

Further, considering there is a mutual causal relation between electrical property and magnetism, we can combine the electrical property and magnetism into the electromagnetic property, hence bijective causality Ⅲ(a) can be simplified as a 3⇒1 bijective causality, denoted as Ⅲ(b) :

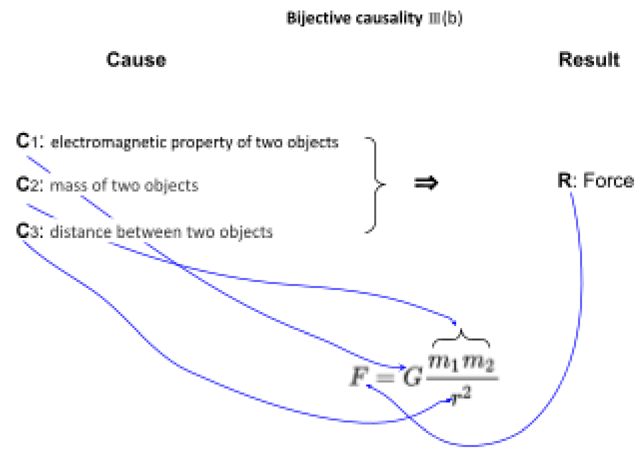
3⇒1 **Bijective causality** Ⅲ(b)

Cause		Result
C_1: Electromagnetic property of two objects C_2: Mass of two objects C_3: Distance between two objects	⇒	**R**: Force

In this causality Ⅲ(b), force[R] and distance[C_3] have been previously measured. According to (7), by fixing the degree of C_1 as constant, we can measure mass through the following equivalence

$$\text{Force}[R]=\{\otimes(C_2\,,C_3\,)\text{ of }P\approx\text{constant }C_1\} \tag{8}$$

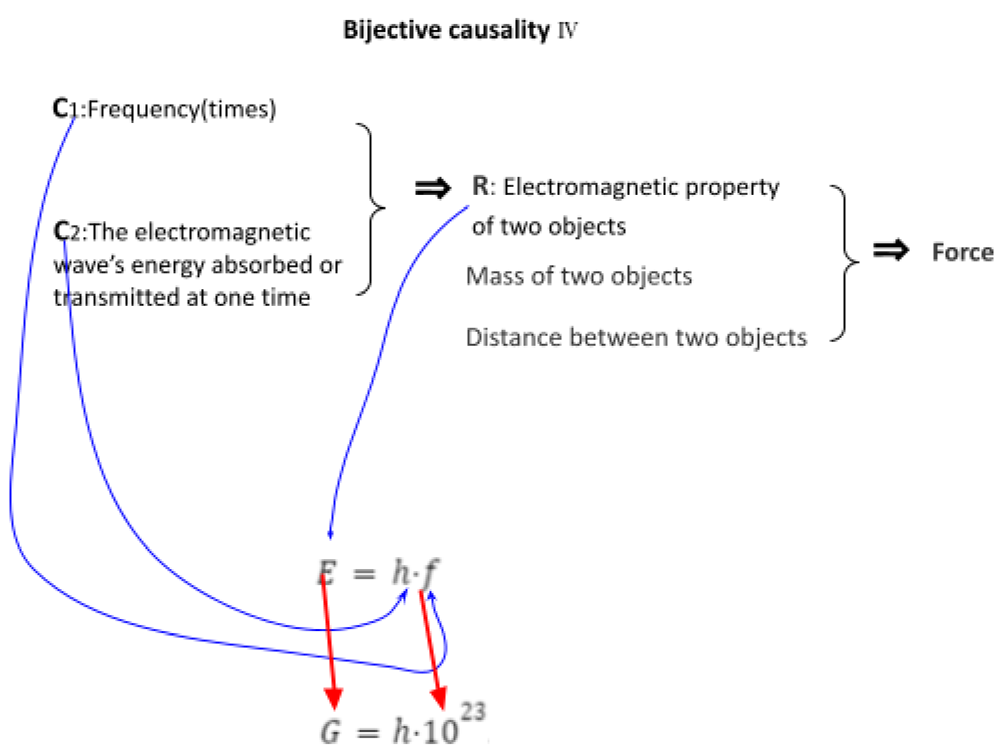
Obviously, Newton's gravity law or gravity mass is a mathematical expression for (25). Here, the constant assumption in (8) does not appear as a reference phenomenon P but the form of a physical constant: gravitational constant. Indeed, from the Fig. 1, the generation of gravity has no requirement on the object's electromagnetic property, which means gravity can be taken as the force that is unrelated with two objects' electromagnetism properties, so the force in (8) can be viewed as gravity only and hence mass measured by (8) can be called gravity mass. However, strictly speaking, gravitational constant should be called 'electromagnetic constant' because constant C_1 actually represents an invariable electromagnetic property of two objects.



3 The underlying relation between gravitational constant and Planck constant and how gravity is generated

Now let us describe C_1 and C_2 in causality Ⅲ(b) at a even more precise level.

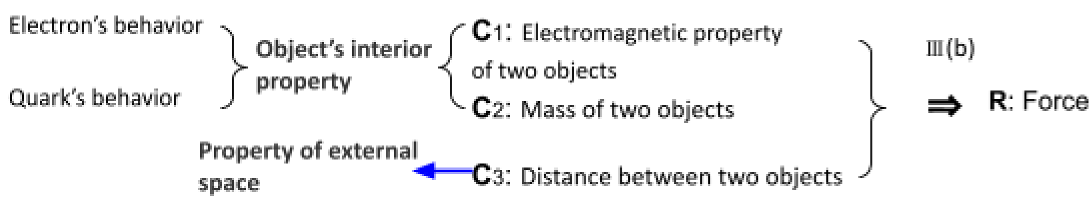
- For C_1 in causality Ⅲ(b) , this is obviously not the ultimate cause for generating a force. If we further seek the causes for the generation of electromagnetic property, we can abstract a new bijective causality Ⅳ, which is expressed by de Broglie equation $E = h{\cdot}f$.



In this view, we can easily understand why gravitational constant and Planck constant have an underlying relationship of $G = h{\cdot}10^{23}$. As the minimum energy unit of the electromagnetic wave, Planck constant is the energy of the electromagnetic wave absorbed and transmitted at one time while the gravitational constant represents the total energy of the electromagnetic wave in 10^{23} times of absorption and transmission. In nature, both Planck constant and gravitational constant represent the object's invariable electromagnetic property but at a different precise level.

- For C_2 in causality Ⅲ(b), it is also not the ultimate cause for generating a force. For instance, we have no answer according to current physics by asking one more 'why' for gravity's one special characteristic: why more mass can lead to a stronger gravity? or, in the view of general relativity, why more mass can lead to a higher curved degree for space-time? No matter Newton's gravity law or Einstein's field equation, they both do not answer the radical reason but just mathematically express the fact. Given that, we need to analyze a more precise reason behind mass to generate the force. As we know, electron and quark are two fundamental components for any object, which means all the interior physical properties of any object can be viewed to be determined by the behavior of electrons and quarks, shown in Fig. 2 below.

Fig. 2.



In nature, electromagnetic property is the consequence of the consistent degree of clustered electrons' motion or spin direction, which can be viewed as the electrons' behavior. Logically speaking, given electrons' behavior is the more fundamental reason behind C_1 in causality Ⅲ(b) and quark constitute most proportion of object's mass, quark's behavior can be viewed as a more fundamental reason behind mass. Further, if the behavior for electrons and quarks are regarded to be similar to affect how a force is generated, quark's behavior can be more precisely expressed as 'the consistent degree of clustered quarks' motion or spin direction'. However, quarks cannot freely migrate like electrons, so it is adequate to only consider the spin of quarks. Hence, we obtain an equivalent form of causality Ⅲ, denoted as Ⅲ(c).

bijective causality Ⅲ(c)

Cause		Result
C1: The consistent degree of motion or spin's direction for clustered electrons between two objects **C2**: The consistent degree of spin's direction for clustered quarks between two objects **C3**: Distance between two objects	⇒	**R**: Force

Based on bijective causality Ⅲ(c), we can easily understand why gravity has that special characteristic mentioned above. Quarks' spin direction has limited possibilities, so more mass means the object contains more possible permutations and combinations for clustered quarks' spin directions. In other words, an object that has massive mass can be viewed to contain almost all such possible permutations and combinations. Thus, for any other object, even if the spin direction of all its quacks are completely irregular, the possibility of this irregularity could still be matched with some interior part of the massive-mass object. However, for two objects with subtle mass, there would be a lower possibility for two objects' clustered quarks to realize a consistent motion direction, hence we can barely perceive any gravity between any two items in our daily life. Thus, we can regard that gravity is formed by a kind of random match for clustered particles' motion behavior at each second. In this view, why the strength of gravity is the lowest compared with the other types of force can also be easily understood.

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