Is Mechanics a Proper Approach to Fundamental Physics?

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Physicists are proposing different mechanics to describe the nature, physical body is measured by intrinsic properties like electric charge, and extrinsic properties being related to space like generalized coordinates or velocities etc., with these properties we can predict what event will happen. We can naturally define the fact of the event and the cause of the event as information, the information grasped by physicist must be originated from something objective, information must have its object container. Intrinsic property information is contained by object itself, but container of extrinsic property information like position is ambiguous, position is a relation based on multiple objects, its hard to define which one is the information container. With such ambiguity, no mechanics is a complete theory, errors hidden in assumptions are hard to find. Here we show a new theoretical framework with strict information container restriction, on which we can build complete determinism theories to approach grand unification.

INTRODUCTION

Information has twofold senses, any fact observed and comprehended by physicists is information, and such information must be originated from something abstract contained by objects, which is also regarded as information.

In classical mechanics, we use objects' generalized coordinates and velocities etc. which rely on reference frame to calculate whether the objects will collide with each other. Does the object contain the information of whether a collision will happen? It seems hard to answer. A simpler question, does the object contain its position information? If it doesn't, why does it be in this position, not other places? If it does contain its position information, then how much does it contain? Mere coordinates are senseless, position is a relation relying on multiple objects, if one object contains its position information, and it should also contain the whole universe's objects' position information. This concept cannot specify a finite scale objective information container. The study subject is not a basic unit of information's container, it may be constituted by many actual information's containers' parts. Though it has some problem in logic, classical mechanics is still good enough to calculate macroscopic phenomenon. The way of counting information deviates from the truth, but if the number of objects is big enough, for example a macroscopic object is constituted by a large number of particles, errors from different objects counteract with each other, leaving a relatively small error in totally counted information. Physicists don't know which information is contained by which object, but they know all the information together is contained by the whole system. But in microscopic scale, such inaccuracy matters very much.

Quantum mechanics inherits the main idea of Lagrangian and Hamiltonian mechanics, so is the incomplete definition of information's container. An electron on the point of colliding and a free electron are regarded as intrinsically equivalent in quantum mechanics, environment of a particle is not the particle's intrinsic information and is not contained by the particle, thus the concept of particle is trivial and redundant, the only meaningful thing is space/space-time, the existence of particles can be regarded as properties of space, information is only contained by space. Additionally, theory of relativity has assumed that no object can travel faster than light, it means the concept of "information transmission" exists, information is not instantaneously contained everywhere, thus the concept of "information's sub-container" exists too, but particle is not information's proper container, so information's sub-containers can only be space's decompositions, quantum physicists propose wave-particle duality to relate the two concepts, thus we have the puzzling concept of randomness.

The essential problem of mechanics is the inconsistence of study subject and information's basic container: particle is not information's basic container, particle doesn't contain complete information about it's own behaviours. If we want to build a theory of grand unification, our study subject must be information-complete, information about all its behaviours and properties must be contained by itself. Study subjects are countable, and thus information is dividedly contained by the study subjects, therefore mathematical description for any individual object should have complete sense and do not rely on other object's description, where position and velocity etc. are not information-complete descriptions.

TO BUILD AN INFORMATION-COMPLETE THEORETICAL FRAMEWORK

Here we introduce a new theoretical framework, on which physicists can build different specified theories to approach grand unification. Our study subject is matter's fundamental constituent and information's only container. Concepts originate from living experience like space and time etc. are not assumed as basic concepts, any basic concept in this theoretical framework must be a complete description of the basic study subject, it doesn't need other descriptions to make sense (unlike concept of position about mere one object is senseless), so that it can be related to information objectively contained by the study subject. In other words, concept describing object is information and is part of the object, it's something objectively exists not merely additional description generalized by researcher. We start from some simple logic with the principle of Occam's razor and try to be cautious.

Basic Assumptions

Assumption 1: There exists our study subject called basic existence (BE), which is matter's fundamental constituent.

If no study subject exists, the world is trivial. BE is not assumed to be point particle or other shape particles, because the concept of shape is relied on space, and space is not defined.

Assumption 2: BE is countable, that is to say it's quantized.

There exists plural BEs. Theory with only one study subject is trivial.

Assumption 3: BE contains abstract information, which can be indicated by BE's properties.

The essence of BE's information is not understandable, but the properties related to it are understandable. By the way, the information concept in our theory is different from the one proposed by Shannon. Information can't be treated as set, it will be mentioned later in assumption 12. The meaning of "properties" will be mentioned later in assumption 15.

Assumption 4: BE can evolve, that means BE's information can change, so are the properties related to it.

The original BE is called evolver, the evolved BE is called evolution production. Evolver and evolution production have a one-way relation called evolution relation. The word "change" means evolver and evolution production have different information and different properties.

Assumption 5: One BE's all properties can be described by some mathematical description like a set of parameters. So BE's information can also be described in such way.

Like BE $\mathcal{A}$ can be described by parameters $(a_1, a_2, ...)$. Thus BE's evolution can be expressed as: $(a_1, a_2, ...) \longrightarrow (a'_1, a'_2, ...)$ or $A \longrightarrow A'$.

Assumption 6: There exists an information creating mechanism, such that some (not all) different information can create new information.

Assumption 4 has mentioned that information can change. Information's change need other information, just like according to two conditions that $a + b = 1$ and $b = 0$ we can deduce $a = 1$.

Assumption 7: There exists a BE stableness mechanism, such that if a BE is "relatively stable", its information must satisfy some condition: BE's different information doesn't contradict with each other. But we don't know information's essence, so this condition can be described as: BE's all parameters satisfy some mathematical condition.

If one BE doesn't satisfy the stableness condition, it can be equivalently decomposed as multiple relatively stable BEs or zero BEs, such that number of BEs increasing and decreasing evolutions can be defined. The words "relatively stable" don't mean BE can't evolve. The condition's mathematical form is not determined yet. Here we assume all BE we talk about is relatively stable, unless it's specially mentioned.

Assumption 8: BE is information's only container.

There's no space-time to contain BE's information. If BEs have relation, such information must be contained by BEs, not the ether-like space-time. Relation is usually regarded as something extrinsic, in our theory it's intrinsic and must be contained by BE itself.

Assumption 9: If a BE's different information can deduce new information, the new information must be contained by the BE itself, except for some special conditions that the new information requires itself not to be contained by this BE.

That means mere a BE itself is unable to evolve. Information's container requirement is also information, being a part of the new information. The special condition will be discussed soon later in assumption 12.

According to assumption 9 that in general a BE's information can't create new information beyond the BE itself, thus for a BE's evolution, another information source is needed.

Assumption 10: BE's evolution requires other BEs' information.

BE gets new information from different BEs to evolve into a new BE (and perhaps zero or multiple BEs), this process is mutual and can be called **interaction**, BEs exchange information, a BE providing information to an evolver is also an evolver, receiving information from that one.

In mechanics, a particle may travel from one space-time point to another one until the interaction happens, that is to say there's a process before the interaction. In our new theoretical framework, such process is trivial, the only meaningful thing is interaction itself.

Assumption 11: All BE can evolve.

If one BE doesn't evolve, it only provides information for other evolver BEs' evolution, such situation can be regarded as equivalent to that these evolver BEs have the provided information from the beginning, the provider exists or not doesn't make sense. If one BE doesn't evolve and even doesn't provide information for other evolvers' evolution, it's trivial too.

Assumption 12: Interaction's all participant BEs must contain information of the interaction's tendency.

For example, BE $\mathcal{A}$ interacts with $\mathcal{B}$, $\mathcal{A}$ must know it will interact with $\mathcal{B}$, and $\mathcal{B}$ must know it will interact with $\mathcal{A}$, the interaction's tendency is **conjugated information** shared by $\mathcal{A}$ and $\mathcal{B}$. Shared conjugated information is just assumption 9's special condition, according to some information BE can deduce its conjugated information, but the conjugated information must be contained by other BE not itself. BE $\mathcal{A}$ contains the information that "I will interact with $\mathcal{B}$", and can deduce another information that "I will interact with $\mathcal{A}$", but this information must be contained by $\mathcal{B}$ not $\mathcal{A}$ itself. It's just like Russell's paradox, thus a BE's all information it can deduce cannot be regarded as a set (as mentioned in assumption 3).

In mechanics, the information of an interaction is decomposed and represented as space-time coordinates, potentials, and momentums etc., such concepts' related information's containers are hard to specify.

Sharing conjugated information is a relation, if BE $\mathcal{A}$ and $\mathcal{B}$ share conjugated information, we say $\mathcal{A}$ and $\mathcal{B}$ are conjugately related (c-related), it can be represented as A — B. One BE can be c-related to multiple BEs, which can be expressed as a graph, BEs are represented by points, their conjugation relations are represented by lines, like Fig. 1. BE's all directly c-related BEs constitute this BE's **environment**, in Fig. 1 $\mathcal{B}$ and $\mathcal{D}$ are $\mathcal{A}$'s environment BEs, but other BEs are not. On the other hand, $\mathcal{A}$ is one of $\mathcal{B}$'s (and $\mathcal{D}$'s) environment BEs.

Assumption 13: For the two relations: evolution relation and conjugation relation, any two BEs in a system must be at least indirectly related.

In a system, if two BEs are not even indirectly related, the system can be equivalently regarded as two independent systems containing each BE respectively. In a system, for any two BEs, there's at least a chain of

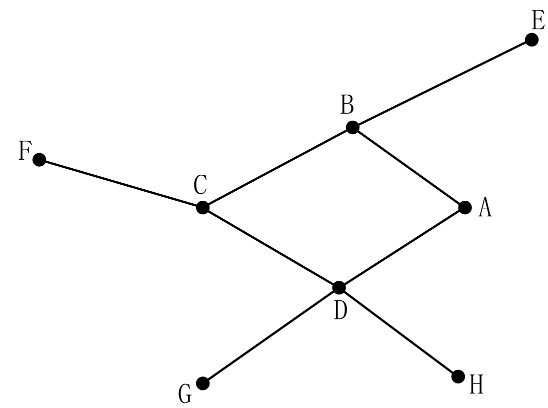

FIG. 1. BEs' conjugation relation can be represented by a graph. A point represents a BE, a straight line represents conjugation relation between two BEs.

relations linking the two BEs, like for any BE $\mathcal{A}_0$ and $\mathcal{A}_n$ we may have a chain like: A_0 — $A_1 \longrightarrow A_2 \cdots A_{n-1}$ — A_n. In our theory, the whole universe is a system.

Assumption 14: BE interacts with all its environment BEs.

BE's all c-related BEs provide information for its evolution, and BE provides information for all its c-related BEs' evolution. Evolution means BE's information changes, which can be represented by parameters' change. An evolver BE's parameters' change is depended on environment BEs' parameters, for each environment BE we can define an operator relying on its parameters, the operator acts on the evolver BE's parameters to get a set of new parameters contained by the evolver's evolution production. The operator is uniquely determined by BE's parameters, thus it's also a representation of BE's properties. Instead of parameters, we use an operator to represent a BE, and the operator acts on environment BEs' operators to change them (the parameters uniquely related to the operators are changed meanwhile), on the other hand, BE's environment operators act on BE's operator to change it. For example, BE $\mathcal{A}$ with parameters $(a_1, a_2, ...)$ interacts with BE $\mathcal{B}$ which has parameters $(b_1, b_2, ...)$, we have:

$$\begin{cases} \Psi_A(a_1, a_2, ...) \xrightarrow{\Psi_B(b_1, b_2, ...)} \Psi_{A'}(a_1', a_2', ...) \\ \Psi_B(b_1, b_2, ...) \xrightarrow{\Psi_A(a_1, a_2, ...)} \Psi_{B'}(b_1', b_2', ...) \end{cases}$$

where Ψ is the operator we want, $\xrightarrow{\Psi}$ is a mapping depended on the operator (and is uniquely related to the parameters), we call Ψ **evolution operator**, or **state function**, because it also represents BE's properties. Such relation can be written as $\Psi_A \xrightarrow{\Psi_B} \Psi_{A'}$ or $\Psi_B(\Psi_A) = \Psi_{A'}$ for short.

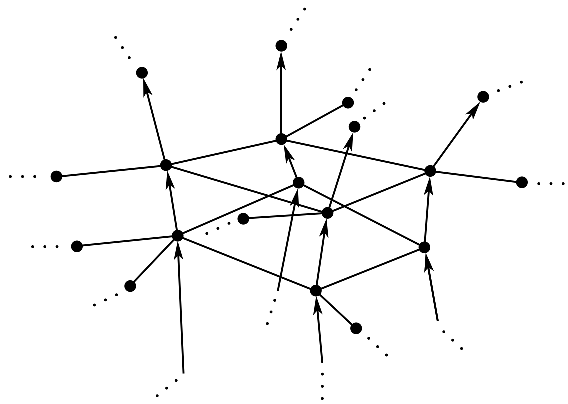

FIG. 2. A relation net can represent BEs' conjugation relations and evolution relations. A BE is represented by a point, between two c-related BEs we draw a straight line, if one BE evolves into one or multiple BEs, we use either one or multiple arrow lines to link the evolver and evolution productions, "$\cdots$" means omitted structures.

If BE $\mathcal{A}$ is c-related to two BEs: $\mathcal{B}$ and $\mathcal{C}$, we have that $\Psi_B \cdot \Psi_C = \Psi_C \cdot \Psi_B$, such that $(\Psi_B \cdot \Psi_C)(\Psi_A) = (\Psi_C \cdot \Psi_B)(\Psi_A) = \Psi_{A'}$, all environment BEs' evolution operators **commute** with each other, where "$\cdot$" is a mathematical operation for operators, the production is also an operator. Conversely, we also have $\Psi_A(\Psi_B) = \Psi_{B'}$ and $\Psi_A(\Psi_C) = \Psi_{C'}$, if $\mathcal{B}$ and $\mathcal{C}$ are only c-related to $\mathcal{A}$. Ψ's mathematical form is not specified yet, assumption 7 has mentioned that if evolution production doesn't satisfied stableness condition it can be regarded as multiple decomposed BEs or zero ones (corresponding to that a BE evolves into multiple BEs or to be annihilated), that means state function also satisfies a stableness condition, which should be defined in its mathematical form.

BEs' relations can be represented by graphs. A BE is represented by a point, between two c-related BEs we draw a straight line, if one BE evolves into one or multiple BEs, we use either one or multiple arrow lines to link the evolver and evolution productions. Thus BE points and their relation lines constitute a **relation net**, like Fig. 2, where "$\cdots$" means omitted structures, in this figure not all BEs are c-related, there are two sheaves, different sheaves' BEs are only related by evolution relations. But we don't require relation net to be able to be decomposed into sheaves, for many restrictions are not specified yet, different specifications yield different theories.

Assumption 15: BEs' parameters and relation net formed by the BEs must be uniquely related.

For any theory, we can add infinite trivial parameters or variables to it and keep the theory describing the same fact. For example, in Newton's second law we have $F = ma$, we can rewrite it as $F + \alpha = ma + \beta + \gamma$, where $\alpha = \beta + \gamma$, the rewritten theory describes all the same as the original one, α, β and γ are trivial parameters. By adding trivial parameters, we can form infinite equivalent theories, so we assume relation net's structure represents something most intrinsic of the nature described by this theory, and we should use the least number of parameters to describe it to keep our theory's form simplest. BEs with different information have different properties, which are represented by different relation net structures.

The next assumption is important and has two possible options. The core of it is how are a BE's environment BEs specified. BE's environment is formed by BEs which have different information. In mechanics type theories, object's environment is not object's information, an object in different environment is the same object (identical particle), but in our theoretical framework, environment a BE being in is information contained by the BE. Environment BEs have different information means that a BE seems to have the ability to specify some BEs whose information exceeds its own, is that a contradiction? We've mentioned before that BE shares conjugated information with its environment BEs, conjugated information is somehow able to be deduced from BE's own information, it exceeds BE's information but it's OK. Then what about the rest information of the environment BEs? To solve this problem, we have two versions of assumptions.

A BE knows (can deduce) what conjugated information its environment BEs share with it, but doesn't know their rest information, so we have:

Assumption 16a: There is a "search mechanism" such that a BE can "guess" what the rest information (not conjugately shared information) its environment BEs may have, and interact with the imaginary environment BEs.

For an interaction, there are infinite possible imaginary environment BEs to create infinite possible interaction productions, each interaction production takes part in new interaction, searches infinite possible imaginary environment BEs to create infinite possible interaction productions... In such theory number of BEs diverges, it's a trivial theory, so we need a restriction: **true path mechanism**, that for one BE's each step of interaction, BE and its evolution production's relation can be regarded as a small path, a collection of such connected small paths form a longer path (if some of these evolutions are one-to-many type, the formed path may have branches). For a BE as beginning evolver, there are infinite possible paths, a true path mechanism select one of the paths to be true, thus divergence can be avoided. It's very similar to Feynman's path integral, and perhaps we can define something like Lagrangian or action with our parameters to make this theory more similar to our known theories, but this true path mechanism is required to deal with global information which is consisted of all possible imaginary BEs' information, it exceeds any one BE's information, such information can only be contained by something like ether, it's contradicted with assumption 8 that BE is information's only container. So it seems not to be a good assumption.

Assumption 16b: A BE can deduce its environment BEs' all information.

That means the "unknown rest information" does not exist, environment BEs' all information is conjugately shared information. As a matter of fact if a BE can deduce all environment BEs' information, its environment BEs can also deduce their environment BEs' information, all indirectly c-related BEs' information (the whole universe's information) can be deduced by one BE. That means BE can not only deduce information which is not contained by itself, but also can deduce information not conjugately shared by itself, which is even not contained by its environment BEs, like BE $\mathcal{A}$ deduces that "I (BE $\mathcal{B}$) will interact with BE $\mathcal{C}$", this information and its conjugated information can not be contained by $\mathcal{A}$. A BE may have multiple environment BEs, thus there's more than one way of information conjugation. Every BE can deduce any other BE's or even the whole universe's information, so each BE's information can be regarded as "essentially equivalent", but being represented in different ways. Every BE's information is related to the whole universe's one representation.

In assumption 15 we have mentioned that BE's parameters are uniquely related to BE's relation net, but didn't specify the relation. With assumption 16b, every BE's information is related to the whole universe's one representation, it leads to that a BE's all parameters are uniquely related to a representation of the whole universe's relation net, where the relation net is infinite, so the parameters required are infinite too. For different BE has different parameters, representing the same relation net (the universe's relation net), but the representation is different, for the core of the relation net is different: the net's starting point is the BE itself, "my position of the net" is the difference.

Assumption 17: No BE is identical to another.

Each BE is related to one point of the infinite universe's relation net, no two points are in the same position.

Assumption 18: A finite part of BE's infinite information can be approximately described by finite parameters.

It's impossible to ascertain a BE's all parameters to know all its information including all its direct and indirect relations. But it's possible to know some of them. We research on a connected local part of the universe's relation net, BEs in such a finite part can be regarded as being in almost the same position of the infinite net, many of their infinite parameters can be omitted, leaving finite parameters to describe their local properties.

CONCLUSION

Mechanics type theory doesn't have strict definition of information's objective container, concepts like position and momentum etc. are unable to specify a finite scale objective information container, thus it's not a self-complete theory. The smaller the scale is, the more inaccurate the prediction is, thus it's not a proper theoretical framework to build theory of grand unification. In this paper we introduce a new theoretical framework with strict information container definition, but the specific mathematical form is extraordinarily hard to build yet. On this theoretical framework we can build many theories, all of them are determinism, but as a matter of fact we can't get completely determined prediction, because we are unable to know all of one BE's infinite parameters, we can only regard BEs with similar information as identical objects just like quantum mechanics, the prediction may be probabilistic.

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