Contradictions inherent in Special relativity: Space varies.

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Special relativity has changed the fundamental view on space and time since Einstein introduced it in 1905. It substitutes four dimensional spacetime for the absolute space and time of Newtonian mechanics. It is believed that the validities of Lorentz invariants are fully confirmed empirically for the last one hundred years and therefore its status are canonical underlying all physical principles. However, spacetime metric is a geometric approach on nature when we interpret the natural phenomenon. A geometric flaw on this will be exhibited and the alternative is suggested. The reasonable geometric model of space and time is a three dimensional space which is translating along the time direction. This model legitimately represents the true characteristic of nature.

Keywords: continual co-existence, complete space, the present, recording, EPR paradox, relativity of simultaneity, ordering on existence.

Introduction

Since the introduction of special relativity[1], most works on this theory have been based on spacetime metric, a four dimensional vector space with pseudo-Riemanian geometry[2]. This is a geometric interpretation on nature using metric tensor and other basic geometric characteristics. Extensive results were deduced from spacetime without any empirical confirmation[3-7]. These axiomatic approaches are the mainstreams of modern physics on this part. However, it will be questioned on the integrality of this and a few contradictions will be suggested. To achieve this, the languages related to time should be defined more rigorously from physical state not from geometry. Conventional uses of language are incomplete and therefore they mislead us to the paradoxical thinking. The geometric character of time should be expressed correctly after sufficient considerations on the difference and similarity of space and time. The contradictions on special relativity using newly established geometric structure are introduced. Throughout this paper, physical and mathematical terminologies will be used together to bridge the ideas between them.

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Geometry

Geometry is widely used in diverse fields as this approach is intuitive and concise. This is a matching process of abstract concept to the geometry which is believed to represent the concept legitimately. A main feature of this approach is that we represent the abstract concept as a matter of location. Therefore, it is important to acknowledge the true characteristic of geometry. When we consider a space, we implicitly assume the existence of it. However, we need to understand more rigorously about what geometry is. A space is called complete when it satisfies the continual co-existing neighbourhood at an arbitrary point inside the space. In this regard, we assume point is a basic element of the space. For example, a straight line is a space that satisfies above requirement and the neighbourhood constitutes one dimensional environment. To construct a N-dimensional vector space, it is essential that it has N dimensional neighbourhoods at arbitrary point inside with the property of continual co-existence. After this requirement is satisfied, it is possible to a construct coordinate system in the space for mathematical working. A coordinate system is virtual lines, which also assume continual co-existence, straightness, and orthogonality in Cartesian coordinate system.

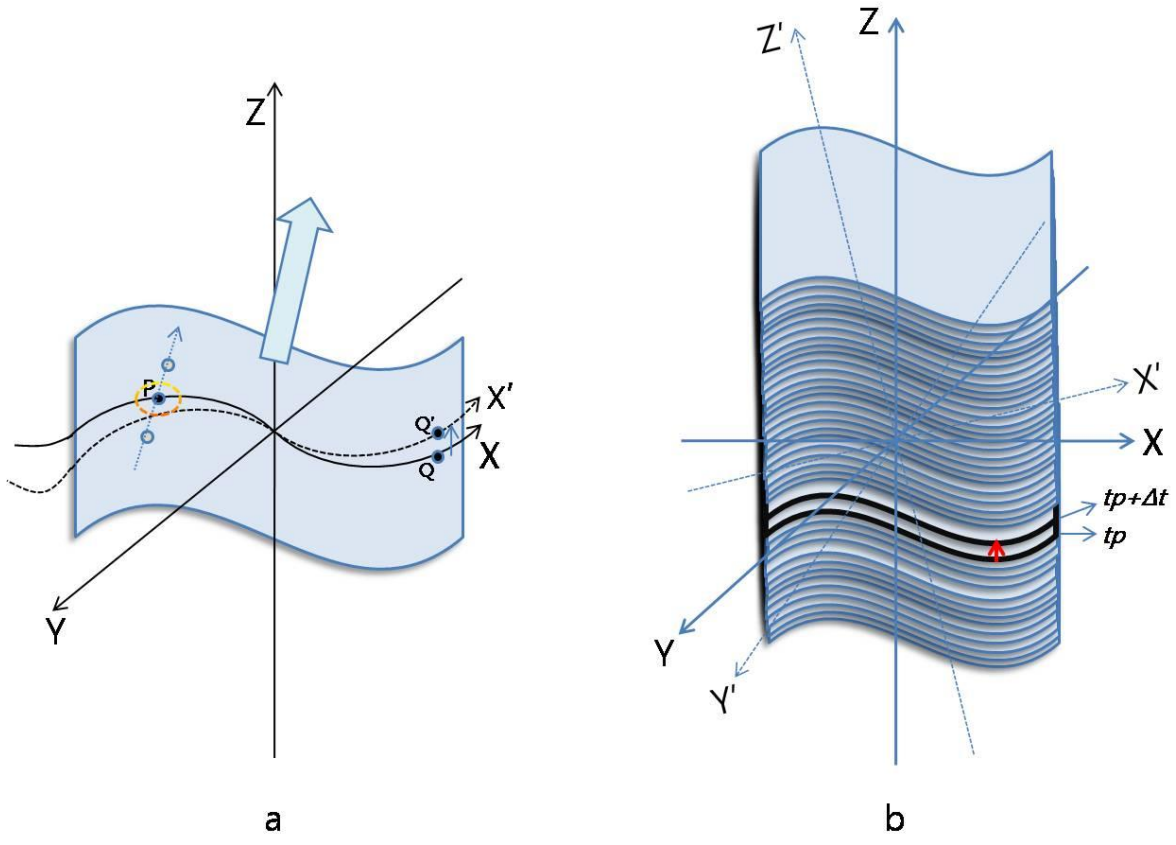

Figure 1. Two different geometries on existence are represented. a) It is a 2-d complete space which is translating along the direction out of surface. b) It is a 3-d complete space. Each picture has different degrees of freedom on the rotation and translation of coordinate systems.

With this in mind, two different geometries are suggested in Figure 1. The first one is a two dimensional space which is translating along the direction out of surface. The second one is a three dimensional(3-d) space which satisfy the above requirement; continual co-existence for the 3-d neighbourhood at arbitrary point. Figure 1b is called complete 3-d space. This space has also countless 1-d and 2-d complete space inside. It is possible to construct a coordinate system inside. The rotation and translation of coordinate system is free as this space is complete. The coordinate axis of this complete space (V^3) can be mapped to the real number space (R^3) for mathematical working as this mapping is isomorphic.

However, the line of reasoning is different in Figure 1a. In this geometry, actual objects are only defined in 2-d complete space. To express the translation of 2-d complete space, we need a 3-d coordinate system. We can rotate and translate coordinate axis inside 2-d space as this is complete. However, this operation is limited in 3-d coordinate system as this means the actual rotation of complete 2-d space. Otherwise, the coordinate axis deviates from 2-d complete space as in Figure 1a.The coordinate axis in 2-d complete space is also translating due to the actual translation of the space. Thus we can represent all parts of 2-d complete space as a parameter of the third axis.

Figure 1a is a 3-d coordinate system. However, this is not a 3-d complete space. It has a 3-d neighbourhood with a 2-d complete space and the third coordinate axis. The third axis doesn't represent actual objects but related to the history of translation. If we choose an arbitrary point inside the 2-d complete space, it has 3-d neighbourhoods with a 2-d continual co-existence as in Figure 1a. However, the reasoning on the third axis is idiosyncratic. The third axis can be separated into two directions, forward and backward. To the backward, a point was once existed but not anymore. To the forward, a point will exist but not until the 2-d complete space arrives there. This refers to a point P in Figure 1a. In this geometry, the 2-d complete surface is named the present surface and all points inside this are called the present point. When we express the history of translation, it is required to record each infinitesimal motion onto a 3-d complete space like Figure 1b. This process is named a recording. The recording is isomorphic as long as the forward translation is always guaranteed. The inverse of recording is not defined. After this, it is possible to do a mathematical work with recorded properties: mapping of V^3onto R^3. In this process, any mathematical object which is represented as a function of the third axis is a recorded value except at the present point.

The geometry of Figure 1a is a 3-d neighbourhood with the2-d complete space and of Figure 1b is a 3-d complete space. These are preliminary works to understand the true character of time.

Time

The nature with space and time

Time is an important concept when we infer about nature. We use this concept to construct a physical theory and to express human activities as well. Someone might think that there are no problems with this concept and therefore they use it without hesitation. It has been used from primitive period and been used by everyone throughout the world with a language of geometry. However, time is a very elusive one which we still don't acknowledge completely. Therefore, this needs to be investigated in depth in order to understand nature correctly. We need to understand the true characteristic of nature and then the human reasoning process on this entity.

The true characteristic of nature

First, it is important to understand how nature is constructed. We are living in a 3 dimensional space. This is all what exist. We can never escape from this space, which is analogous to the fish in a fish bowl. However, the physical state of this space is continually changing. This is the way nature is constructed.

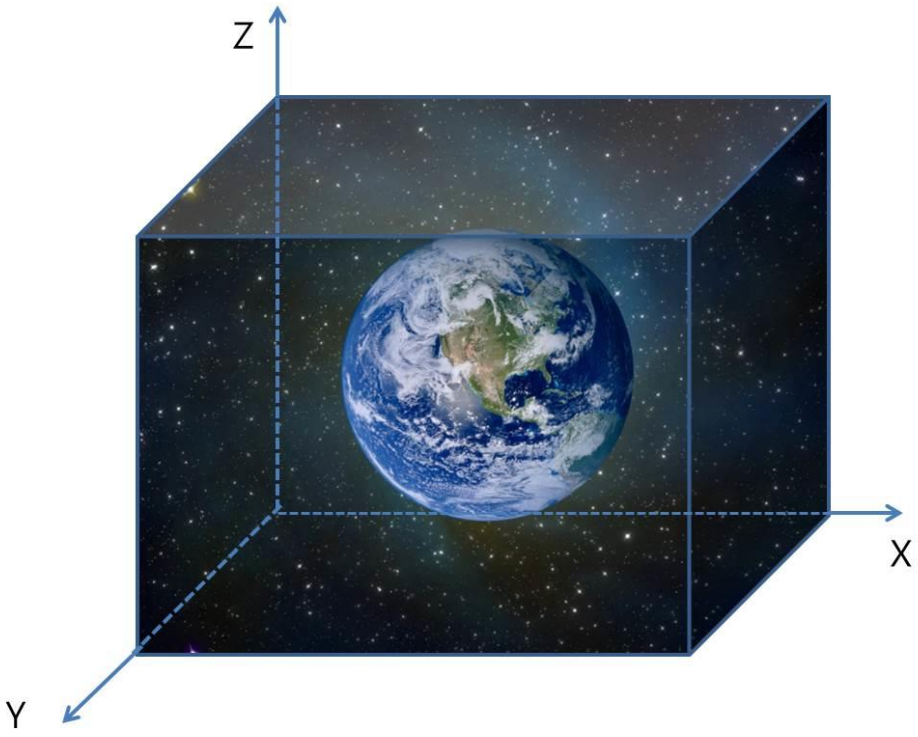

Figure 2.There exists a three dimensional space and it maintains the quantity constant. However, the physical state of this space changes continually. The concept of time is introduced to express this circumstance and represented geometrically by incorporating time coordinate to that of space.

We cannot define the magnitude of whole universe. However, it is possible to define a space of which we are mainly concerned. Suppose the three dimensional(3-d) spaces as in Figure 2. We assume all natural phenomena happen inside this and there are no physical interactions with outside. The magnitude of space is maintained constant but there are continual transitions of a physical state in this space. First of all, there are seasonal changes. Thermodynamic and biological evolutions also happen. We get older in this space. Certain elementary objects transform into an apple macroscopically and return to the earth again after eaten and digested by someone. We endow identities when the objects have a unique character macroscopically, like apple, car, bridge, book, computer, etc.

In Figure 2, a three dimensional space exists and maintains the magnitude constant. However, the physical state is not so. Thus, we need to introduce a concept to express this. We can observe these phenomena easily if we are located outside of the space. However, we cannot sure this if we are at inside. We might lose some important facts in that situation.

To understand nature, we need to clarify important facts regarding this entity. First of all, a matter of existence needs to be defined. Many kinds of materials exist and occupy the space. From the point of elementary particles, material is in a sense a space with dense and strong interaction of particles or part of it. Natural phenomenon such as cosmic background radiation also happens in the empty space without any materials. Thus, it is possible to identify a specific existence even with empty space. The relationship between space and existence is defined in this way. A transition of space needs also to be understood definitely. The transition means the process of variation in the materials or space.

There is an apple on the table in front of you. The apple is a unique existence in the whole universe, i.e. the uniqueness of existence is guaranteed. However, the physical state of the apple has changed continually from blue to green, and then to red. We need to specify this process. During the process of variation, the apple does not clone itself. It does not left a blue apple behind and makes a new green apple. It just has changed its state. There is only one apple on the table. Rigorously speaking, an apple with infinitesimal state exists on the table.

The other example is the variable position of particle. There is a glass ball on the table in front of you. The ball is unique in the whole universe. It starts to roll across the table. We observe the process of rolling. The location of ball is unique during the rolling by observation. When the ball is located at the centre, it does not exist anymore to the backward direction. It will exist somewhere to the forward but not until it actually moved to that position. The existence of ball is unique only at the present position. The ball does not clone itself during rolling. Rigorously speaking, a ball exists at the present point with infinitesimal period.

The variations of state and position are interrelated each other. The change of state corresponds to the movement of elementary particles which constitute the object at microscopic level. The change of location can be expressed as a variation of state when we consider the particle with its

surrounding together. It is just a matter of the subject. Physical state will be used throughout this paper to represent them together.

Motivation and measuring method of time

We need to express the above circumstance. Therefore, the concept of time is introduced. We don't need this concept if there are no variations at all in nature. In other words, this concept is useless, when everything is standstill and maintains the initial state forever.

There are various events in the universe. Certain objects change more rapidly than others. Physical and chemical interactions also happen regardless of space and time. Even the identical objects change differently depending on the location. There is no unique pattern with the variation. Because of this, we need to make a rule how to measure it with reliable one. It should be steady and reproducible for us to use as a reference. Natural phenomena such as the location of the sun or its shadow were used from primitive period. These have been replaced by a mechanical or digital clock as the technology advances. The traditional methods are closely related to geometry. We should be extremely careful about what the measuring of time means when we use geometric method.

The related language

The language related to space and time should be defined rigorously at this point. From primitive time to modern age and regardless of ethnic background, we use space when we recognize, understand, and express time. We mention time flow without enough consideration about how this expression is invented by ourselves. It is necessary to consider the motivation of this concept again. This is introduced to represent the process of variation. We endow direction which is geometric concept to this process and represent onto space. This direction is named time and we interpret this geometrically.

Once the motivation and measuring method of time is introduced, it is important to acknowledge how this conventional method was used without any recognition on about fallacy. We need to clarify languages related to time to do this. First of all, a matter of existence needs to be arranged definitely. Proper noun and abstract noun represent the real objects in nature and the abstract entities in our head. The former is to identify actual objects and the latter is to clarify concepts when we infer about nature. Examples of proper noun include car, furniture, sun, moon, etc. These can be perceived through human senses or detected through mechanical tools when this is out of our ability. Examples of abstract noun include time, the past, the future, etc. These can be recognized after thinking or be measured by certain methods if we make a rule for these in advance. The word existence will be limited to proper noun throughout this paper as we mainly interested in what are actually exist in nature and how these are understood by ourselves.

We understand time with a language of geometry. This means that time is expressed as a matter of location. It is important to acknowledge what this implicitly means, including paradoxical aspect.

We mention time flow very commonly. Flow is a geometric concept representing the change of position. The same is applied to time travel. We state the following in ordinary life: i) Time flow very fast. ii)Time flows from the past to the future. iii) Does time travel possible? However they are metaphorical expressions, which can mislead us to the wrong conclusions. Time never flows in nature if this belongs to proper noun. Instead, a physical state has just been changed.

Once we recognize the fact that time represent the process of variation, we can rephrase the expressions with correct ones: i) A physical state has changed rapidly. ii) An old state has disappeared completely in the whole universe and replaced by new one. iii) This statement belongs to Russell paradox, which mainly originate from wrong or ambiguous definition. Therefore, it is meaningless from the point of logic. If this means the reappearing of old state, it is impossible in nature.

The present should be defined first. Think of yourself where you are at the moment. You and your surroundings have changed into current state and they will vary continually. The present represents what actually exist in nature. After this, we need to define the past and the future, not from geometry but from physical state. There is an apple on the table and I eat this. Therefore, it does not exist any more. This is a drastic change of physical state which loses the macroscopic identity. Rigorously, it was existed on the table but not any more as I have eaten it. Tomorrow in the morning, you plan to bake bread but this does not exist until you press the button of oven. Specifically, it does not exist until it becomes the present time and you do actually take an action. Without this, it is just in your imagination. An expression that the apple still exists on the table where it is called the past is wrong. Just planning for tomorrow does not guarantee the existence of real objects in the future. The disappeared state of an apple and the backward position of a rolling ball where a ball once exists belong to the past. The opposite state and position of the past are called the future. The present represents the infinitesimal physical state during the variation. We can define the past and the future as forgone and forthcoming physical state. The present is defined as a state which actually exists in nature during infinitesimal period. Space is a subject which has a specific physical state and experiences a variation. This can be identified with existence.

The mapping process: infinitesimal state to the location of real objects.

We have defined the true characteristic of nature and the related languages which are indispensable for the correct understanding of it. It is necessary to discover how they are interrelated and expressed, especially with geometric tool.

Periodic motions of device are conventionally used as a tool to measure a time. This method is convenient to coordinate times with an identical interval. However, the true property of time is the continual evolution of a physical state. As time evolves, it is substituted a new state for the old state and repeating this endlessly. During the evolution of physical state, each infinitesimal state is mapped into the location of the needle of clock. This in turn is mapped into real number system

for the quantitative analysis of the geometry of space and time. The coordinate of space and time is completed after this process. First, we need to observe nature and then record the process of variation onto space. We need to keep in mind that there is only one apple on the table and it does not clone itself during the evolution. An apple with infinitesimal transition state actually exists on the table. What's happening inside the apple is the disappearing of old state with the emerging of new state. Variation means the repeating process of this event. We need to compare the actual phenomenon of the apple to the geometry of space and time.

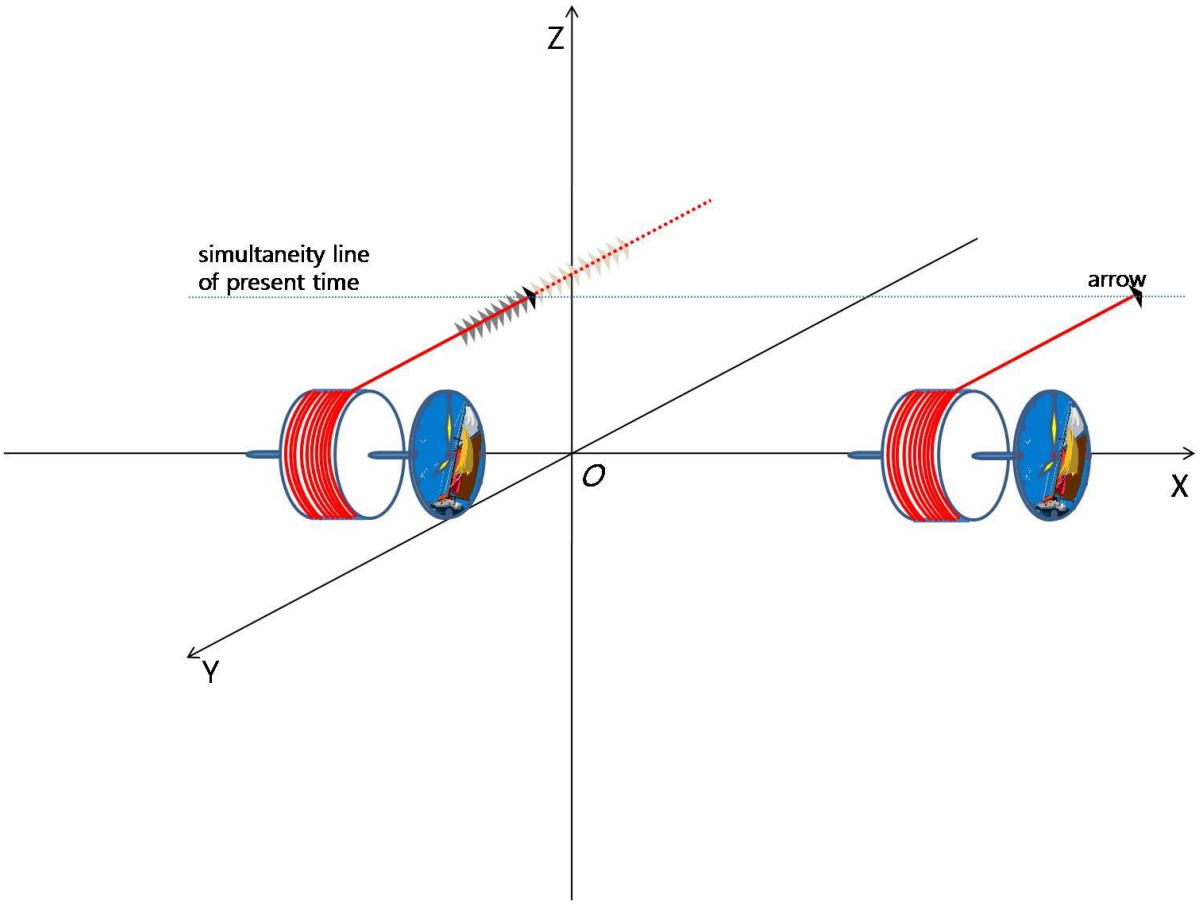

Figure 3.Geometric character of time is represented with an arrow at the end of thread. Footprints imply the foregone and forthcoming the present.

Figure 3 provides a valuable insight into apprehending time and its geometric character. This is a Reel clock. It is devised to represent the evolving property of time in addition to the periodic motion of conventional clock and to get an idea on the geometric characteristic of time in real 3-d space. It releases an identical length of thread every turn and an arrow is attached at the end to indicate the direction and location. With this clock, we can identify time from the length of

released thread if it is exhibited on the reel or from the present location of arrow. The present location of arrow identifies the present time. During the translation of arrow, we can also identify backward direction if the arrow left footprints along the path. To the forward, it is possible to infer the location of footprints when we assume the homogeneity of space and time, thus the translation of arrow is predictable. This process is named recording, identifying backward and predicting forward through footprints. With these, it is possible to construct the geometry of space and time. It is done on a 2-d space and the space is complete from the line of reasoning on the previous geometry section. Only the present time indicates a real arrow. From this location, an arrow was existed but not any more to the backward. It will exist but not until it becomes the present time to the forward. We just infer the foregone and forthcoming existences through footprint.

Suppose there is an apple beside the Reel clock. We can compare the variable property of an apple with the clock. It is possible to map each infinitesimal state to the location of arrow. We can infer the location of arrow without any consideration on the speed of light if the length of thread is exhibited on the shaft of the reel. The occurrence of event and observation are simultaneous and thus the mapping can have exact value. A disappeared state can be identified with a footprint. The forthcoming states can be inferred if we have a well-established physical theory that predicts the evolution of an apple correctly. After this, they can be mapped to the expected position of an arrow, when the translation of arrow is predictable with the homogeneity of space along the path.

It is crucial to understand the sequence of above works. We need to know the characteristic of an apple and then we need to recognize how and what we obtain from the above reasoning.

Construction of space and time with pure geometric languages

We have acquired the geometry of space and time. This can be represented by other method with purely geometry languages. It should be expressed with a correct language of geometry. The essence of geometry is closely related to an existence and location. Geometric approach means that we deal specific abstract concepts with the matter of location. It is absolutely important to define what actually exist in nature and to represent variation legitimately. We need to distinguish what exist in nature from what is in our head. In nature, the 3-d space with an infinitesimal physical state exists. The variation is expressed as the translation of this space to the time direction. With this method, time is represented as a matter of location. The geometry of Figure 1a is consistent with this circumstance. In this model, the present surface translates to the forward direction. Nothing exists outside of this. We observe the translation and record it. Figure 1b corresponds to this. The completed geometry by this method is named recorded one. The rotation and translation of coordinate systems is limited in Figure 1a.

To sum up, Figure 1a expresses nature through geometry. With this structure, matters of existence and location are solved. The transition of the space is represented with the translation of it. Figure 1b is acquired by the works of man such as observation and recording.

The metaphorical expression in previous section can be rephrased accordingly with more reasonable ones: ⅰ)The present surface translates rapidly. ⅱ) The present surface translates to the forward direction. ⅲ) The question itself is paradoxical one. If that means the rotation of simultaneity line or backward translation by artificially method, we suppose this is impossible in this model.

Interpretation of recorded geometry

Once the geometry is completed, it is necessary for us to interpret this correctly. Suppose the specific time t_p represents the present in Figure 1b. The backward and forward zones belong to the past and the future, respectively. If we retrospect the actual situation in nature, the object has changed to this state and the simultaneity line corresponding to this represents what actually exist in the whole universe. The others represent the entities what we remember from observation or what to expect from imagination. From this time, it has passed an interval Δt and then the present becomes $t_p+\Delta t$. The simultaneity line has translated to this position and this represents real objects in the whole universe. The other zones represent forgone and forthcoming existence.

Recording represents this circumstance within one geometric frame and thus make it possible for us to observe them all at once. The relationships between recorded footprints in Figure 3 are totally different from the points in complete space where the footprints are marked. The former are characterized by ordering on existence and the latter are by continual co-existence. The footprints should be understood just as markings on the corresponding space and should not be considered as the identical one with their background. Recording is a human activity to describe the fact that recursion of the present continues forever. We can never escape from the present. Think of yourself where you are at the moment. That is the present. A second has passed but you are still at the present. The same happens even after another second. You continue to stay at the present even though this process repeats countless.

This can be understood otherwise. You can replay a certain motion picture and suppose the screen corresponds to the whole universe. What you observe on the screen always represents the present and this is what actually exists. You can compare this with the translation of the present line in the recorded geometry. This is a useful method when we retrospect a specific natural phenomenon and compare this with the geometric representation. The recursions of the present are also applied here. The recorded geometry expresses the ordering of existence. Each infinitesimal state corresponds to the individual existence which is concerned. The interval is expressed geometrically. It can be predetermined depending on how we measure it with a specific tool. In other words, it depends how we make a rule on the measuring method. The overall structure of this geometry represents the sequence of existence with simultaneity line and thus makes us possible to observe them all at once. The geometry itself is constructed by the work of man.

In depth analysis of time with its geometry

The fact that we can never escape from the present seems strange at first sight. However, this does not originate from the bizarre character of nature, but from the defective language related to time. If we define the related language after recognizing the true characteristic of nature, it is possible to infer about nature correctly. We are here at present and just experience variations with our surroundings. The infinitesimal physical state at the present is what actually exists in nature. This fact never surprises us. The variations happen even when you don't move and stop breathing temporarily. The standstill object in front of you also experiences microscopic changes. Therefore, it is not the same object as the one a second before. Sometimes, we don't realize this fact due to the lack of intuitive sense.

Why the paradoxical aspects of time have distressed us for so long? Above all, we have understood time with a geometric language. Therefore, we unwittingly identify them together and this has been ingrained in our reasoning process. The lack of our perceptive ability has also contributed to the misunderstanding, especially because of standstill objects surrounding us and ourselves. This can be understood with the figurative circumstance of fish in Figure 2. The outside observer can easily recognize everything with regard to the space. He can also grasp a very important fact about the relationship between the space and inside fish, an object and the observer. He does know how the fish inside objectify its surroundings. The fish inside can not realize these with easy. It is difficult to survive when it tried to be an outside observer for true understanding. Even more, it does not recognize the fact that it also in the middle of variations. It is also located at the present line of recorded geometry when this translates forward. We are observer of nature and also part of it.

We have used defective language related to time and therefore this demands rigorous alternatives to comprehend it correctly. We have an entity which we are interested in and suppose that it is nature. It is necessary to discover what object exists in this and we realize that this is space. This object is identified as a space, which belong to proper noun. Once we have found the object, it is required to acknowledge the property of this. It has a variable property. This is defined as time, which is abstract noun. Finally, we obtain a statement that a space always varies. The space and time in this correspond to a subject and predicate, respectively. Time is not an object but the property of it. Therefore, we should not use it like proper noun. A statement that time always varies is an incomplete one. Space is perceived or detected and then measured for quantitative analysis. However, time is just measured not detected. A space subject to variation is nature. This is the objectification of nature.

Geometrically, the past is a direction to which a physical object was once existed but not any more and, to the opposite, it will exist but not until it becomes the present time. The present line or surface exhibits what actually exist in nature. This corresponds to an infinitesimal physical state. It is possible to identify the past from observations but the future is subtly different. The future events can be categorized into four different ones: predictable from physical theory, plan-able

with human activity, contingent although predictable and plan-able, and completely chaotic thus no contingent. All of these candidates cannot be real objects in nature until they are located at the present and thus identifying the existences. It is only a few of them what we can do recording in the future zone. We are not living in predetermined world and everything does not already exist where it is called the future. There are always some uncertainties in the future.

Time is a useful concept when we compare the ordering and interval on existence. Different times at the same location imply how the physical states are ordered. The same time at different location implies the objects exist simultaneously. The real number when time is mapped onto it represents this. Physically, this ordering is related to causality relationship. We can infer the interval on existence through recording. If this was yesterday, it is one day interval on existence. The existence itself has disappeared in the whole universe, not just to me.

This concept can be used when we compare the ordering of events which happen in two isolated places. When two observers have the identical clocks synchronized and they are located at different places, they record what they observe in each place with the same time interval. They don't communicate each other until joined together after finishing recording. They compare the recordings and this is the mapping of two well ordered sets. Time plays role on this. It is isomorphic, which conserves the structure such as function or relation. With this method, it is possible to construct the recorded geometry along any specific direction in space.

Actual present time in nature is the one where you are at the moment. It is a unique time in the whole universe. When we retrospect a series of forgone events with a recorded geometry, we should remember that only the present translates.

Fallacy

The true characteristic of nature is understood and the geometric model for this is established. Therefore, it is possible to investigate the validity of this theory with the revised meaning of the present.

A physical theory loses validity when the result predicted by it contradicts the postulates on which it is based. Metric is not a necessary and sufficient condition for the integrality of physical theory. Any kinds of metric are viable if we do not consider empirical validity on nature. It is just one of many. There are fundamental assumptions on nature when we interpret it: homogeneity of space and time[8], isotropy of space[8], principle of locality[2], causality invariance[2], conserved quantities as in Noether's theorem[9], irreversible entropy increase[10], etc. These assumptions are verified empirically for a long time with sufficient considerations about nature. Therefore, its generalization is not doubted. However, this theory predicts many non physical phenomena when we speculate about nature with the revised concept of the present. Even more, it is contradictory to the above assumptions and is not consistent within itself.

This theory is paradoxical[4, 11, 12-14] on many aspects and most of which are resolved with spacetime metric, especially with the relative of simultaneity. This is the last resort that supports this theory deductively. However, this necessarily accompanies inevitable conclusions on some bizarre natural phenomena as apparent without any empirical confirmation. The simultaneity line is related to the existence of real objects, which is the present. This becomes definite in Figure 1a. The rotation of this line during acceleration predicts non-physical phenomena such as action at a distance, white-out, self cloning, etc.

This theory predicts non-physical phenomena. Upon recognizing the meaning of the present time and recording, we can understand definitely what the relativity of simultaneity means. It is only hypothetically possible when we assume each inertial frame from unknown origin and maintain this state always. In other words, it never experiences any kinds of acceleration.
However, the philosophy of Einstein-Podolsky-Rosen(EPR) paradox[15] provokes a controversy on this issue. Suppose there are many observers at the origin in Figure 3and they suddenly scatter to the both directions of X-axis. They will have different simultaneity lines of the present time and we can guess these from the location of an arrow. However, this is not a simple matter. The different simultaneity lines of the present will be indicated by footprints, not by real arrow. There should be action at distance by hidden variable to be indicated by a real arrow. Even more, this can be satisfied only when one observer is infinitesimally accelerated. If there are many, this becomes completely non-physical state. Of course, we do not observe these empirically. It is a spooky action at a distance as indicated by Einstein[15], which is represented as a point Q in Figure 1a. This problem might be resolved when we assume each inertial frame from negative infinite times without any acceleration, considering the arrow can evolve at arbitrary time. However, this also causes another controversy on the age of universe[16].
If we revise a rolling ball on the table, it is apparent what time travel means, if possible. Suppose we replay the motion pictures of this event or we can retrospect the series of this event. The location of ball is unique at the present and therefore it is possible to compare this to the world line of Minkowski space. The ball should clone itself during the translation. It lefts a ball behind and then move to another place. This process should be repeated continually to satisfy the world line. The world might implode if this actually happens. Time travel itself is neither logical concept nor physical phenomenon.

Homogeneity of space and time, isotropy of time are also violated when a new inertial frame is created. Creation of new inertial frame from the same origin necessarily results in a non-homogeneous spacetime due to the relativity of simultaneity when it is accelerated by homogeneous force or by pulling. The physical state of the forward direction always advances the opposite. Bell spaceship paradox[11] predicts this. When the two spaceships separated apart are accelerated infinitesimally by an identical homogeneous force, they will be in the same inertial

frame but will have different times. It is homogeneous only with regard to the property of light. The deductive reasoning is viable only under the acceleration by pushing as in Rindler coordinate[2]. In ordinary life, we observe many collisions and even more, inertial frame is in a sense an idealized state which does not exist in the world as this is always subject to internal or external interactions. Rotation of simultaneity line actually means violations of fundamental assumptions such as principle of locality and causality invariance.

It is necessary to revise the above arguments with the unique present time where you are at the moment, rather than the present on the recorded geometry. Spooky action is related to causality invariance. This also predicts infinite speed. Nothing exists except at the present. Therefore, it cannot be the present time to anyone else who suddenly approaching toward you or distant away from somewhere in the universe. If the simultaneity line of the present time rotates as in special relativity, you need to place the apple you have just eaten back on the table. This is a violation of causality invariance. In some situations, you need to jump into the tomorrow in the morning, press the button to make the bread actually existing object and comeback to where you are today. Or the bread cannot exist forever if you suddenly change mind right before the due time. Just a memory and imagination do not guarantee real objects.
If you accelerate while driving on the street, the outsides suddenly become white out or the street trees grow more or less due to the rotation of simultaneity line. These become apparent when we refer to Figure 1a. Empirically, these do not happen and therefore the degree of freedom on the rotation and translation of inertial coordinate systems is limited.

Scientists believe that Lorentz invariants are on solid empirical foundations, confirmed with high precision using the modern state-of-art technology[17-19]. Time dilation[20-24], length contraction and relativity of simultaneity are indispensable to complete spacetime metric. Without any, the metric loses validity. However, empirical foundations on length contraction are neither solid nor abundant[25-28]. As long as these conclusions are not from out of immediate reasoning, they need to be revised. They are inferred from the analysis of the interference pattern or the frequency shift of light[25, 28, 29].We need to desist from doing any kinds of axiomatic approach on spactime. This is not as integral axiom as it is known when we contemplate about nature. On this occasion, we should adapt what is true obviously. This should be the rule of inference when we establish a physical theory.

A fallacy regarding to special relativity originates from retrospective reasoning method without any recognition about the meaning of the present and recording. We record all events on complete space and observe them all at once. This is the Minkowski space[2]. Instead, we need to acknowledge the fact that the simultaneity line which translates in this space represents the present. Only the present can translate in this geometry. We can retrospect an actual situation in

nature and then compare this with the translation of the present line in Minkowski space. Recording is a manifestation that the present continues forever. It is recommended to tick a specific time as the present to avoid unnecessary confusion. This is a useful method to indicate a current state in the world line.

It is possible to construct a more specific structure than Figure 1a with the fundamental assumptions. In this construction, the present surface in Figure 1abecomes plane and translates uniformly when we assume homogeneity of space and time. The time coordinate is orthogonal to that of space upon assuming isotropy of space as in Figure 4. A absolute space and time of Newtonian mechanics are originated from these, not from infinite speed as indicated by special relativity[2]. If we don't accept these assumptions, time becomes a relativity property and the presentsurface is curved. The relativity of time becomes a matter of location but not different inertial frames. It needs to be determined empirically whether the validities of above assumptions are universal or local.

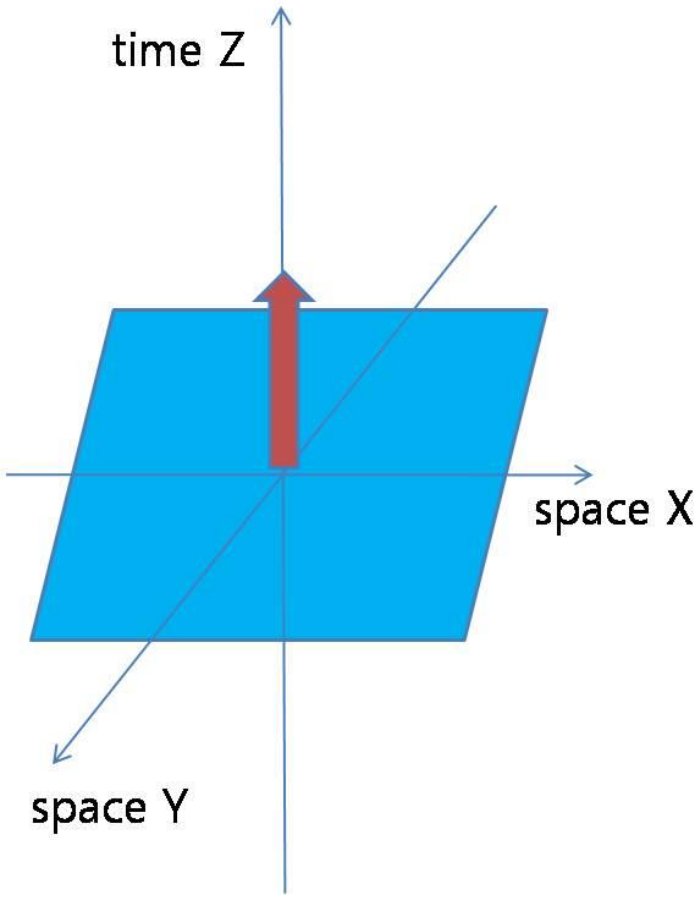

Figure 4. Homogeneity of space and time, isotropy of space determine the geometric structure of present surface more specifically. It is a plane which is translating along the time direction and this is orthogonal to space direction.

When we interpret a geometric structure, we identify it with the entity we mainly concerned about, especially with the matter of existence. We construct a coordinate system with this structure and analyze it quantitatively. A problem with this approach is that we assume coordinate system is a unique artificial factor, which we can choose arbitrarily just for convenience. Cartesian coordinate is the most widely used. However, we need to discover another artificial factor. When the property of objects needs to be described, how can we express them with geometry? If that is a dynamic property of objects, we need to observe them and then record onto space. This should also be included in artificial factors as well. Otherwise, it can result in faulty interpretations.

We also need to distinguish the underlying philosophies of physics and mathematics. Physical objects exist only at the present. In mathematics, we initiate deductive reasoning under the assumption that mathematical objects exist, a set and its elements. Even in the set-theoretic operation, the existence of mathematical object is such a trivial that it is not even mentioned as an axiom[30]. For example, real number is an underlying set in the field of real number(R). Constant, unary and binary symbol represent the property between real numbers. A real number and the symbols correspond to the mathematical object and the properties, respectively. They characterized field of real number. A physical property called time is mapped into this mathematical object.
However, the existences of physical objects are located only at the present. This includes the vestige of the past event. We need a precursor recording for mathematical working when time is related. What we deduce mathematically from time are recorded values except at the present. When we express complete space with mathematical variable, it can be mapped onto real number immediately as both objects satisfy continual co-existence. However, time need to be mapped onto real number after recording as this concept represents the ordering of existence itself.

From the perspective of formal logic, the structure of this theory is a valid argument but not sound one. The logical consequence of this theory is valid from premise to conclusion. The propositions of this theory can be applied to material conditionals. In this theory, conclusion is confirmed empirically but not the premise. A spacetime metric is equivalent to time dilation, length contraction, and relativity of simultaneity. These in turn is equivalent to invariant speed of light. They are the premises of this theory. What have been confirmed empirically are Lorentz invariants. This can be understood with Michelson-Morley experiment. In this, the isotropy of interference pattern is proved by experiment. We interpret the conclusion under the assumption that the speed of light is invariant. Therefore it is a valid argument. However, this does not guarantee that the premise itself is proved and thus it is sound one. We cannot ascertain that the spacetime metric is a unique premise for the interpretation of the conclusion. Elliptical polarization of light which is reflected from thin layer can also be used for the interpretation of isotropic

pattern and this is more reasonable one. This theory even loses the validity and consistency when we interpret it with the present. It is only valid when this is interpreted with strictly limited propositions. Other way, these can be inferred from the casual relationship in English sentence. The conclusion is also proved here. A casual relationship is decided deductively in this theory but this fact does not ensure that the relation should be empirically true.
Invariant speed, time dilation, and length contraction are always hypothesis even though there are many Lorentz invariants. This fact will be never change. They are only premises for the valid interpretations of other experimental results and cannot be a conclusion itself which is proved by experiment immediately.

Once the necessity and measuring method of time are established, we can obtain an interesting result. If we use reel clock, it is possible to represent the velocity of certain object differently. It is just the ratio of variation relative to criterion. A speed can be a dimensionless value. With this, we can define a time more rigorously. Time is a variable property which is measured through a particular criterion. If the tool is geometry or the mass of sandglass, time is not an independent fundamental unit any more. The dimension of time(t) includes that of criterion, such as length(l^c), mass(m^c), etc. Time is just a representative of these. It is just a matter of choice. Of course, the criterion should be reliable one with certain properties such as reproducibility and steadiness. It is much more important to acknowledge the fact that time represents the variable property itself of a particular criterion than to choose which one. A role of time in many physical equations is that they are expressed with a certain criterion. These criteria are standardized with which we use nowadays such as second, minute, and hour. A geometric method is composed of two factors, background and indicator. Both factors should be in steady state. A relative position of the indicator to the base represents time. Therefore, a relative velocity and location of the background and indicator to different inertial frames does not determine time. If we use other tools than geometry, the paradox related to time might have different shapes. Time is also related to entropy. A space subject to irreversible increase of entropy is nature. This is more in depth expression about nature.

Conclusion

Space varies. Once we understand this sentence, it is apparent to us what the present means. The essences of space and time are an existence and the variations, respectively. This in turn means that the true characteristic of nature is that an object continually varies. Space and time are a subject and a verb, respectively, in this expression.
The past and the future are foregone and forthcoming the present time, respectively. An object with infinitesimal physical state is actually exists in nature. This is the present. The geometry of space and time is the combination of the characteristic of nature and works of man. Therefore, it should be interpreted correctly. Only the present translates in this geometry. This is the

manifestation of the fact that we can never escape from the present. It is an obvious fact when we consider the unique present time where we are at the moment.

Time is a variable property in nature. This becomes a geometric object after we make a rule on measure using space. This is a human intervention. Both space and time are mapped into real number, a mathematical object. However, we need to distinguish the different routes they have from intrinsic character to the same mathematical object. The former is from natural object to mathematical object, the latter from its property to the same object.

A fallacy related to the theory of relativity is apparent when we interpret this theory with revised languages. The rotation of simultaneity line is closely related with spooky action, white-out, and self-cloning. Therefore, the translation and rotation of this line in different inertial frames are limited.

The paradoxical aspects related to time are originated from the defective languages which we use in ordinary life. They do not represent the actual trait of time but the property of tools which we use to measure it. They are mixed in our usage and therefore should be sorted to clarify a circumstance. When we consider a subject of interest, it is important to define an object and its property. After this, it is possible to characterize the entity. The word existence should also be classified accordingly.

When we establish a physical theory, the fundamental assumptions should be verified fully from empirical foundation and thus its generalization is not doubted. Only after this, it is possible to derive and conclude another result which should also be proved by experiment. A physical theory should be constructed by this way. We need to answer definitely to ourselves for the two questions: What is proved by experiment? What is inferred from this? If a conclusion is proved and the premise is inferred, this is the reverse of normal inference rule. This is not included in formal logic and it can result in a faulty physical theory.

The geometry of space and time is obtained from the characteristic of nature and work of man as well. Only after substantial considerations of these rationales, it is possible to construct a physical theory, including the construction of coordinate systems to express it with mathematics. Nature can be expressed with two important factors, space and time. Space always varies. This is nature.

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Appendix Summary of manuscript

The following is a summary of my research and I'd like to discuss with others about those issues. It should be generic investigation on the human reasoning process, especially on the understanding of intrinsic character of nature and the role of observer during the construction of a physical theory. The most important things are that we need to distinguish object from property and we also need to distinguish what is proved by an experiment from what is inferred from the experiment. What kind of rule of inference is used in this theory? Does this method is reliable? The followings suggest answer for these questions?

1) What is the meaning of space and time in nature?

Nature: Space varies. (subject+verb)

Nature: Space and variation (proper noun and abstract noun)

Nature: Space and time (synonym of above)

Nature: an object called space and a property called time.

Once we understand the sentence "Space varies", it is apparent to us what the present means.

2) How physics and mathematics are related each other?

The mapping process between different worlds

a) Natural world: Space and time (object and property)

b) Mathematical world: the underlying set (number, object) and its properties (ordering, relation, function)

c) Geometric world: Cartesian or other coordinate system (objects) and their properties.

Number is an object in mathematics. Mathematics is a man-made world which investigates the properties of number.

How the natural world is mapped into mathematical world?

Both space and time are mapped into real number, a mathematical object. However, we need to distinguish the different routes they have from original character to the same mathematical object. The former is from natural object to mathematical object, the latter from its property to the same object.

The questions 1), 2) are about the intrinsic character of nature and the human reasoning

process on it. In other words, we understand and express **the natural property** through **geometric object**.

It is important to distinguish objects from properties when they are mapped into different world. Many properties are expressed with objects, especially in different world.

3) What is physical theory, especially a valid theory?

The theory of relativity is valid from premise to the conclusion.(If p, then q)

What is proved by experiment? q; Isotropy of interference pattern, frequency shift, etc.

What is inferred from this? p; Invariant speed, time dilation, and length contraction.

(Rigorously, "What are the premises for the conclusion?" is more correct one)

Does the uniqueness of premise is fully confirmed? Not sure.

Is there an alternative premise for the interpretation of conclusion? I think, Yes.

We should investigate the two sentences to acknowledge the process how logic is constructed.

a) If p is true, then q is true.
b) P is true, therefore q is true.

In the theory of relativity, the word "if" can never be removed. In other words, it cannot be the sentence b). Physical theory should be constructed through b) sentence. **If** the speed of light is invariant, **then** we observe unexpected interference pattern of light. However, we should know that whether or not the premise is a unique one for the conclusion. There are a lot of candidates for premise after the word 'If'. This should be understood with the concept of uniqueness of premise. The eclipse of 1919 can be understood differently.

1) If the gravity of the sun attracts light, then the path of light can be deflected.
2) If a magician inside the sun attracts light, then the path of light can be deflected.
3) If the atmosphere surrounding the sun is non-homogeneous, then the path of light can be deflected.

Empirically, we observe the deflection of light. Therefore, the first sentence is accepted as a foundation of physical theory. However, if we apply the same rule of inference, the second one should also be accepted. There are no reasons to stick to first sentence. In this case, we need to investigate the premise without the word "if". Empirically, the truth of sentence 1 and 2 is not clear. Probably, the magician premise is completely nonsense. However, the sentence 3 is different. We have enough data about the atmosphere of the sun and well-established

electrodynamics, plasma physics. The premise itself has an empirical foundation. Logically, this sentence is b) structure. The same principle can be applied to Einstein ring, an astronomical phenomenon.

The Michelson-Morley experiment should also be revised.

4) If the speed of light is invariant, then the interference pattern of light is isotropic.
5) If a magician plays a trick, then the interference pattern of light is isotropic.
6) If the two beams (transverse and longitudinal) are elliptically polarized, then the interference pattern of light is isotropic.

The controversy over ether has produced this theory. The first sentence has been accepted. When we interpret the result of this experiment, the two beams have the same polarization vector. They only differ in phase angle. However, this is a wrong supposition. Modern optics is well established compared to the one hundred years ago. Elliptical polarization is a well known optical phenomenon and be explained with Jones vector. When the light is reflected from thin layer, it is elliptically polarized. This is widely used in industry. Modern optics guarantee the premise of sentence 6) is true.

I think we need to investigate generic human reasoning process, which include language, logic, mathematics, and physics. Modern physics lacks the insight which penetrates all of these. It is important to acknowledge two important factors when we establish a physical theory, a nature and its observer. We need to acknowledge the intrinsic character of nature and then the process of understanding about this by ourselves. How the observer understands and expresses nature? We need to be an observer of the observer. The role of observer is also important for the establishment of physical theory as this is unwittingly incorporated into the theory. The investigation of observer tells us how physical theory is constructed and what kind of tool is used to express the natural property. Geometric object is a tool to express the natural property called time. Geometric expression of space and time is a by-product of human reasoning process, not the intrinsic character of nature.

These issues should be discussed with researchers from diverse fields for prolonged times. When we repeat the discussion, I am sure that we can find contradictions inherent in special relativity.