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Gravity and the Nature of Physical Interactions

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Abstract

This work is a kind of thought experiment aimed at answering the question: what might a theory look like in which time and space (spacetime) are not fundamental? The article formulates theoretical frameworks that introduce the number of spacetime dimensions, the principle of equivalence of mass, and the value of the gravitational constant not as empirically given data, but as results of theoretical deduction. This analysis opens up potential connections between gravitational and electrostatic interactions, proposing a new approach to traditional physical assumptions. The theory is presented in a preliminary form, intended to inspire possible further research. The final part of the paper proposes experiments to verify these ideas.

Keywords

Time, Space, Gravity, Principle of Equivalence, Gravitational Constant, Planck Mass

1. Introduction

What is the nature of time, and does it really exist? Various scientific theories offer diverse answers to these questions. Julien Barbour [1]-[3] suggests that time is merely a phenomenal phenomenon, while scientists such as Lee Smolin [4] and Carlo Rovelli [5] present theories that often stand in opposition to commonly accepted ideas. Why does space have three dimensions, and spacetime four? These questions, although seemingly theoretical or even "philosophical" at first glance, are fundamental for understanding the physical world we live in. This work poses these questions in a light different from the standard (but not contradictory to it), proposing a theoretical approach that reformulates traditional assumptions into outcomes of theoretical deduction, potentially paving the way for further research. The reasoning is conducted at an elementary level, introducing a non-standard conceptual and formal apparatus. I am aware that this makes the text somewhat difficult to comprehend. Therefore, I encourage the prospective reader to first read the text without delving into the details, which will enable an assessment of whether a more detailed understanding is worth the effort.

2. Method

2.1. Preliminary Determinations

We assume the concept of identity along with the terms "identical" and "the same" as primary. Identical objects can differ in identity, whereas the same objects need not be identical (they can vary). In particular, a certain object being the same does not imply it is identical. This corresponds to the following intuition: I, at the age of five and at the age of thirty-five, am the same person but not identical.

2.2. Real Space (of Identical Elements)

When we have two identical spheres (**Figure 1**), one is to the left and the other to the right, or one is closer and the other farther. The terms "left," "right," "closer," "farther" are introduced with respect to us. However, there is something that does not depend on their position relative to our body. That thing is the distance between the spheres. The space between them. The mutual distance is a property (at least) of the two spheres. It is evident: a single sphere does not determine the distance from nothing. Moreover, distance is, in a sense, a measure of difference. Hence, what distinguishes two identical spheres is the space and a certain characteristic of it (distance). Therefore, space is a property of at least a pair of identical objects. Identical objects are differentiated by space/distance, a relational property they do not possess individually but which is attributed to them as elements of a set (e.g., a pair) and at the same time is a property, a relation defining that set. This means that space is a property of identical objects. In this case, a pair of identical spheres is a special object because the pair has properties that (individual) spheres do not have. We will call it an object of composite identity.

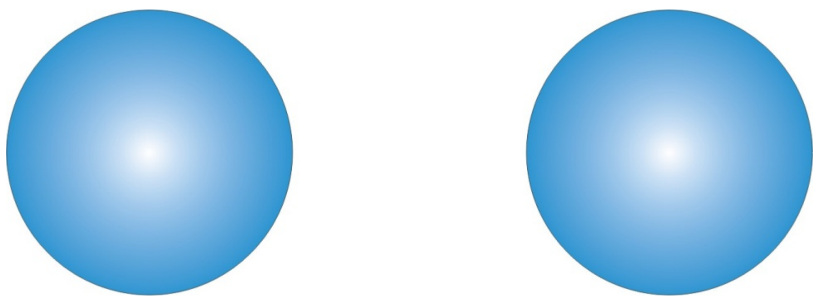

Figure 1. A pair of identical spheres.

Principle 1

Space is a property of objects with composite identity.

Of course, we are dealing here with a special kind of space: the space of identical objects. Distances in it can be determined by assigning appropriate real numbers. We will further refer to such spaces as real spaces. These are spaces of identical but identity-wise different objects. The word "space" here does not denote any special object like Newtonian space or common notions of Euclidean spaces. It is not an object but a relation, a layout of dependencies between objects (identical but, in particular, not the same). It is thus space in the general mathematical sense, whose properties allow for its treatment, to a very close approximation, as if it were "empty something". However, these approximations can lead to incorrect notions. What are genuinely given are identities and their relations, all other interpretations are secondary.

We described space as a property of an object with a composite identity, an object type such as a pair of identical spheres. But we also say that a single sphere is a spatial object. Moreover, we usually observe objects not as identical but different (for example, cubes and pyramids) and call them spatial as well. First, let's consider a single sphere. Observation shows that a sphere has many distinguishable spots, spots that are essentially identical because they have no traits other than "distinguishability". We can imagine it (geometrically) as "composed" of "points" or (more "physically") of tiny, below the threshold of perception, "atomic balls". Points and undetectable balls have one essential property: they differ from the rest only in distance, having no other properties. After all, a sphere is defined as a set of points at a distance equal to or less than the radius from the center. Hence, the only characteristic of a point is its distance from others, being a property of the corresponding object with a composite identity (spatial) and the only property being identical to other points but different from them. A single sphere is thus also a spatial object because it itself is an object composed of (a multitude) of identical objects. When comparing a circle and an ellipse, we notice they are different because the distances between their points and a certain point (points) are different, meaning their points differ "otherwise". Thus, we see that the property of spatial objects is multitude.

The fundamental properties of objects with composite Identity are: extensiveness and multitude (as in the case of a pair of spheres). Both these properties are interdependent and coexistent, hence numbers can be characterized by distance (spatial difference) and points by numbers (the value of distance). A real interval or spatial-type distance refers to the distance between identity-wise different objects, specifically identical but not the same.

2.3. Identity Space of the Same Elements

An object being "the same" does not have to be identical. An object that is "the same" can be different objects, e.g., composite ones. This can be approximated by referring to the common intuition of time: a temporal object is one of varied identity, two "different" objects (composed in real space) can be "temporally" the same object. An identical object ("the same") is some object and at the same time another, in particular, a different one (not identical). When an object that is "the same" is two (or more) identical objects, we say it remains (spatially) unchanged or endures. When it is different, then we use the term "change." Of course, there is a difference, *i.e.*, a distance between the objects which the temporal object is. It is a difference of identity, *i.e.*, the distance of an object from itself. Identical objects differ (are distant) from themselves in their respective (own) identity spaces. Objects being different objects in identity space are called objects with composite identity. Their properties are: extensiveness and multitude of a "temporal" type, *i.e.*, extensiveness and multitude of the same identity-wise object. In real space, the smallest sensible distance is zero. We assign it to objects that are touching and/or single objects (distance of a point from itself). Therefore, identity-type (temporal) distance must be treated as a number of a different kind than real since it is a distance (non-zero) of an object from itself. Real numbers define distances between identical but not the same objects. A non-zero distance of a point from itself should be negative (less than the smallest real distance), but such cannot be determined in real space (of identical objects). We need other numbers, "orthogonal numbers" to real ones. Therefore, imaginary numbers are the natural tool for describing identity distances (distance of an object "from itself"), while real numbers describe spatial distances. Such spaces are called identity spaces (spaces of the same). Intervals define distances, *i.e.*, identity differences of the same object, and their values are given by imaginary numbers.

2.4. Composite Space

The proper space for describing an object that is "the same" is the identity space (imaginary). If such an object also has real dimensions (e.g., is composed of identical ones), then it is a complex space with appropriate real coordinates. Understanding the relationship between real and identity spaces is important. Every identical object can be described in its identity space, in particular, we can describe its "evolution" or "history," *i.e.*, the differentiation of the same object. Then we use imaginary or complex intervals. However, comparing different "the same" objects (differentiated in identity) can only occur in real space (because it is the space where identity-wise different objects can exist). Therefore, in this space, relations and potential "interactions" between differently identity-wise (but possibly identical) objects occur, each "evolving" in its own identity space. However, such a space allows for determining only real distances. Therefore, temporal-type distances (distances of objects "from themselves") can only be determined indirectly, e.g., by measuring the spatial (real) distance between designated points. Of course, they are given by real numbers (in particular, are functions of appropriate modules of complex numbers). This corresponds to the intuition of measuring time by measuring the distance between the positions of a clock's hands. Thus, we have two types of identity intervals or "temporal" types: actual (in identity space) and "spatialized" determined in the real space of identical objects.

2.5. Theory of Identity

So far, using colloquial language, we have approximated the basic intuitions associated with thinking about identity. However, to further construct a description of the properties of objects that interest us, especially to calculate something, we need a more precise language. Therefore, I will now introduce the basic concepts, assumptions, and operations of the theory of fuzzy identity.

The basic concepts and terms are:

- a general object (denoted by the letter A)
- elementary objects (denoted by a, or a_{el} and indexed as needed a_1, a_2, a_3, …)
- composite objects (from elementary ones)
- identity ("being something"), the relation of being an object will be denoted by the symbol *e*.
- degree of identity ("being something to some extent") denoted by the symbol SN taking values from the closed interval [0, 1].

There is an analogy between the theory of fuzzy identity and set theory. The general object corresponds to a set, elementary to an element, composite to a subset, and the relation of being an object to the membership of an element in a set. Meanwhile, the "degree of being an object" is analogous to the "degree of membership of an element in a set" in Zadeh's fuzzy set theory. However, the analogy is limited because, in set theory, elements are not the sets to which they belong nor are sets their own elements (a set of two spheres is not any one of them), while in the theory of fuzzy identity, we allow these possibilities. To reiterate: in set theory, fundamental objects, meaning sets and elements, essentially, fundamentally, are not each other. Elements differ from each other identity-wise, and sets are not elements. In the theory of fuzzy identity, they are, to some extent, each other and are the general object that they are. On the other hand, the theory of fuzzy identity is in a way more general because it is sufficient to set appropriate SN values to zero (*i.e.*, abstract from identity dealing only with differences) to obtain an exact analog of set theory (fuzzy or not).

2.5.1. Simple Identity

We write:

A *e* a

We read:

The general object A is the elementary object a.

Intuitions:

A pair of spheres is each of them.

2 is 1 because it is larger (two-element sets contain one element).

2.5.2. Fuzzy Identity

We write:

A *e* aSN 1 (for example)

We read:

A pair of spheres is to the degree of one each of them.

Intuitions:

A pair of spheres is entirely a sphere, each of the pair, meaning it "contains" it precisely.

2 contains 1, thus 2 e 1SN1

2.5.3. The Relation in

We write:

A *e* aSNn in B

We read:

A is a to the degree n in object e.g., set B.

Intuitions:

A pair of spheres is to the degree 0 a piece of lead (a) in the set (general object) of iron spheres (B).

2.5.4. The Relation Rel

We write:

A *e* aSNn rel C

We read:

A is a to the degree n with respect to C where C is a certain identity (thus an object and/or property)

Intuition:

A pair of iron pieces (A) is a sphere SN1 with respect to shape (C) which occurs in an object with composite identity made of two iron spheres.

2.5.5. The Identity of an Elementary Object with a General One

We write:

A *e* ASNn

We read:

a is A to the degree SN.

Intuition:

A single sphere is a pair of spheres but to a lesser degree than 1 (because it is not the entire pair). If the spheres are identical, we assume that each is the pair halfway, thus SN0.5.

As can be seen, the relation e is asymmetrical with respect to the degree of identity.

2.5.6. The Relation "=" (Being Precisely, Equality)

We define:

$A = aSNn \leftrightarrow_{df} n = \min\{SN(A\ e\ a), SN(a\ e\ A)\}$

We read:

A is precisely (or equals) a to the degree n when n is the smaller (min) of the values SN(a e a), SN(a e A). Reading SN(a e A) means: the degree to which A is a.

Intuitions:

A pair of spheres is one sphere SN1 but is precisely one of the spheres to the degree 0.5 when the spheres are identical.

A pencil is yellow SN1 ("it is true that the pencil is yellow") but is precisely entirely yellow to a lesser degree (e.g., corresponding to the part of the painted surface) because usually, the graphite is black, the inscription gold, etc. Of course, a pencil entirely yellow might rather be a crayon.

As can be seen, the relation of precise identity is symmetrical (SN(A = a) = SN(a = A)) consistent with the intuition corresponding to the equality relation.

2.5.7. Normal Fuzziness

We define:

An object A is called an object of normally fuzzy identity when

$$\sum_{i=1}^{i=n} SN(A = a_i) = 1$$

This means that the sum of the identities of A with all its component objects equals one, implying it is exactly and entirely them.

2.5.8. Degraded Fuzziness

We define:

An object A is called an object of degraded identity when $\sum_{i=1}^{i=n} SN(A = a_i) < 1$

Such an object is "less than exactly itself."

2.5.9. Excessive Fuzziness

We define:

An object A is called an object of excessive identity when $\sum_{i=1}^{i=n} SN(A = a_i) > 1$

Such an object is "more than itself."

2.5.10. Uniformly Normal Fuzziness

We define:

A is fuzzily uniform if $\forall_{a_i; A\, e\, a_i} SN(A = a_i) = n$ and $\sum_{i=1}^{i=n} SN(A = a_i) = 1$.

An object is uniformly normally fuzzy if it is to an equal degree each of the elementary and has a total identity equal to unity. We assume that in such case, this degree is equal to $\frac{1}{\text{card}\{a_i\}}$, obtained by dividing one by the number of elementary objects. If necessary, many more similar definitions describing objects of different structure and identity properties can be formulated.

2.5.11. Identity Distribution of an Object

We define:

The identity distribution of object A is called a function that assigns each of the elementary objects a corresponding identity value with A, *i.e.*, a function of the form $f(i) = SN(A = a_i)$. In particular, it allows for a graphical representation of the identity structure.

2.5.12. Paradoxical Identity

We define:

An object A is called an object of paradoxical identity if

$$\left(\sum_{i=1}^{i=n} SN(A = a_i) > 1\right) \wedge \left(\exists_{a_i, a_j}; SN(a_i = a_j) < 1\right).$$

If $A = a_1SN1$ and $A = a_2SN1$ and $a_1 = a_2SN0$, then $\sum_{i=1}^{i=n} SN(A = a_i) = 2$ and object A is called an object of extremely (sharply) paradoxical identity.

So far, we have defined objects of spatial-type identity, e.g., tuples of identical or different spheres or a (yellow) pencil. However, an object of paradoxically fuzzy identity is a temporal-type object. In the example above, we have a two-element exactly paradoxical object, meaning an object being exactly two zero-degree identical ("different") elementary objects. This object has an excessive identity and can be defined as paradoxical to the degree of 1. Note: if its components a_1, a_2 were identical to a degree greater than 0, say 0.5, the paradoxicality of object A would be reduced. If, however, they were precisely identical ($a_1 = a_2SN1$), then A would be paradoxical to the degree of 0 because it would be fuzzy on one element. To approximate the intuition: an object of paradoxical identity is exactly the same object being two precisely different ones. Say, it is entirely close and entirely far. When we try to imagine it, it is once close and once far. Such a series of "close-far" objects we call the sequential development of an object of paradoxical identity. It represents the variability of the identity of the same object and thus intervals have a "temporal" character. Time, therefore, can be intuitively treated as a space of preserving identity.

2.5.13. Special Cases

As you can see, I do not develop the theory of identity according to the rules of art. I introduce it only as much as it will be needed in further research of a more natural than formal nature.

Now let's consider a couple of special issues, the solutions to which will help us construct the theory of temporal-type objects. Elementary objects are defined as to some extent identical with the general A, *i.e.*, as objects which A is to some extent, while they do not have any other defined properties. Elementary objects are given by the degree of identity with A and only so.

Let there be given two elementary objects a_i, a_j such that:

$$A = a_iSNn_i,\ A = a_jSNn_j$$

We ask: to what extent are a_i and a_j each other with respect to being A? that is, we need to find x in the formula $a_i = a_jSNx$ relA. Since the elementary objects a_i, a_j are given by identity with A and only so, we assume that a_i is any other elementary object to the extent that it is A (since they are also only A). Therefore:

$$a_i = a_jSN(SN(A = a_i))\ \text{relA}$$

that is

$$a_i = a_jSNn_i\ \text{relA}$$

Note that this relation is asymmetrical because:

$$a_j = a_iSN(SN(A = a_j))\ \text{relA}$$

that is

$$a_j = a_iSNn_j\ \text{relA}$$

therefore, if $n_i \neq n_j$, then $SN(a_i = a_j\ \text{relA}) \neq SN(a_j = a_i\ \text{relA})$. One can say that "the greater" is more "the lesser" than vice versa. However, since elementary objects always have the same degree of identity with A, in their case, the relation is symmetrical though it does not have to be so when it comes to composite objects.

Principle 2

All elementary objects of the general object A are each other to a degree greater than zero.

Let's introduce the notation aSNn as an indication of natural numbers by which *a* is to the degree n. We assume that *a* is also a natural number. This formula also precisely defines two natural numbers for all a ≥ 2. For example: ((4SN0.5 = 2SN1) ∧ (4SN0.5 = 8SN1)) thus SN0.5 = (2, 8)SN1 inN.

It is easy to notice that these values are calculated by treating the "SN" sign once as a multiplication and once as a division (we multiply and divide 4 by 0.5). The pair (2, 4) is an analogy of the sequential development of the object 4SN0.5, which is "simultaneously" two numbers (similarly as the square root of 4 is the pair 2,-2). We can also use degrees of identity to determine single numbers by setting up identity equations of such form:

$$((x = (2SN0.5)SN1) \wedge (x = (8SN0.5)SN1)) \text{ thus } x = 4.$$

Now we ask: to what extent is the object a_i identical with A with respect to the identity with some a_j. We thus want to calculate *x* in the formula:

$$a_i = ASNx \text{ rel } a_j$$

$$A = a_iSNn_i,\ A = a_jSNn_j$$

I observe: a_i is identical with a_j to the extent that it is identical with A:

$$SN(a_i = a_j) = SN(A = a_i) = n_i$$

Simultaneously $a_j = ASNn_j$

Thus a_i is identical with A rel a_j to the degree

$$(SN(A = a_i))SN(A = a_j)$$

This notation is read as: "the degree of identity $A = a_i$ in the degree of identity $A = a_j$" thus

$$n_i\ SNn_i$$

Interpreting SN as multiplication, we get:

Principle 3

$$SN(a_i = A \text{ rel } a_j) = n_in_j$$

This is a theorem about the product or about relative identities, which we will use again. It is worth noting that the relation $a_i = ASNn_in_j$ rel a_j is symmetrical.

3. Theory

3.1. Subject

We will now explore the general properties of objects with paradoxical identity, that is, general temporal objects denoted further by the symbol A. An example of a general object is a pair of spheres, meaning an object that is each of the spheres to a certain degree, for identical spheres we can assume that it is equal to 0.5. If the spheres are different, determining (existence of) the difference requires introducing (existence of) "points" and distances between them so that they can be individualized (distinguished). In turn, "points" must be identical because if they were different, they would have to be composed of "lower-order points", that is, identical objects differing only in distance. Thus, as we can see, every general object is composed, at the lowest level, of identical, "point-like" objects. These objects will henceforth be called the elementary objects of the general object A and denoted by the symbol a_{el}.

A pair of spheres are objects of two kinds. First, as elementary objects (points) and second, as spheres, which themselves are composite objects. Even if the spheres are identical, to be spheres (solids of a defined shape), they must have a composite identity, meaning they must themselves be general objects of lesser generality than the general object "pair of spheres".

Therefore, in studying general objects, we will deal with three types of objects:

- first, the general objects A themselves (type pair of spheres)
- second, the elementary objects a_{el} which are identical and have no features other than resulting from the identity with A ("points")
- third, composite objects, which can be "somehow", e.g., have a specific shape, size, etc. In other words, they can be different or the same (spheres).

3.2. Elementary Cell

A general temporal object is an object being elements of a complex identity, particularly paradoxical. Such ones that "are somehow and are different".

The smallest general temporal object A (universe A) has only one elementary object. Therefore, it is identical with it to the degree of 1, and its sequential development consists only of two steps "moments". We will now examine its basic properties because, on this occasion, we will learn the general properties of all objects A. Note: the smallest temporal object must be, to some extent, at least two different (also to some extent) component objects. It must, therefore, be (simultaneously) two different spatial objects, and they are to be (simultaneously) the same object. Thus, the elementary temporal object corresponds to a necessary difference (change) of spatial identity. These formulations may not be clear enough. So, we will build the corresponding intuition step by step, constructing a matching model. Imagine introducing one simple elementary temporal object. We might try it like as in Figure 2.

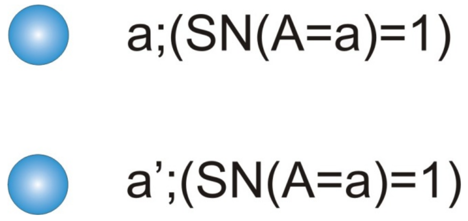

Figure 2. First attempt at a graphical representation of an elementary temporal object.

Or, simplifying it like in Figure 3.

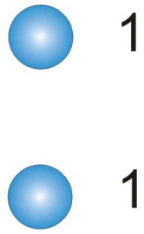

Figure 3. Second attempt (approximation) at a graphical representation of an elementary temporal object.

This drawing is supposed to represent the sequential development of the proposed temporal object. But as you can see, the first position does not differ from the second; they are simply two identical spheres, thus a typical general spatial object and not a temporal one. Such a "jump" turned out to be trivial. So, let's try like as in Figure 4.

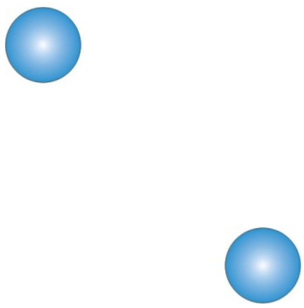

Figure 4. Third attempt (approximation) at a graphical representation of an elementary temporal object.

This time the difference is clearer, but it arises from the position on the paper or relative to our body and is not introduced in the space of the general temporal object universe A. It is not because it requires introducing a differentiating identity distribution of the elementary object a_{el} in the universe A without referring to the paper surface. What we usually introduce implicitly and somewhat automatically, that is reference points, we will now explicitly mark as in Figure 5.

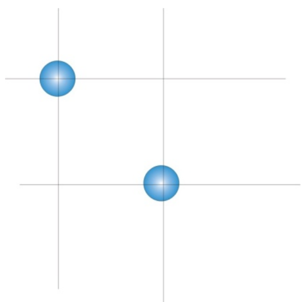

Figure 5. Fourth approximation of the graphical representation of an elementary temporal object.

If the points of reference marked by the intersections of lines are to be incorporated into the identity structure of A and a_{el}, they must also possess a certain degree of identity with A. Let's assume then that the points marked by spheres are identical with the designated intersections to a degree less than 1, so that the identity difference determining the distance in space is not zero. Let's denote it by P, we then have **Figure 6**.

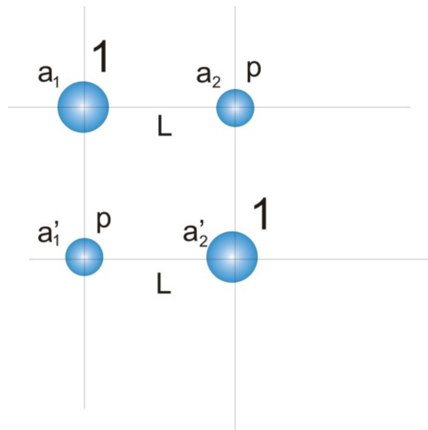

Figure 6. Representation of the identity distribution of an elementary temporal object that meets the required conditions.

Such development shows that the identity of a_{el} undergoes a "jump", or more precisely, an identity-preserving shift in the space of identity A. Since we are considering the necessary properties of the simplest elementary (and general) object, then:

Principle 4

Every temporal elementary object has a spatial extent.

If the general object A were a larger number (n) of elementary objects, we could write: $\begin{bmatrix} 1\frac{1}{n} & P\frac{1}{n} \\ P\frac{1}{n} & 1\frac{1}{n} \end{bmatrix}$. This is the matrix of identity distribution in the simplest and minimal case of sequential development. It describes an elementary object of the structure of the universe A, which we will further call the elementary cell. Notice; we introduced a certain value P such that $\frac{1}{n}P < \frac{1}{n}1$. It is governed by:

Principle 5

The value P is constant throughout the universe A.

If it were not so, then temporal elementary objects (as temporal) would not be identical and therefore would not be elementary objects of the general object A. This value determines elementary spatial and temporal distances. Spatial distances are marked on the drawing (**Figure 6**) with the letter L, while temporal ones correspond to equal lengths of vertical lines connecting "past" and "future" objects, *i.e.*, objects a_1, a_1', and a_2, a_2'. We will now, somewhat arbitrarily, establish a special condition. Namely, we will deal with general objects A, for which the value P is equal to 0.5. I introduce it for two reasons:

- It is very intuitive to state that two objects being each other to a degree not less than 0.5 (half) are rather one object. Whereas being to a lesser degree, they are rather two. More precisely: objects are two to the degree they are different SN(A ≠ B). This degree can be determined as equal to 1-SN(A = B). As you can see, for an identity degree equal to 0.5, the degree of difference is greater than it. However, for the value of 0.5, objects are equally the same as they are different. I adopt the value P = 0.5 because it corresponds to the maximum (limit) change without violating the intuitive condition of "rather" being oneself. Of course, we can consider objects with P less than 0.5, *i.e.*, objects with a "rather discontinuous (non-continuous) identity". However, it is worth noting that they will be to a lesser extent temporal objects because they will be rather different and to a lesser extent will be "the same object being different".
- I determined that adopting the "condition of 0.5" results in many naturally interesting consequences, which we will look at more closely later.

Principle 6

There exists an elementary degree of identity ($|a_{el}|$) *with the general object* $\forall_{a_{el};A\,e\,a_{el}SN1} SN\left(A = a_{el}\right) = \frac{1}{n} = |a_{el}|$. *This means that* $|a_{el}|$ *is the minimal degree of identity with A of its elementary objects.*

Principle 7

Spatial and temporal distances corresponding to the elementary change of identity (0.5) *are the smallest distances in the universe A that also make sense in this universe* (*because smaller ones are not determined by the existence of corresponding objects*).

Principle 8

Every universe A is characterized by three basic elementary units: *elementary identity* $|a_{el}|$, *elementary spatial distance* $|el|$, *and elementary temporal distance* $|c_{el}|$.

It is worth noting that both $|el|$ and $|c_{el}|$ values are determined by $|a_{el}|$, which is in turn determined by the number (power) of the general object A. Thus, temporal and spatial distances are equivalent to the identity with A and given by its appropriate differences. The minimal nature of these values results in particular from the "condition of 0.5". As a simple conclusion from the above principles, we obtain:

Principle 9

In every universe A, *there exists an elementary and simultaneously minimal spacetime volume.*

Possible larger volumes are compositions of elementary ones, and smaller ones are not (precisely) sensible volumes of the given universe A, meaning they are not its structural elements to the degree of one.

Notice; the distinguished (greater) identity of the elementary object marked in our drawings with the number 1 undergoes a spatial movement when we move from the upper to the lower row of the matrix of the elementary cell.

Vectors C and P (**Figure 7**) correspond to temporal and spatial shifts, and vector CP is their resultant vector (temporal and spatial). It must be remembered that the shift occurs in the same space only in the sequential development represented by two different rows of the matrix or levels of the drawing. This shift occurs relative to the (temporally) previous state and maintains the identity of the object, thus it is a movement.

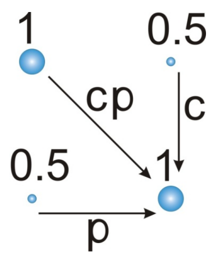

Figure 7. Vectors of identity shifts of an elementary object (temporal, spatial, and spacetime).

Principle 10

Every elementary object is in motion.

The interpretation of motion as the displacement (identity) of an object in space precisely expresses the common observation. As we standardly say, "motion consists of moving an object in space over time."

Principle 11

In the universe A, there exists an elementary motion corresponding to the elementary change of distance in elementary time. All elementary objects are subject to it.

Therefore:

Principle 12

In every universe A, there exists an elementary speed $v_{el} = \frac{|el|}{|c_{el}|}$. *This is the speed of elementary objects relative to their own identity.*

Notice; if we wanted to precisely (sharply) locate an elementary object in the elementary cell, we could try to do it like as in **Figure 8**.

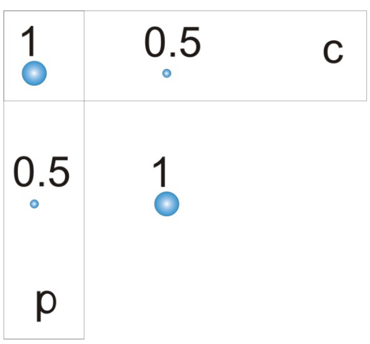

Figure 8. Hypothetical exact spacetime location of the identity of an elementary object.

However, it turns out that the distinguished spatial and temporal coordinates do not define the location of identity 1 because they omit the object in the bottom right corner. That means they do not provide the actual location because the elementary object is equally and to the degree of 1 fuzzy on the "diagonal of the elementary cell," which is equally paradoxically fuzzy as befits a temporal object, as illustrated by the next drawing (Figure 9).

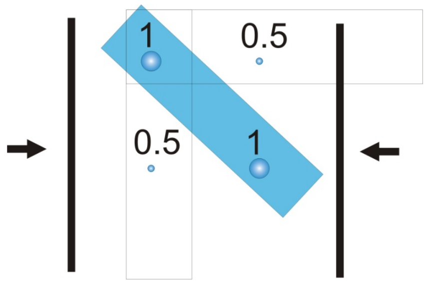

Figure 9. Correct localization of the elementary object (its fuzzy identity).

The rectangle defines the extent of the elementary object, and it can be seen that temporally and spatially, it cannot be located with greater accuracy than the dimensions of the entire cell. However, if we had a "magical force" and wanted to "squeeze" it to determine a sharp spatial position (which the thick lines and arrows represent), we would get Figure 10.

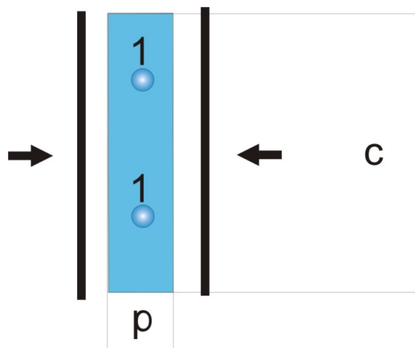

Figure 10. The impossibility of "completely precise" localization of the identity of an elementary object.

Indeed, the spatial coordinate p is now precise, but the temporal one has completely "scattered" (since temporally the object is indistinguishable) and even lost its meaning (since we obtained two spatial objects). Of course, forcing the accuracy of temporal location would have a similar effect.

Principle 13

Simultaneous precise determination of the spatial and temporal location of an elementary object in the spacetime of the universe A is impossible and nonsensical in this space (*meaning while preserving the temporal character of A*).

Thus, any object does not have a more precise location than with the accuracy to the dimensions of the elementary cell. This principle additionally deepens the understanding of the terms "sensibility" and "minimality" in relation to the elementary parameters of universe A. Elementary spatial or spacetime volumes are indeed the smallest that can be measured in this universe because simply there are no smaller ones. More accurate measurement is at the expense of another essentially important parameter and is therefore "a measurement not from this world." Using elementary units, we can introduce various derived quantities also having the property of elementariness and minimality, in particular, we can define the elementary value of a dimension $\frac{|a_{el}| \cdot |el|^2}{|c_{el}|}$.

It's important to note that time, space, and all derived values (like speed) are only possible ways of description (parameters) of the identity structure of objects. So far, we have studied the basic properties of the elementary cell, *i.e.*, the basic properties of the smallest, elementary temporal object. However, a temporal object can be identical with more than two components, and sequential developments do not have to end with one "jump."

The elementary cell was represented like in **Figure 11**.

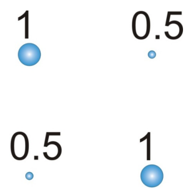

Figure 11. Identity distribution of the object within the elementary cell.

Therefore, one might think that the next, simplest step of sequential development should add another row identical to the first, which corresponds to the intuition of a "jumping" object "close-far" as in **Figure 12**.

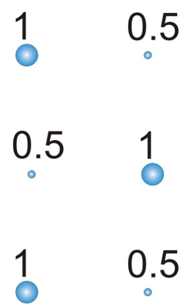

Figure 12. Attempt at constructing a space that encompasses more than one elementary cell.

However, notice: the last row is (spatially) identical to the first; we, therefore, do not have three different objects but only two because the first and last row represent the same spatial object. Hence, introducing another element of sequential development requires fuzzing the identity of the elementary object not on two but on three spatially different component objects, and this fuzzing meets the "condition of 0.5." The minimal object meeting these requirements is shown in the Figure 13.

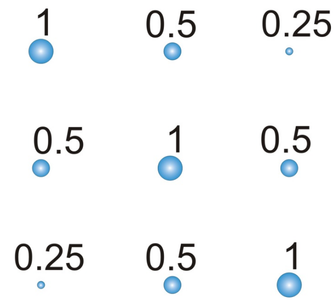

Figure 13. Identity distribution forming a space corresponding to a double elementary shift (two "elementary moments").

As can be seen, the sequential development of a temporal object differs from "jumping" close-far, in that there is no possibility of returning to the previous state. This means also the expansion of the universe A's space with the "passage" of time because adding the next step of development increases the space. In the case of larger, potentially finite temporal general objects A, we can generally present the structure of their universe (Figure 14).

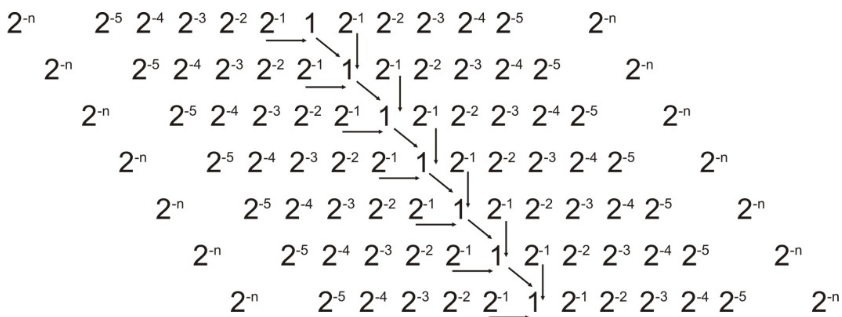

Figure 14. Multiple elementary shifts; as seen, the space increases with time.

Note: the elementary object is spatially extended and surrounded by an identity field. It is a vector field where the direction of the vectors is determined by the increase in identity towards the central object "1". The drawing marks horizontally the vectors closest to "1" corresponding to the temporal elementary shift. It's important to observe that vertical temporal vectors also determine the direction of identity increase, meaning the time of universe A "flows" precisely in the direction of increasing identity (spatially preserved as indicated by diagonal vectors).

Principle 14

With the increase in temporal dimensions, the spatial size of universe A also increases.

Principle 15

Elementary and composite objects of the general temporal object A are surrounded by identity fields (elementary or composite) that move along with them.

Principle 16

The space of universe A is identical to the vector field of its objects.

In the case of a single elementary cell, we had the impossibility of locating an elementary object with greater accuracy than the dimensions of that cell. Therefore, we actually had no possibility of locating with greater accuracy than "to the world" because the whole consisted of only one cell. In the case of a larger ("older") universe A, we can locate a single cell with accuracy (at the limit) corresponding to its dimensions because it is surrounded by other, distinguishable cells with appropriately lower values (degrees) of identity.

The elementary cell marked in blue with CP (**Figure 15**) coordinates is distinguishable from the surrounding neighboring cells determined by these coordinates. Since time (the identity of spatially different objects) and space (given by the difference of elementarily identical objects) are independent characteristics of the same object, they define orthogonal vectors of one space, namely the space of the general temporal object A. Further note, if we tried, similarly to the previous chapter, to "forcefully" establish sharp temporal or spatial coordinates, we would result as in **Figure 16**.

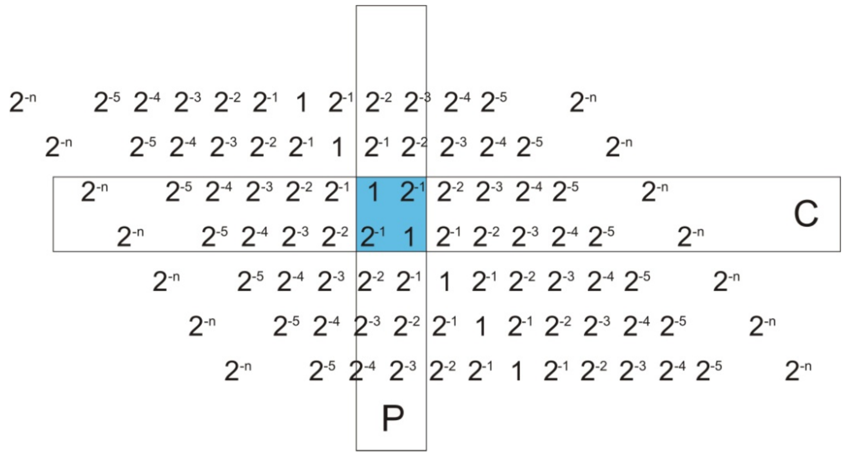

Figure 15. Localization of a single elementary cell within the extended identity space of the elementary object.

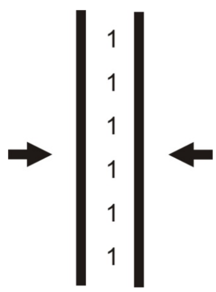

Figure 16. The impossibility of "absolutely precise" spacetime localization of an elementary object within the identity space.

Thus again, a location with "world" accuracy. The localizability principles and other fundamental principles resulting from the properties of the elementary cell thus remain in force also in universes A larger than the minimal. Logically speaking, the non-localizability (fuzziness) of an elementary object in the cell is the result of introducing a (non-explosive) contradiction: the object is somewhat and at the same time different (not the same), therefore any statement asserting location is true.

3.3. Dimension

Notice, the elementary cell in the space of universe A with a time greater than elementary undergoes a certain change resulting from being surrounded by other such cells. Let's examine this more closely.

The drawing (Figure 17) marks the elementary cell in blue and, framed, parts of the surrounding cells. It can be seen that the elementary object is fuzzy on the elementary cell but simultaneously and to the same degree on segments reaching beyond it. This poses a certain problem because, in that case, its spatial extent is greater than elementary at an elementary moment in time (stretches from the upper left 0.5 to the lower right). On the other hand, this condition indicates the "extension" of the cell. Moreover, the elementary temporal movement of objects can be presented as moving, defined at every (sensible) moment and place of the spatial identity vector. As can be seen, Zeno's paradox known as "the arrow" does not apply to movement in universe A because, in this universe, the arrow does not rest at any (sensible) moment. Graphically, we can present it as follows (Figure 18).

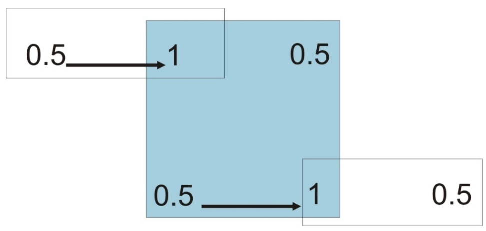

Figure 17. Identity distribution of an elementary object in three neighboring elementary cells.

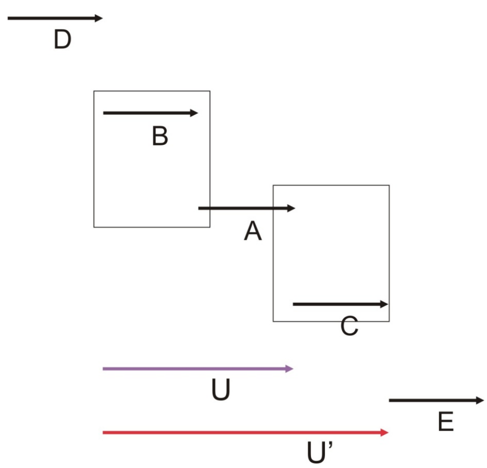

Figure 18. Summation of identity vectors of neighboring elementary cells.

It's easy to notice that vector A is contemporary with the "past" vector B (only an elementary distance divides them) and with the "future" vector C (for analogous reasons). However, it is not simultaneous with vectors D and E because their elementary cells have correspondingly lower degrees of identity (rather not the cells of vector A) and it is spatially distinguishable from them by more than 0.5. But if B is simultaneous with A, then the total elementary shift would be equal to vector U, and if simultaneous with B and C, then the distance of total shift is determined by the length of U', etc. However, this would violate the "condition of 0.5" (we would have a distance corresponding to three times 0.5).

According to earlier determinations, we demand that the elementary object be fuzzy on a single elementary cell SN0.5. Simultaneously: an elementary object of a potentially finite universe A is represented by three independently contemporary spatial vectors. This means that the independence of vectors should be treated as their orthogonality, *i.e.*, the elementary cell and space of universe A are three-dimensional. As easily seen, a greater number of dimensions is not needed because further cells differ in spatial identity from the cell (vector) "present".

Principle 17

The space of universe A is three-dimensional, and spacetime is four-dimensional.

At the same time, it should be noted that for distances smaller than corresponding to three lengths of elementary vectors, a reduction of dimensions will occur, meaning the space will become correspondingly 2 and 1 dimensional.

Therefore, we can imagine the elementary cell of the potentially finite universe A as a hypercube, with displacement vectors located on its edges (Figure 19).

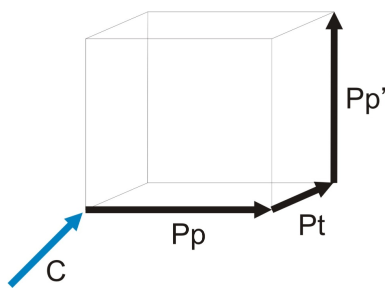

Figure 19. Correct representation of an elementary cell in the extended identity space.

The temporal (imaginary) vector is marked in blue, while the three spatial ones are black and marked as "past" (Pp), "present" (Pt), and "future" (Pp'). As can be seen, the past, present, and future are spatially orthogonal and (independently) contemporary in the elementary cell. On a larger time scale, an elementary object can be spatially presented as a composition of many cells.

It's easy to notice that the elementary object performs a half-turn for a single cell (*i.e.*, a "temporal moment"). Since it can rotate both to the left and to the right, we will have at least two types of three-dimensional elementary objects, namely right and left-handed (Figure 20).

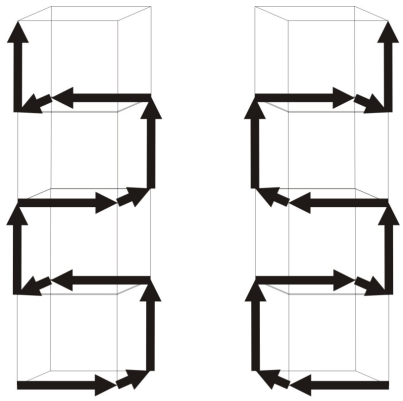

Figure 20. Possible left-handed and right-handed trajectories of the identities of elementary objects.

3.4. Elementary Speed

Elementary speed is the speed corresponding to a change in the identity of an elementary object by 0.5, therefore, it is the speed at which an object covers a distance corresponding to this change in the same amount of time. If the speed of some object were greater, then this object would cover a distance greater than corresponding to 0.5 $|a_{el}|$ in elementary time, which would violate the adopted "condition of 0.5". An object moving at such speed would be, in the next step of temporal development or "moment", rather a different object from the one in the previous moment. Thus, greater speed would somewhat violate the continuity of its identity, which would be "interrupted". Such an object would rather not be the same object, and therefore, would rather be different from a temporal object. This fact led me to adopt the "condition of 0.5" although as a "soft" condition, that is, allowing for consideration of exceptions. After all, objects having an "interrupted identity" are also to some extent temporal.

Principle 18

The speed of an elementary object cannot be greater than elementary.

Principle 19

The speed of a composite object cannot be greater than elementary.

Because if it were greater, then the speed of the component elementary objects would also have to be greater, which is inconsistent with the previous principle and/or the "condition of 0.5".

Principle 20

The mutual (*relative*) *speed of two composite or elementary objects cannot be greater than elementary.*

Because if two objects had a relative speed greater than elementary, the "condition of 0.5" would be violated, meaning they would mutually have an "interrupted" (degenerated) identity, or (which comes to the same) could not belong to the same universe A, hence "falling out" of the "world". If in three-dimensional space we have a certain number of objects moving relative to each other, we can assume that one of them defines the center of the coordinate system, in which it rests. This way, we obtain a reference system allowing for the description of the movement of objects. Let there be given three objects (elementary or composite) a_x, a_y, a_z (**Figure 21**). Let a_x be the (resting) reference object, a_y moves with elementary speed (v_{el}), while a_z with some speed v less than elementary.

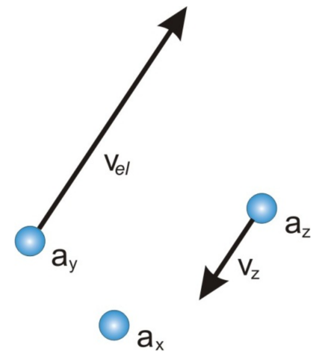

Figure 21. Three objects moving relative to each other, where object a_x is considered stationary.

The question arises: what is the speed of ay relative to a_z? By established principles, the composition of speeds must have a form preserving the elementary speed as the maximum. Say like this: v_{el}"+"$v = v_{el}$ where the sign "+" is the symbol for speed composition. But from this, we immediately get the condition v_{el}"−"v = v_{el} imposed by the property of symmetry of relative motion. So, if we bind our system to a_z then a_y also has elementary speed in it. Thus, we have (**Figure 22**).

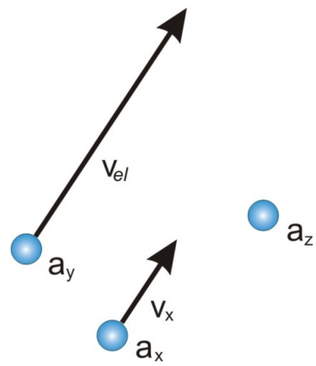

Figure 22. The system of the same objects as in **Figure 21**, this time considering object a_z as stationary and associating the reference frame with it.

Principle 21

An object that has elementary speed in a certain system has it in every system.

This raises the issue of finding transformations preserving elementary speed when transitioning from system to system. These transformations are well known: for systems $a_x(x, y, z, c)$ and $a_x'(x', y', z', c')$ assuming that the movement is parallel to the x, x' axes, we have

$$x' = \frac{x - vc}{\sqrt{1 - \frac{v^2}{v_{el}^2}}}, \; c' = \frac{c - \frac{v}{v_{el}} x}{\sqrt{1 - \frac{v^2}{v_{el}^2}}}, \; y' = y, \; z' = z$$

A known consequence of the constancy (invariance) of elementary speed is the fact that an object moving at this speed is a flat object. In our approach, we can represent it as in Figure 23.

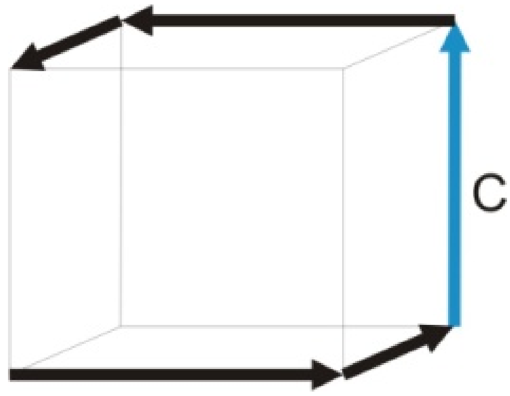

Figure 23. Schematic representation of the identity vectors of a "flat" object moving at an elementary speed relative to other objects.

The temporal vector is marked in blue. As can be seen, such an object lacks the spatial "future" vector. Since elementary objects are in constant "own" movement with elementary speed, the change in their relative speed (*i.e.*, acceleration) is a rotation of their directions of movement relative to each other in spacetime.

3.5. Distances: Elementary Structure

As we determined, the spatial type identity distribution of an elementary object can be represented as follows (Figure 24).

Figure 24. Spatial distribution of the object's identity.

However, we did not introduce distance explicitly, satisfying ourselves only with a general statement of the existence of spatial and temporal type identity differences. Now we define it as the inverse of identity, meaning we assume that an identity degree equal to 0.5 corresponds to a distance of 2, a degree of 0.25 to a distance of 4, etc. Generally, the distance $|1, 2^{-n}| = 2^n$ which we can represent graphically as in Figure 25.

Figure 25. Distances in the identity space of the object.

We introduce an elementary unit of length |el| corresponding to half the elementary identity change $|a_{el}|$ of 0.5. As can be seen, the identity of the object decreases exponentially inversely to distance. The drawing is somewhat misleading. It suggests the existence of distances smaller than double the elementary one, and the central object is marked as point 1 without distinguishing any of its extents. But, the elementary temporal object has a finite spatial extent at the elementary moment, the smallest that makes sense in universe A. Therefore, "1" should not be represented as a point, and we should remember that distinguishing any distances smaller than 2|el| is devoid of (precise) meaning in the spacetime of universe A. We draw, therefore Figure 26.

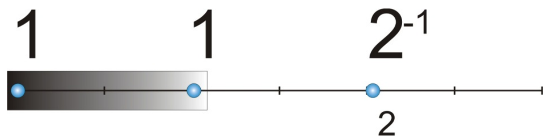

Figure 26. Identity distribution determined by an extended (non-point) object.

The identity of the elementary object is exactly the same across the entire marked extent, its more precise location is not defined in universe A. However, the entire segment has a finite and defined size in this universe. Thus, the three-dimensional elementary object can be represented as in Figure 27.

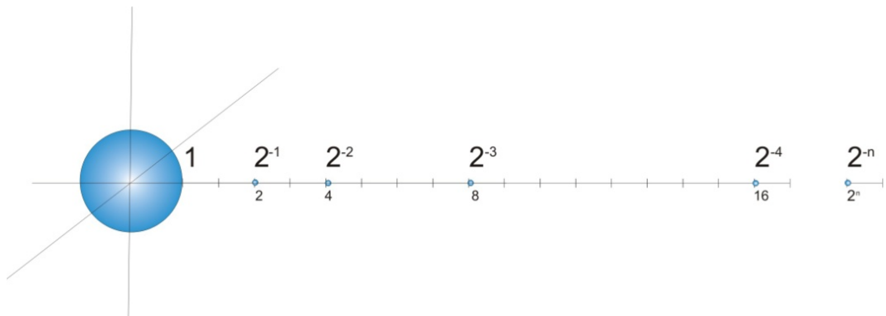

Figure 27. Distances in three-dimensional space determined by the identity distribution. Important: The object's identity forms space (is space), and is not, for example, immersed in some other kind of space.

It is a sphere surrounded by spheres of varying degrees of identity with A.

3.6. Cell and Elementary Identity in Real Space

Let's note that we are dealing with two types of spaces. Every elementary object exists and "evolves", is describable in its four-dimensional complex spacetime, formed by its identity distribution. Meanwhile, different elementary objects interact and are describable in real spacetime, where they are (mutually) locatable. So far, we have presented the elementary cell as a hypercube in the identity space (complex). The elementary object is equally fuzzy on it, but this statement is misleading because it suggests the existence of an independent structure "on which" fuzziness occurs. However, the identity of the object itself (its structure, distribution) creates distance and volume. In real space, the elementary cell cannot be treated as a hypercube because there is no distinguished direction in it. Direction and orientation are distinguished in the spacetime of each elementary object by its identity-based elementary movement, *i.e.*, distinguished relative to it but not other elementary objects. Thus, in real space, the elementary cell is a priori spherical and is a three-dimensional sphere. The question, therefore, is about its sizes. The radius of such a sphere is determined by the average of the real distance of the elementary object from itself in the elementary cell, *i.e.*, by the average of the modulus sum of edge lengths and is therefore equal to $0.25|1 + 1 + 1 + 1i|$. Therefore, in real space, the elementary object is a three-dimensional sphere with a radius of $|3 + 1i|0.25$ (it is fuzzy over its volume).

3.7. Identity Field Structure of Composite Objects

When we consider a certain number of elementary objects, we notice that their identity fields overlap, especially at the geometric center of gravity (**Figure 28**), where the sum reaches its highest value.

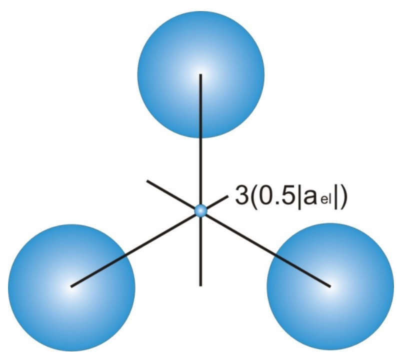

Figure 28. Summation of the identities of three objects.

This effect is, of course, stronger the closer the elementary objects are and the more of them there are. The object marked in the drawing as the central one has a cumulative identity with A greater than elementary, and we can consider it as a "source" of an identity field stronger than the field of an elementary object. This means that we are dealing with two types of identity fields. The first is simply the sum of all fields of elementary objects, and the second is generated by the "source" and overlays the first.

The object that is the "source" (Z) determines its own unit of relative distance greater than the elementary distance |el|. The basis for determining the distance |el| is the smallest sensible difference of the smallest identity, *i.e.*, the value $0.5|a_{el}|$. We obtain the natural unit of the relative distance of the object |Zrel| analogously, and it corresponds to $0.5(m|a_{el}|)$. Since the identity differences in the case of a composite object are multiples of elementary ones, the corresponding relative distances will be multiples of |el|. Notice: given by successive powers of the number

2, the next multiples of |Zrel| determine the distances of objects with which Z is in degree 0.5, 0.25, … 2 – n …. These objects themselves have a certain identity with A, thus have their own identity fields. Note, almost all of them are objects rather different than the source. For example; object z3, such that Z = z3 SN0.25, is rather different from Z to the degree of 1 – 0.25 or 0.75. These objects are distinguished relative to the object Z (*i.e.*, rel Z). Their identity fields overlap with the identity field of the composite object. Therefore, the field of Z will not be exactly homogeneous, meaning it will not be uniquely defined by the identity distribution in space considered so far. In particular, it can be expected to be locally somewhat stronger. As can be seen, the identity fields of composite objects interact with each other. We will now calculate the distances at which distinguished objects are located relative to the central object Z. Composite objects can be compositions of different numbers of elementary objects spatially distributed in various ways. Therefore, |Zrel| will have a very different value measured in |el|. In the case of an elementary object, we assumed that it is fuzzy on a sphere of elementary dimensions. However, in the case of the object Z, the radius length is greater than |el| and can be sensibly calculated. Thus, we can draw it as in **Figure 29**.

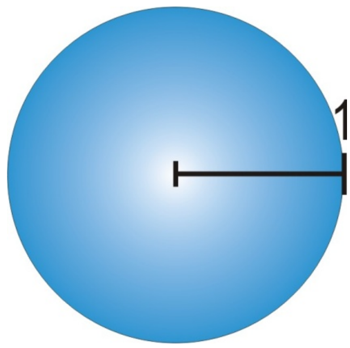

Figure 29. An object fuzzy on a sphere with a radius equal to the elementary distance.

1 indicates the surface of identity, while the radius length equals 2|Zrel|. In the case of an elementary object, the surface with identity 1|a_{el}| coincides with the cell/sphere surface of the object, but for a composite object, the "identity radius" can be significantly larger or smaller than the radius of the aggregation of elementary objects forming it. This depends on the packing density of the latter. When the composite object has a "nebulous" character, meaning the distances between its elementary constituents are large, this radius may be smaller than the "nebula's" radius. In the case of dense packing, it is significantly larger (**Figure 30**).

Figure 30. An object composed of many elementary objects determines its own identity distribution, where the unit distance is greater than the elementary distance.

Thus, the spatial distribution of objects distinguished relative to the aggregation of the composite object undergoes a certain change. Namely, we obtain an additional distinguished object located at a distance of 2|Zrel| from the center of aggregation. We can represent this as in **Figure 31**.

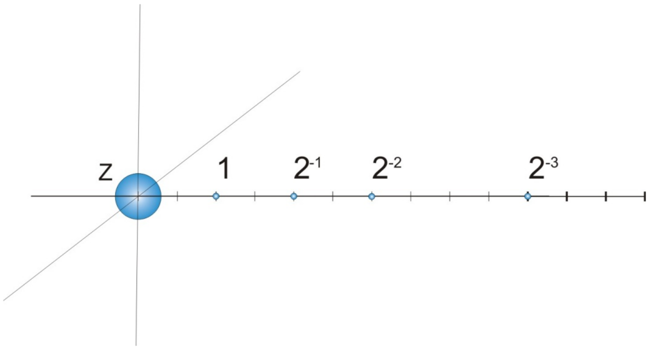

Figure 31. Identity distribution of a composite object in three-dimensional space.

As can be seen, distinguished objects are distributed at distances of 2, 4, 6, 10, … from the center of aggregation Z. Generally, this relationship is captured by the formula: $2 + 2(2^{n-1})$ where n is the number of the distinguished object counting from the center Z.

Principle 22

Objects relatively distinguished in the identity field of a composite object are distributed at distances: 2|*Zrel*| (*the first*) *and* $2 + 2(2^{n-1})$ (*the subsequent ones*).

These types of objects are simply "concentrations" of the identity field of a composite object.

3.8. Composite Objects in Identity Fields

Consider the case of two composite or elementary objects Z, Z'. Let Z = A SNm|a_{el}| and Z' = A SNm'|a_{el}|, with the distance between them being n|*el*| (**Figure 32**). On the segment connecting the geometric centers of gravity of Z, Z', mark a point located n-1|*el*| from Z and 1|*el*| from Z'.

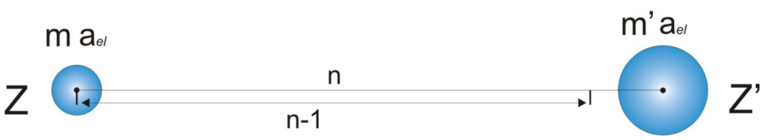

Figure 32. Two objects Z, Z' at a distance of n elementary lengths.

Since the identity with Z and correspondingly with the general object A increases in the direction to Z and simultaneously Z' is to some extent Z, the identity of Z' increases in the direction of Z. Z' "exists towards Z" (**Figure 33**), its identity increases towards Z. This "existence towards Z" is a vector quantity defining the change in distance because increasing identity values correspond to shortening distance over time (*i.e.*, Z' movement towards Z).

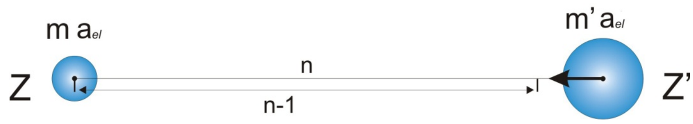

Figure 33. Vector of identity increase of Z' towards Z.

The point distant from Z by $n|el|$ is identical with it and with the general object A to the degree of $\frac{m}{n}$, so distant by $n-1$ will be identical in $\frac{m}{n-1}$ relative to Z. Therefore, the asymmetry value of the identity field of the object Z per unit of elementary length is given by the difference $\frac{m}{n-1}-\frac{m}{n}$. However, what concerns us is the increase in identity of Z' due to being in the identity field of Z. Since Z' is A to the degree of $m|a_{el}|$, the numerator of the fractions should not contain the value m but the identity degree of Z' with A relZ, *i.e.*, the product mm' (theorem on products). Denoting the vector magnitude by *P*, we get:

$$P=\frac{mm'}{n-1}-\frac{mm'}{n}$$

However, Z is also in the identity field of Z', and likewise, its identity increases towards Z' (**Figure 34**).

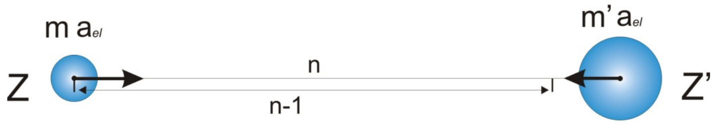

Figure 34. Vectors of identity increase of Z, Z'; these objects "exist in their own direction".

We are interested in the value of the cumulative vector defining the character of the relative movement of objects Z, Z'. Denoting it by ***P***, we get:

$$\boldsymbol{P}=\left(\frac{m\cdot m'}{n-1}-\frac{m\cdot m'}{n}\right)+\left(\frac{m\cdot m'}{n-1}-\frac{m\cdot m'}{n}\right)=2\cdot\frac{m\cdot m'}{n^2-n}$$

As can be seen, the obtained magnitude defines the increase in relative speed per elementary unit of time and distance. Since for large composite objects and significant distances $|el|$ is negligibly small, for such cases we can with good approximation assume:

$$\boldsymbol{P}=2\cdot\frac{m\cdot m'}{n^2}$$

Principle 23

The identity of elementary or composite objects increases towards their geometric center of gravity in accordance with the relationship.

$$\boldsymbol{P}=2\cdot\frac{m\cdot m'}{n^2}$$

In other words, these objects "exist towards each other" to the degree specified by the given relationship. Note: until now, we considered elementary and composite objects without taking into account the interaction of identity fields of other such objects. Therefore:

Principle 24

Every object, not influenced by others, moves in a straight line with elementary speed, and relative to other objects, the speed takes values in the range (minimal, elementary) relative to those objects.

This results from the fact that in elementary movement, direction and speed are determined by respective identity characteristics. In the identity field of another object, this movement accelerates, and its direction may also change. Since movement occurs towards increasing identity, its change (regardless of the causes) consists of changes in identity distribution. Thus:

Principle 25

Change in movement (acceleration, direction) always involves corresponding changes in identity. In particular, a change caused by the presence of identity fields of other objects is the same as a change caused by other possible causes. The identity vector of an object in another's identity field is as much an identity vector as an identity vector in relative motion.

For small distances, the graph of the function $\frac{1}{n^2-n}$ looks like as in Figure 35.

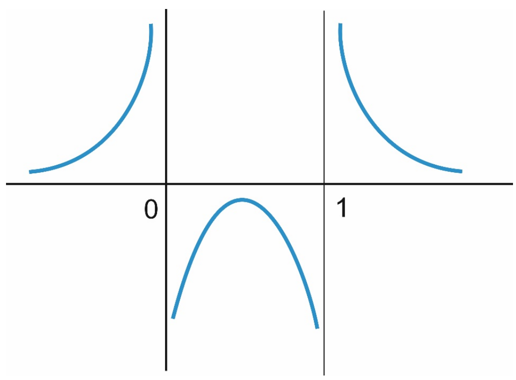

Figure 35. Graph of the function $\frac{1}{n^2-n}$.

This means that for distances close to 1, the interaction of the identity field increases very strongly, while for distances smaller than 1, it turns into a repelling interaction (due to the change of sign). Negative distances can be interpreted as distances inside the elementary cell (spatial distances "from itself"). Imagine that the elementary cell is not occupied by one but two or three elementary objects, for example, occupying its edges. The interactions between them would then have a special character. They would grow with the increase of distance (e.g., if we wanted to "tear apart" the cell by separating the objects occupying it). As can be seen, the identity interaction changes its character depending on the distance and the nature of the objects. Essentially, we have three different interactions: 1) at relatively large distances for which the difference between $(n^2 - n)$ and n^2 is negligible. 2) at small distances for which this difference is not negligible. 3) "internal" interaction for negative values. How can we intuitively interpret such values? Imagine two spheres. If they are distant, the distance between them is positive. If they touch, the distance is equal to 0. The distance measured inside one of the spheres (relative to the other) can be interpreted as negative. Additionally, there is some "barrier" interaction in the range [0, 1] providing objects with "hardness". Of course, respective values cannot grow or decrease indefinitely because they are limited by corresponding elementary values, which cannot be exceeded.

3.9. Interpretations

The results obtained so far allow for the interpretation of the degree of identity with A as mass. Thus, $|a_{el}|$ should correspond to the Planck mass calculated under the assumption that G in natural units is equal to 2, as derived from the formula.

$$m'_p = \sqrt{2c\hbar G^{-1}} = 3.078048904 \times 10^{-8}$$

According to the theory, this is the mass of an elementary object moving with elementary motion, *i.e.*, at speed c. Thus, this theory excludes the infinite relativistic increase in mass. Hence, the issue arises of estimating the smallest value of elementary mass corresponding to the intuition of rest mass. To this end, we first determine the smallest physically sensible speed with which m'_p can move, which is the speed of the elementary mass corresponding to an action smaller than the Planck constant (different from 0). We determine it from the formula

$$m''_p \cdot v_{\min}^2 < \frac{\hbar}{s}$$

we obtain $v_{\min} < 2.381768887 \times 10^{-13}$.

Let's denote the sought minimum mass by $m_{\min}$. We can expect that $\frac{c}{v_{\min}} \approx \frac{m''_p}{m_{\min}}$ because both distance and time are given by respective values of identity with A (*i.e.*, are gravitational characteristics). As a result, we obtain:

$$m_{\min} < 1.476916034 \times 10^{-30}$$

This value constitutes 1.621 times the mass of an electron and allows us to identify it as an elementary object of our theory.

On the drawing representing a four-dimensional elementary cell (**Figure 36**).

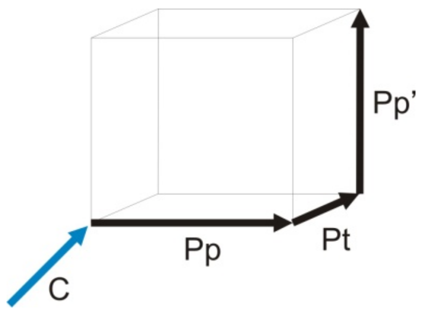

Figure 36. Four-dimensional elementary cell with the identity distribution vectors marked: c—temporal, pp—"past" spatial, pt—"present" spatial, pp'—"future" spatial.

We see that the elementary object performs a rotation around the four-dimensional axis, hence its identity field also rotates. In projection onto a plane, we can represent it as in Figure 37.

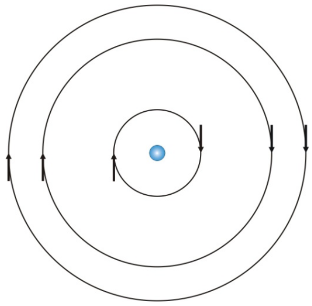

Figure 37. Rotation of the object's identity field presented on a plane.

Notice: between two objects rotating in mutually opposite directions (congruent relative to the surrounding space), there is a zone of summing opposite velocities (Figure 38). Their identity fields move (at greater distances) with a linear speed equal to c.

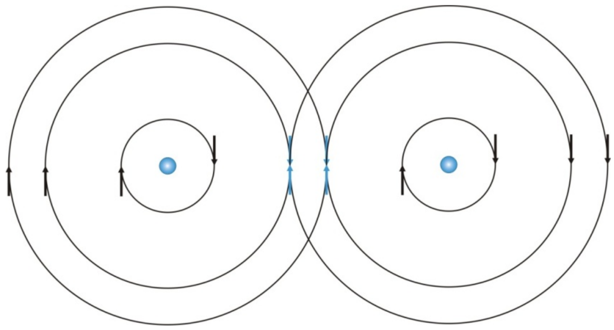

Figure 38. Two objects rotating in the same direction relative to the surrounding space. It is worth noting that any number of objects can rotate this way.

However, when they rotate congruently (Figure 39), the summing occurs outside the objects:

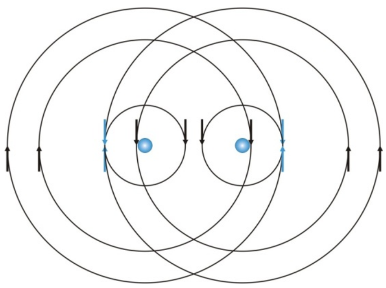

Figure 39. Two objects rotating in opposite directions relative to the surrounding space. If there are more than two objects, they cannot all rotate this way as some must rotate in the same direction.

Since the objects rotate around four-dimensional axes, they cannot be rotated in three-dimensional space. Therefore, any interactions resulting from the summing of opposite velocity vectors will have a monopolar character in this space. Notice: with the movement of identity fields, we can expect a relativistic increase in mass (identity), *i.e.*, a "strong" effect causing the objects to attract or repel each other depending on the direction of rotation. Simply, they will have (relatively) greater mass attracting (causing an increase in identity) "to" or "away". What we are currently seeking is the relationship between gravity and electrostatic interactions. We will try to quantitatively connect them by calculating the "gravitational equivalent of charge". If the postulated effect occurred, the interaction between two rotating masses should have a force equal to the Coulomb force of elementary charges interacting. Postulating the relativistic increase in mass of elementary objects (electrons), we can expect that the force of their interaction will be equal to the force of interaction between two Planck masses. The situation is somewhat more complicated, however. As we saw, the full rotation of an elementary object occurs in two cells, but in real interactions, only one cell (the "present") participates, and it is three-dimensional. Thus, the mass of the elementary object is fuzzy over a larger volume, and only a part of it participates in the real interaction, so not the entire Planck mass. To calculate the sought value, let's first use simplified reasoning. If the mass m were evenly fuzzy on a "normal" (real) cube with an edge length equal to 2, the portion of the mass corresponding to a unit cube would be equal to $\frac{m}{2^3}$. According to previous determinations, however, we are dealing not with a cube but a sphere with a radius $|2+2+2+2i|\cdot 0.25$, and the Planck mass should be divided by its volume. Denoting the sought mass by m''_p, we obtain:

$$m''_p = \frac{\sqrt{2c\hbar G^{-1}}}{\frac{4}{3}\pi\cdot\left(|6+2i|\cdot 0.25\right)^3} = 1.858989314\times 10^{-9}$$

Therefore:

$$\left|\frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2}\right| = \left|G\frac{\left(\frac{\sqrt{2c\hbar G^{-1}}}{\frac{4}{3}\pi\left(|6+2i|\cdot 0.25\right)^3}\right)^2}{r^2}\right|$$

By substituting the appropriate values into the above formulas, we obtain:

$$\left|\frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2}\right| = \left|\frac{2.307075\times 10^{-28}}{r^2}\right|$$

And:

$$G\frac{\left(\frac{\sqrt{2c\hbar G^{-1}}}{\frac{4}{3}\pi\left(|6+2i|\cdot 0.25\right)^3}\right)^2}{r^2} = \frac{2.306374\times 10^{-28}}{r^2}$$

The difference between the obtained values is 0.00070×10^{-28}. It is not difficult to notice that the movement of charges in three-dimensional space generates corresponding bipolar fields, which we can interpret as magnetic.

3.10. Fuzziness, Probability, and Interaction Probability

The degree of fuzziness is a function defined in the closed interval [0, 1], similar to probability. Indeed, the degree of fuzziness can be regarded as the probability of a certain event occurring. For instance, if an object is evenly fuzzy over a certain volume, the probability of its location in a specific place is the same as in any other and is defined by the value of fuzziness. Let's illustrate this with an example. A coin in a heads or tails game situation can be considered as an object evenly fuzzy between two states. The object is 0.5 tails and 0.5 heads. Thus, the probability of one of the states occurring is 0.5. In other words, the identity distribution is also a probability distribution. Since elementary objects are fuzzy in their respective identity spaces (complex), the probabilities of their interaction in real space are given by the magnitudes of products of complex values defining identity values. Note that the identity space is somewhat the "own" space of elementary objects. This space is created by their identity distribution, so they are in every "place" of it to a certain degree ("places" are created precisely by identity). Therefore, they do not have a sharp location; one could say they "are everywhere." Conversely, in real space, *i.e.*, the space of objects that are the same but (rather) not the same, relative positions are well-defined, and fuzziness values do not exceed the minimal fuzziness value. In this space, the identity distances of (individual, the same) objects cannot be measured directly (because they are imaginary quantities). In other words, direct measurement of time is not possible in real space; it is only indirectly possible through the measurement of distance (e.g., marked positions of a clock hand). From the perspective of real space, an elementary object is (to a certain degree, *i.e.*, with some probability) "everywhere." We deal with the interaction of objects in real space when their mutual action exceeds the value of the Planck constant. At the moment of such interaction, an object (let's denote it as "a") gains localization relative to others in real space. These "other objects" are the entirety of objects already interacting with each other (let's denote them as "B"). However, simultaneously, "a" remains in the identity space (is "unlocalized") concerning all objects not interacting with "B". This means that "a," interacting (detected) in a certain place by "B," may in another place interact with "C" if "B" and "C" do not interact with each other.

3.11. Types of Interactions

It is worth noting that although our theory fundamentally posits only one type of interaction, namely identity interaction, its nature can vary depending on factors such as the distance between objects or their rotation. For large distances ($n^2 - n \approx n^2$), this interaction corresponds to gravitational interaction. For smaller distances, it becomes stronger. Within elementary cells, one- and two-dimensional interactions will occur, as well as interactions whose strength increases with distance. In cases involving rotational motion, interactions at short distances will be weaker than those at larger distances (analogous to electrostatic interactions). A thorough investigation of this emerging variety is a separate task.

3.12. Cell Structure

So far, we considered an elementary cell formed by a single elementary object, but three edges of the cell can be occupied by at least two objects in various configurations. Considering time, we can distinguish three spatial edges: "past," "present," and "future". There are three (left-handed) single-edge occupancies of the spatial cell: "past," "present," and "future," each corresponding to 1/3 turn and 1/3 (possible to occupy) edges. There are three (left-handed) two-edge occupancies: "past-present," "present-future," and "past-future," each corresponding to 2/3 edges and 2/3 turn. There are six (left-handed) three-edge occupancies, corresponding to paths along the edges to the opposite corner, corresponding to 3/3 edges and 3/3 turn. Three of these paths are continuous, and three are interrupted (effects of turn weakened). For every left-handed occupancy, there is a symmetrical right-handed one. Together we get 24 possibilities allowing for the assembly of various objects of low complexity.

Possible Experiments

The considerations so far allow for proposing many verification experiments. Let's look at two possibilities. If the reasoning regarding the nature of electrical interactions is correct, then in the case of any two rotating bodies, an additional force dependent on the rotational speed should arise between them. This experiment is not simple due to the negligible (easy to calculate) values of this force but is fundamentally feasible. In the section "Structure of the Identity Field of Complex Objects," we derived the formula $2 + 2(2^{n-1})$ defining the distribution of "densifications" of the identity field. This means that the gravitational field, especially in the case of massive objects, is not entirely uniform. Such non-uniformity should also be detectable using existing techniques. Nature provides some potentially confirming information. Namely, if we whimsically chose to express distances using the distance of the third distinguished object, taking it as the unit, we would get: $|Z, Ow| = 0.3(3) + 0.3(3)2^{n-1}$. This is almost identical to the relationship known as Titius-Bode's law, defining the distances of planets from the sun measured by the earth-sun distance, having the form: $0.4 + 0.3(2^{n-1})$. In our theory, these distances correspond to areas having "relative identity," which should correspond to slightly higher gravity. If we imagine, as we usually do, the formation of planets through the accretion of particles from the dust cloud surrounding the sun, it's understandable that their accumulation in areas of gravitational field non-uniformity is more likely than in others. Areas corresponding to distinguished objects simply attract them (particles). Initial densification of matter naturally strengthens this effect, causing an increase in the attraction force and furthermore intense accretion. It would follow that the Titius-Bode law is a universal relationship in the case of accretion-origin systems, although the absolute distances of planets will depend on the star's mass. Of course, this is not an exceptionless principle, and the forces involved are weak. Planetary systems are objects with a long history that leaves its mark on them. For example, in our system, at the fourth predicted place, we do not have a planet but an asteroid belt (likely something happened to Phaethon). Mercury's orbit is slightly larger, which could have been influenced by, for example, the solar wind causing dust repulsion in the initial period. Either way, only direct measurement can be decisive.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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