

(This is a part of the book [The Concept of Reality.pdf](#))

Summary

Each time I've come to the end of a chapter, I was chased by the idea I should have explained some things in an easier way. In some chapters I tried it, but I didn't succeed.

So I decided to place at the end of my work a summary which does not contain the full descriptions and explanations of the respective scenarios but only the basic concepts.

However there is also another reason why I think that such a list of the ideas that form the basis of the hypotheses presented in Parts 1 to 3 is important:

Compared with the established view of the universe, everything I have to say on any of the presented topics seems disconcerting or even absurd – even if *per se*, considered as single hypothesis, it appears reasonable and consistent. Only within the new global context, as part of a universe with different basic elements and connections between these elements, the various hypotheses prove their strength, by confirming each other and leading from different starting points independently from one another to the same results.

Therefore, the overall view is very important – and it is much easier to achieve it by a short summary than by a detailed text of several hundred pages, in which the completeness of the explanations is one of the main criteria.

Wouldn't it have been possible to present such an overview already in the introduction? No. As introduction, a new narrative about the universe would appear bizarre. As a postscript to a series of argumentations that have been designed as stringent as possible, however, it can serve to organize what has been read and to put it in a clear context.

Where to start then? With the *origin of everything*? That would be the perfect start if there were not already an interpretation of the universe. But since there is one, and because it has conquered its place as a fundamental explanation of the world – even though it explains actually nothing *fundamental* – I'm going to follow the order of the main text also in this summary: *First*, the path must be cleared, which leads to the *mechanism of the universe*. The omissions, errors, and, to say it openly: the crazy ideas, which now for more than a hundred years have been distorting the thoughts of all involved and have been causing the wildest speculations, must be corrected. Only then it is possible to begin with the intellectual adventure at the end of which one can understand what that, which exists, actually is.

So we start again with that fact, which seemed to prove the inconceivability of what happens at the bottom of things: the correlations between measurements on spatially separated quantum mechanical systems.

What is it about? In short about the following:

Be A and B two objects that interacted in the past and must therefore be described by a common function Ψ .

We want to determine the value $E(A)$ of an attribute E of A by a measurement. Ψ does not specify a definite value $E(A)$ but only a probability distribution, and the same applies to $E(B)$.

However, Ψ contains the prediction that $E(A)$ and $E(B)$ in any case meet a condition Z (this could e.g. be $E(A) + E(B) = 0$), such that after the measurement on *one* of the objects also the measuring value of the *other* one is known.

Now we perform a measurement on A. Then we know $E(A)$ and, because of Z, also $E(B)$. There are then two possibilities:

(1) The measuring value $E(B)$ was determined already before the measurement on A.

(2) *Before* the measurement, the measuring value $E(B)$ was not determined, *after* the measurement, it was determined. Thus, the measurement changed the state of B.

In the first case, the probability, which Ψ gives for $E(B)$, is a *normal* probability, that is: $E(B)$ has a definite value before measurement, we simply do not know it.

This would mean that quantum mechanics is *incomplete*.

In the second case, a *non-local* connection between A and B must be assumed, i.e. a connection which either is mediated by faster-than-light signals or exists without any mediation at all.

In this case, the probability, which Ψ gives for $E(B)$, is a so-called *objective* probability, that is: $E(B)$ does in fact *not* possess a definite value before measurement.

At first, it looks as if the choice was very simple: (1) appears reasonable and evident, (2) enforces the assumption of non-local connections and "objective" probabilities.¹

¹ Through the assumption of "objective" probabilities, the concept of probability is deprived of its logical basis. In the case of "normal" probabilities, the distribution depends on the (unknown) values of some variables. But *what* should it depend on in the case of an "objective" probability? *How* should nature comply with the predicted

So we decide – as did Einstein, Podolski and Rosen in their famous paper – for (1).

Now, however, an unexpected complication occurs through which our reasonable intentions seem to come to naught:

Under the assumption that (1) applies – i.e. that $E(B)$ is determined already before the measurement –, cases can be constructed that contradict quantum mechanical predictions. Thus it can be tested by experiment whether (1) *or* quantum mechanics applies.

The experiments clearly decide for quantum mechanics.

So (1) must be wrong, and (2) must be right.

Is that really true? Is the existence of non-locality and objective probabilities thus proved? Is reality actually that crazy?

Fortunately for us, the answer is *no*!

Indeed, the construction of the cases that contradict quantum mechanics – the so-called Bell's inequality – presupposes not only that $E(B)$ is determined already before the measurement on A , but it also contains *another precondition* which, because of its ostensible self-evidence, so far has escaped the attention of the physicists – the prerequisite, that is, that the measuring value depends *exclusively* on the object that was underway to the measuring apparatus prior to the measurement.

This additional precondition is needed, because the inequality contains also statements about *further measurements on the same objects*. Without such statements, there would only be the results of the measurements which *in fact* have been carried out, and no further conclusions could be drawn.

Now, if $E(B)$ simply represented an attribute of B , which B possessed already before the measurement, then of course it could be predicted which results *further* measurements on B *would* lead to.

But if $E(B)$ *additionally* depends on the time-varying state of the measuring apparatus, then such statements are not possible without involving this state.

distribution, if such variables do not exist at all? That would only be possible if nature could indeed "remember" the past events!

With this, the seemingly immovable logical scheme has changed: the previously determined case distinction in (1) and (2) is incomplete. Case (1) must be further divided, namely into:

(1.1) The measuring value $E(B)$ was determined already before the measurement of A *and* it depends only on B .

(1.2) The measuring value $E(B)$ was determined already before the measurement of A *and* it depends not only on B , but also on the time-varying state of the measuring apparatus.

(1.1) leads again to Bell's inequality and can therefore be disproved by experiment.

Thus the new alternative we are faced with reads:

Either (2) applies – the world is crazy, it is non-local and contains objective probabilities – *or* (1.2) applies.

What kind of cases should there be in which the measurement also depends on the time-varying state of the measuring apparatus?

First, it should be noted that these cases are by no means of an exotic or remote type, but indeed very simple measurement events. I remind you of the example from 1.3 in the First Part:

Here, balls with different weights are distributed into containers to the left and right. The value 1 is assigned to a measurement where the weight in at least one container reaches or exceeds 5 grams or multiples of 5 grams; otherwise the measurement value is 0

In this simple scenario, the measurement result is of course already determined before the measurement. Yet nothing can be said about the result of another measurement on exactly the same objects – the balls that have been distributed –, because this measurement depends not only on *these* balls, but also on the balls, which had been in the containers already *before*.

The example is particularly instructive, because – in spite of its simplicity – it contains everything which is needed for illustration:

The scenario is (of course) entirely *local*. The measurement results are determined already before the measurements. However, they are not only dependent on the measurement objects, but also on the time-varying state of the measuring apparatus – and, in the case of a whole series of measurements,

this means: on the *specific course* of the respective series –, and from this follows: *Nothing can be said about the results of further measurements on the same objects.*

Moreover, the scheme of the example can directly be transferred to the EPR scenario:

In the case of two entangled photons, for example, it must only be assumed that the measured transition is not caused by a "photon" but by the accumulation of wave intensities – completely analogous to the accumulation of the balls in the example.²

However, it must be ensured that the condition Z, which is contained in Ψ , is met in each case during a measurement series. But that's easily achieved. (E.g. by expressing the probabilities of the measuring results through the covariance of the wave intensities, as demonstrated in 3.11 in the First Part.)

In this way it is possible, first to free the EPR scenario from the grasp of Bell's inequality, and then – after the path to local interpretations has been cleared – to reconstruct the quantum mechanical predictions for the measuring values in a completely local manner.

Thus it is by no means proven that reality is crazy; Rather there is reason to hope that reality is reasonable and just some of its interpreters are crazy, and this is – provided you are not one of these interpreters – certainly a very encouraging finding! Let us raise our glasses and drink to the reasonable reality!

Now, however, exactly that occurs, what I pointed to at the beginning of this summary:

For itself, the train of thought just conducted may appear consistent, but in the whole context of the interpretations of physical theories, it seems completely absurd. Since more than a hundred years, it is proven that transitions between different electron-states are caused by *photons* and not by waves. The wave-model is inappropriate for describing the interaction between radiation and matter. There is no "accumulation" of waves; photons are *indivisible* entities.

This certainty, and other ones, seem to prove that the local alternative I propose cannot be true and is simply absurd – *unless* the fundamentals of the whole network of physical interpretations are flawed.

Who would seriously take into consideration that this could be the case? And yet it is true, exactly this is the case: The entire physical interpretation network must be changed.

² The quantum mechanical formula for the event probabilities contains indeed *wave amplitudes*. However, they are simply not considered as amplitudes of existing waves but as square roots of probabilities.

Thus we state:

(A1) *A necessary condition for the local explanation of the measurement results in an EPR scenario is the assumption that the measurement events (the measured attribute values) are caused by the accumulation of wave intensities.*

*The discontinuous changes, which quantum theory owes its name to, must therefore be interpreted as transitions between (short term) stable local wave-states. Thus, only the observable transitions between the local wave-states are discontinuous and may appear like "jumps", but the causal process itself is continuous.*³

Before we carry out, step by step, the transition from the concept "particle" to the concept "transition between stable local wave conditions" caused by wave accumulation, we first turn – as in the main text – to the interpretation of special relativity.

In the building of current physical theories, the special theory of relativity is the simplest component. It is confirmed many thousands of times and correct without a doubt. So what else should be said about it?

Only, that it is *un-interpreted*, and what I mean by that is that the fundamental insight from which the fact of special relativity arises *as a conclusion*, until now has remained undiscovered.

To elucidate what insight that is, I shall begin with a note of Einstein. In the book "Relativity: The Special and General Theory", he puts the reader the following definition of simultaneity of two events into the mouth:⁴

"[...] the connecting line AB should be measured up and an observer placed at the mid-point M of the distance. This observer should be supplied with an arrangement (e.g. two mirrors at 90°) which allows him visually to observe both places A and B at the same time. If the observer perceives the two flashes of lightning [note by the author: which strike at A and B] at the same time, then they are simultaneous."

³ An illustrative analogy are the transitions between the states of standing air-waves the in a wind instrument. Hearable (observable) is only a discrete sequence of tones that seem to change abruptly, whereas the actual causative process is continuous.

⁴ A. Einstein, *Relativity: The Special and General Theory*, Really Simple Media, London, 2011, p 22f.

Einstein now argues against the reader that, in order to establish this definition, it would have to be *presupposed* that the light travels from A to M with equal velocity as from B to M.

(Of course the argument is aimed at the question of how this definition of simultaneity can be valid also for other observers moving relative to the first observer, for whom the velocities of light into different directions would apparently no longer be identical.)

Einstein then allows the reader to end the discussion victoriously by having him say:

"I maintain my previous definition nevertheless, because in reality it assumes absolutely nothing about light. [...] That light requires the same time to traverse the path $A \rightarrow M$ as for the path $B \rightarrow M$ is in reality neither a supposition nor a hypothesis about the physical nature of light, but a stipulation which I can make of my own free will in order to arrive at a definition of simultaneity."

Is that really true? Not at all! This "stipulation" has namely *consequences*, e.g. the slower passing of time in moving systems, and the question is whether nature is willing to comply.

In 2.4 of the First Part, I've presented a definition of time by sound signals, which is logically consistent and unambiguous, but still nonsensical, because nature does not care: observers who move with almost sound speed do *not* age more slowly according to the time defined by sound signals. And the reason for that is that the speed of the sound *is* in fact *not* equal for all uniformly moving observers, although I have *defined* it as equal through the definition of the time by sound signals. Nature, however, does not care about my definition, and therefore this definition applies only to sound and to nothing else.

This means: I can *not* stipulate the time at my discretion. I would *not* be able to *make* the speed of the light equal for all observers, if it *were* not equal – as opposed to what is the case with sound speed.

But then the question arises:

Why does nature obey the spacetime conditions defined by light signals?

To concretize this once again: according to the above definition, two events, which are simultaneous with respect to a resting observer X, are *not* simultaneous with respect to an observer Y who moves relative to X. Say, Y observes the event in A one second earlier than X, the event in B one second later.

For example: if for X both events occur at 12:00:00, then for Y the event in A occurred at 11:59:59 and the event in B will occur at 12:00:01.

But this means that, for Y, in A and B *is* another time as for x, and that *all possible processes that take place in the system of Y, must obey this changed time.*

All pairs of signals that are emitted from A and B at the same time as the light signals must, provided that they belong to the system of Y (that could e.g. be a spaceship), arrive at Y with a time difference of 2 seconds. And exactly that will be the case. But why?

Why, by the holy enlightenment – should the signals comply with this requirement?

Or: persons traveling with Y must age according to the time defined by light. And they will do so. But again the question is: why?

Why does reality comply only with the light-time and not with the sound-time or any other time?

Of course one can say it is simply that way – as indeed has been done up to now. With this, one identifies the relativistic formalism with reality. But reality is *obviously* not four-dimensional – it is a three dimensional space in which objects move.

And the fatal consequence of equating formalism and reality is that it prevents the fundamental insight that results from the answer to all these why-questions.

Which insight is meant? This ensues from the following train of thought:

Everything which happens, any change, is a *change of position*, which takes place at a definite velocity. If the time is determined by light signals, then *all these velocities* must comply with this time-definition.

If there were any processes that had no connection with the speed of light, then there would be no reason why these processes should conform to the time determined by light.

Thus any process must be related to the speed of the light. What kind of relationship could that be?

Evidently, the only way in which the adaptation of the velocity of the respective process to the time defined by light could be substantiated is that *ultimately* this process can be traced back to another, fundamental process which propagates at the speed of the light.

Therefore can be asserted (I quote from the main text):

There is in fact no difference between light and sound regarding the area of validity of the measurement systems based on them: both systems apply only to phenomena that can be derived from the respective kind of waves.

Therefore, the only possible reason why all existing processes comply with the time-determination through light, is:

Nature conforms to the measurement system of space and time determined by light because there is only light speed and phenomena derived from it.

From this follows in turn:

(A2) *Everything which exists and which occurs is an **interference phenomenon**, a pattern of superpositions of waves with light speed.*

In 2.6 of the First Part, I have shown that there is a direct connection between this assumption and the quantum mechanical description of material objects. Section 2.7 contains the proof that from this very assumption the relativistic spacetime conditions can be derived *directly* – without any further presuppositions and, as it should be the case with such a fundamental hypothesis, without any physics. The relativistic world is built anew from scratch.

As can be read from (A1) and (A2), both the restoration of the locality of the world and the explanation of special relativity lead to *waves* as basis of what exists and what happens.

Let us now turn again to the quantum mechanical phenomena.

The hypothesis (A1) now has to survive a first test. Is it possible to describe the phenomena that occur in the interaction between light and matter, which, at the beginning of the 20th century, defied all attempts at explanation by the wave model of the light – the Photoelectric Effect and the Compton Effect – on the basis of a pure wave model?

As it turns out, it is not only possible but incredibly easy. Again, the derivation succeeds without any physics. The only requirement is the Lorentz transformation, which has been deduced in the reconstruction of the relativistic spacetime conditions.

Since the desired results – in accordance with the assumption that a superposition of waves takes place – follow *exclusively* from the frequencies and lengths of the interaction partners light and electron, while any other physical concepts – also the particle concept – at this point prove completely

superfluous, here the concepts "frequency" and "wave-length" must be understood as *fundamental*, whereas the concepts "energy" and "momentum" have to be regarded as *derived*.

However, the defining equations $E = h\nu$ and $p = h/\lambda$ contain the quantity h , which presupposes the concept "mass" and is commonly considered to be just the one natural constant that connects the two aspects of existence – the corpuscular and the wave aspect.

Therefore, in order to justify the assertion that energy is derived from frequency and momentum from wave-length, the concept "mass" must be eliminated, or, to put it correctly: it is necessary to transform the concept "mass" from a basic concept into a derived concept.

This, however, can only be carried out later, in the context of the build-up of a metric-dynamic universe.

(A3) *The Photoelectric Effect and the Compton Effect can be derived on the basis of the assumption that the interaction between light and matter is a wave superposition. The derivation follows from this assumption alone; no physical concepts and relations are needed.*

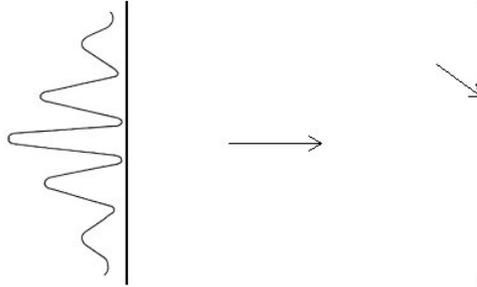
The short version of (A1), (A2) and (A3) is: *There are only waves.*

Equipped with this assumption, we are now prepared to face the innermost sanctum of quantum theory, the *reduction of the wave function*.

The enigma we are confronted with reminds of the riddles known from tales and legends. Many who tried to solve it have lost their mind. In our civilization, their symptoms are revered as manifestations of the Holy Spirit of quantum mechanics and considered as alternative interpretations. I name only two of them: the assumption that the consciousness of the observer effects the reduction and the assumption that in each measurement the universe splits into some – or infinite many – copies of itself which differ from each other only with respect to the value of the just performed measurement.

To wrest the secret from quantum theory, we step up to the altar where many generations of physics students have sacrificed their thinking ability and spoken their *credo quia absurdum*, in order to be accepted in the circle of the initiates: to the *double-slit experiment*.

The following diagram shows what is supposed to be inexplicable:



Left, the quantum-mechanical description of a particle at the moment of impact on a detector plate: *an extended wave* caused by diffraction at the double slit and subsequent interference.

On the right – at the position which the small arrow points to – the same particle at the next instant: *a microscopically small object*. The extended wave has disappeared.

Since the explanation in I, 3.6 is simple and understandable, I can be very brief.

The assumption (A1), through which the non-locality of the EPR scenario could be eliminated, already contains the answer to the question what *actually* happens:

(A1) says that material objects – comparable to standing waves – can only exist in certain states which are defined by wave lengths. Waves that hit such objects cause *transitions* between these states due to the accumulation of their intensities. These transitions appear like jumps and are regarded as *particles*.

Thus the wave, which is depicted on the left in the above outline, does not disappear at all. Instead it permeates *everywhere* into the material wave-field – the detector plate – and, where the wave amplitude is not equal to zero, the wave intensities will cause transitions at later points in time, if further "particles" follow. And of course the rate of the transitions will depend on the magnitude of the quantity by which they are caused, that is: on the local intensity or the local amplitude square – exactly as prescribed by quantum mechanics.

The particle, which appears to the right in the outline at the position designated by the arrow, is therefore *not* identical with the wave on the left side of the outline. It contains also waves, which *previously* have arrived there.

And that's about all. With this, the quantum mechanical probability distribution of events in the double slit experiment is explained in the most simple way. Everything is local and objective, nothing disappears, there are no objective probabilities.

The secret has dissolved.

The choice of the double-slit experiment as example for elucidation, which physical process lies behind the quantum mechanical formalism, is basically arbitrary. The quantum-mechanical measurement scenarios are in fact all of the same kind: what is measured is always a wave or a wave packet, and only the type of waves, into which the packet is split, varies. It depends on the attribute whose value is to be determined.

Instead of a position measurement, one could, for example, analyze a momentum measurement. The momentum is assigned to the wavelength of sine waves. So the wave packet, whose "momentum" is to be measured, must be decomposed into sine waves with different wavelengths.

Formally, this decomposition is effected by the application of the momentum operator. One obtains then a distribution of amplitudes of sine waves with different wavelengths, which form the package. The amplitude square is interpreted as probability density of the possible events – i.e. measurements of momentum values that belong to these wavelengths.

Experimentally, the decomposition could be carried out through scattering on a crystal surface. The wave packet is *actually* split into sine waves with different wavelengths, which now propagate in different directions. Obviously, the distribution of the amplitudes of these waves must be the same as before the split when the waves still formed a wave packet, and, just as obvious, the probability of an event – that is: of a transition – in a detector which is brought into a beam path, must be proportional to the square of the amplitudes of the waves which enter into this detector.

In this way, the probability distribution of the events at a momentum measurement is explained completely and comprehensibly.

The same scheme can be applied to all quantum mechanical measurements. Each attribute corresponds to a particular type of waves.

In order to calculate the probability of a specific value of an attribute to be measured, it is required to decompose the wave packet into partial waves of the type that belongs to this attribute, and to determine the amplitude with which the wave that corresponds exactly to this value is contained in the

whole wave packet. The square of this amplitude must then be proportional to the probability of a measurement of this value.

In summary, it can be stated:

(A4) *In a world that consists exclusively of waves, all physical attributes must be traced back to wave-attributes. The quantum mechanical formalism is nothing other than a wave analysis, which serves for determining the amplitudes of those waves, whose intensities cause the transitions that are observed as measuring events through the accumulation of their intensities.*

The scheme is always the same as in the double slit experiment: No wave disappears, each makes a contribution to future measuring events. The "reduction of the wave function" is a normal physical process.

Also the so-called uncertainty is cleared up: it is a fact which, in the case of wave packets, is a matter of course.

So we have arrived at a local, objective world. The seemingly impenetrable fog that concealed what actually happens has lifted.

Having freed our mind from deceptions and prejudices, we can finally start thinking of what the world actually consists of.

This fundamental issue has even assumed a concrete form:

If there are only waves – what oscillates then? What is the law of this oscillation?

And furthermore:

Formally, an oscillation is the periodic change of the value of a variable. Which variable is it? In what context does it change? Is it really possible to trace back the whole physics to *one* such context?

The current physics does not contain any references to the sought answers. In this framework, there is not even an awareness of their absence. The retreat into mathematics, into the formal scheme is just too complete. That, which is being treated mathematically – the waves – is deprived of its existence, and it cannot be asked what that which exists *actually* is.

Therefore, in order to answer the "why" and "what is" questions, the project *cognition of nature* must be started again from scratch – not with the intention to change everything hitherto achieved, but to put it on a new basis.

So what is the primal ground of reality?

This time I will dedicate myself to this question a little more detailed. In its first presentation in the main text (in II, 1.3), I confined myself to the bare essentials, in order not to overload the train of thoughts metaphysically and instead let the concepts unfold over the course of the further conclusions.

However now, in retrospect, I'll try to say everything important already at the outset.

Let us first ask: How to arrive conceptually at this primal ground of reality?

On a very short path. One starts with some objects and asks what they consist of. If they are composed of simpler objects, one asks what *those* consist of. Thus finally one arrives at objects that cannot be further decomposed.

Is then the end of possible questioning reached? At first glance it may seem so. Although one can list the attributes of an indecomposable elementary object, still there seems to be no answer to the question what e.g. an *electron* or a *string* consists of.

However, it is immediately evident that each object *must* consist of something: the assumption that it consisted of nothing would obviously be absurd.

So what does it consist of? Let us start with a definition. Let us call the attributes of an object its *accidents*, and that which it consists of its *substance*. The substance is then also that, what is left when all attributes are (mentally) removed from the object.

Just before, we noted that the substance cannot be *nothing*: an object cannot consist of nothing.

At the same time, however, it is obvious that the substance also does not meet the criterion of existence: something that has *no attributes*, does not exist. Having no attributes means not being able to interact with anything else, and to an entity that does not interact at all cannot be assigned existence.

Therefore, the substance can also not be *something*. Thus it is neither nothing nor something. It does neither exist nor not-exist.

This means:

Prior to any existence, there is not the alternative something or nothing, but there is that which is neither something nor nothing.

But that which neither exists nor not-exists is *necessary*, because for its kind of "being-present", there is no alternative: if it were removed mentally, then it would *not-exist*, it would be *nothing*.

Everything which exists, can also not-exist, every being stands in the alternative *be or not-be*. But that, what neither exists nor not-exists, has no alternative – it cannot not-exist, it is necessary.

With this, we have determined the ontological status of the substance: not as existence, not as non-existence, but as *necessity*.

At the same time, the *first and most fundamental question* is answered:

Why is there anything and not nothing?

The answer is:

There cannot be nothing, because prior to any existence, there is not nothing but that which is necessary.

For the further definition of what the substance is serves the difference between actually existing objects and objects that are elements of a description of reality.

Actually existing things are always *active*: the earth always exerts gravitation, the electron always carries electric charge.

However the things in a description are *passive*. I can attribute gravitation to the earth and charge to the electron, but without my intervention these accidents are not active; in the description, nothing happens *by itself*.

As opposed to an actually existing thing, a thing in a description does not consist of *substance and accidents*, but *only of accidents*. It is *defined* by its accidents, and it is *nothing but* this definition. Without this definition, the thing in the description disappears. There is nothing which it consists of, it does not exert any effects, which would have to emanate *from* something.

In short: the thing in the description has no substance.

Thus, substance is that, what provides the actually existing things with *activity*, that, what makes their accidents *active*.

So this is the metaphysical quality of the substance: *activity*

The question could arise whether the concept "substance" is in fact an *ontological precondition* of being or just a *logical precondition*.

A "logical" condition of an object represents something which is logically necessary for its existence. But an "ontological" condition of an object is something from which the object has *actually originated*. In the reality, the respective simpler, which a more complex object consists of, is always the ontological precondition of this object.

Therefore, in order to be able to apply this principle also to this Simplest and most General which our train of thought has led to – to the substance – it must only be recognized that *everything that exists has originated*.

This insight, however, is a matter of course. Assuming non-originated being means setting it as *absolute* and ascribing to it an ontological status that does not belong to it.⁵

Let us therefore assume that the substance of a being is not only the logical but also the ontological precondition of this being, such that the being has emerged from it.

By definition, the substance is that which has no attributes. This means: it is *indistinguishable*, and from this follows that it is not only the condition of *one* being but of *all* beings.

Therefore applies:

⁵ Moreover, due to this assumption *unsolvable* problems occur. Together with the absolute entities, natural constants appear, whose values are then unexplainable *by definition*. From this follows in turn the problem of the so-called "fine-tuning", i.e. the question why the natural constants are tuned in such a way that a universe evolves which can bring forth life and, finally, mind. This question leads then to the so-called "anthropic principle" etc. It can be seen how a fundamental error continually produces nonsense.

However, the really fundamental problem of the assumption of non-originated being is that all "why" and "what is" questions are then *unanswerable*.

The substance is the *origin of everything*. I call it AGENT.

Why does the *origin of everything* unfold to being? Why does it not just remain what it "is"?

Because its metaphysical quality is *activity*. To remain identical, however, would be *inactivity*. Making a difference, however, means nothing other than ascending into existence.

Now the question is: *How* does being emerge from the *origin of everything*?⁶

As that what it is *in itself*, it cannot be thought. In order to be able to think it, we must ascribe to it a predicate.

Its metaphysical quality is *activity*. So this is the first accident: "activity". It must be kept in mind, however, that the concept *activity* as metaphysical quality is *more* than the concept of "activity" as accident. This "more" remains within the concept of the substance.

Due to this mentally performed division, the concept *substance* has changed. The substance that is connected with the accident activity is not identical with the *origin of everything in itself*.

In itself, it is undivided; it is *pure substance* and at the same time *pure activity*.

This first intellectual step – the division of what *in itself* is undivided – is precisely the act where *in itself* and *for us* separate. However, it concerns not only the *origin of everything* but also every being. Also on being, substance and accidents *in themselves* are *inseparably connected*, and only *for us* they appear divided. This unity of substance and accidents is the *essence* of being.

For example, consider the earth: it is inextricably linked with its accident gravitation; the *real* earth continually determines the orbit of the moon. For the *thought* earth, however, this is not true; in thought, the moon can be stopped at any time.

It is even easy to understand why this is the case: indeed the things of reality do not appear "as themselves" in our perceptions and thoughts, but in the form of representations, which result from the influence that the things exert on their environment, i.e. from their attributes or interactions.

⁶ This is to be understood *ontologically* and not *temporally*. It did not happen at some point in time, it is *always* the case. The *origin of everything* is what unfolds into being; it *is* this unfolding.

Therefore, of that, what existence is *in itself*, we experience only that part, which reaches us via our senses – either directly or mediated by technical devices –, and that part we call *accidents*.

Of that, what existence *additionally* is, we experience nothing. This part of existence is unthinkable. We only know that it is there, and call it *substance*.

On being, we are used to such an extent to presuppose the substance, that this fundamental deficit escapes our attention. At the *origin of everything*, however, the scheme of substance and accident collapses, and the *metaphysical difference* between that, what *is*, and that, as what we perceive and think it, is revealed.

It appears through the fact, that that, what every being consists of, disappears, if one tries to think it.

In itself, the *origin of everything* is undivided. It is *pure substance* and, at the same time, *pure activity*.

For us, the *origin of everything* divides into substance and accident. It is activity of AGENT.

AGENT is the *first substance*, activity is the *first accident*.

Activity means change. What changes? AGENT.

The indivisible unity of *substance* and *activity* expresses itself *for us* through the fact that AGENT exists only *as changing*. Without the accident change, there would be nothing.

If the change of AGENT remained without consequences, then there would again be just nothing – in contradiction to the necessity of the *origin of everything*. Thus, from the change must follow something, and this consequence must again be a change of AGENT.

Therefore, there must be two different changes.

Previously, we have realized that the *origin of everything* is *necessary* and that it must unfold into existence. Therefore, we can presuppose existence, and this means that, in order to determine these changes, we can use the necessary conditions of existence: space and motion.(alternatively: space and time).

With this, the first substance AGENT turns into SPACETIME.

Thus we have arrived at our first statement:

The change of space causes the change of motion.

But only if also the reverse is true, the perpetual chain of changes is created, which is necessary to prevent that there would again be nothing. Therefore, it must also apply:

The change of motion causes the change of space.

– And from this follows:

The change of space is equal to the change of motion.

I shorten the rest of the thought process that leads to the first equation:

There is no memory. This means, that changes can only take place from instant to instant. So they must have the form of differential quotients. Moreover, from that follows that there is no absolute size, which the changes can relate to. Therefore, they must be *relative* changes. These assumptions lead to the first equation

$$\frac{d\sigma}{dr} = \pm \frac{1}{c^2} \frac{dv}{dt} \quad (1)$$

– where σ is the metric density of the length (or the angle), and v is the velocity of the longitudinal (or transversal) metric flow. c is the (later) speed of light.

With this, we have reached the basis of the physical world. Now the metaphysical train of thought, which has led us to equation (1), must prove to be valid, which means: this equation must enable the derivation of known physical facts and theories and possibly also of new physical insights.

If these attempts are successful to a sufficient degree, then from equation (1) follows, that *everything which exists is a pattern of alterations of the metric density and the velocity of the metric flow.*

This is the right point to pause for a moment. Although already the new interpretation of relativity and of quantum theory may have seemed strange and disconcerting, and the tedious progress in rough metaphysical terrain may have caused consternation – the difference between my statements and those of standard physics is nowhere larger than here.

According to the convictions of most theoreticians, standard physics comes closest to the origin of being in the so-called M-Theory, which represents a unification of the different string theories. If this were true, then the fundament of the universe would be 11-dimensional. The according mathematics is so complex that hitherto no testable predictions could be deduced.

It seems unlikely that this is in fact the necessary condition for a universe. Much rather such assumptions have to be considered as symptoms of the decline of the paradigm, within which the physical progress has taken place up to now. This paradigm is no longer prolific.

Physics has begun with the observation of material objects, and it has never freed itself from the concepts that belong to these objects. They continue to exist as residual waste and, where physics approaches elementary facts, lead to absurd conclusions – I remind you of the reduction of the wave function. In this context, the assumptions of the string-theoreticians appear as last link in a chain of misguided interpretations, which, as long as the mathematics connected with them enabled verifiable predictions, remained in touch with reality, but which now, due to the abandonment of this criterion, are completely lost in an ivory tower.

The equation, which in this treatise represents the *origin of everything*, is not the final consequence of observations on existing things, but the first consequence of insights about this origin, which have been recognized as necessary. It is the *simplest possible* expression of them.

Precisely because of its simplicity it enables the maximum possible structural richness, and its purely differential form turns out to be the necessary condition for the existence of freedom.

This brings me to another important point that should be mentioned here: All concepts, which belong to the just performed metaphysical derivation, prove not only to be appropriate for the build-up of the physical world, but represent also the basis of the integration of mind into the reality built upon them.

Back to the physics that can be deduced from equation (1).

The first result is, that *in the metric flow* **waves with light speed** occur: longitudinal waves (later, they are associated with gravitation) and transversal waves (they belong to electromagnetism). Both kinds of waves appear in two forms: in the one, the periodically varying quantity is the metric density (of the length in the longitudinal waves and of the angle in the transversal waves), in the other one, it is the velocity of the metric flow (parallel to the direction of the flow in which the waves exist or normal to it).

With this, the fundamental conclusion is confirmed, which formed the central point of the interpretation of special relativity: *There are only waves with light speed. Everything which exists and which happens is an interference phenomenon, a pattern of superpositions of these waves.*

Now the knowledge is added, that the waves exist *in the metric flow*.

From this follows that in this universe there are only two basic quantities: metric density and metric flow. All other quantities are derived. The system of units consists only of two basic elements: a length-unit and a time-unit. It is a **metric-dynamic universe**.

The second result is the derivation of the **gravitation of a central mass** from equation (1). Both the Newtonian approximation and Einstein's version can be reconstructed.

For that the following metric assumption is needed:

Be R^3 an empty, flat continuum. Be r the distance of an arbitrary point P from a given point O . If in O a geometric mass m exists ($m = MG/c^2$), then the distance PO is reduced to $r - m$.

This means: Each point is m units closer to the center O than before. *The continuum lacks m units in every direction.* To the metric density σ applies then $\sigma(r) = (r - m)/r$.

Combined with equation (1), this results in Newton's gravitational acceleration $dv/dt = -MG/r^2$.

Before I continue with the representation of gravitation, I want to point out that, in the metric-dynamic view, electromagnetism is based on a metric deformation, which is completely analogous to the metric deformation in the case of gravitation:

In the case of gravitation, all distances from a central (geometric) mass m are m units smaller than in a Euclidean continuum. This results in an accelerated radial flow towards the center. In the case of electromagnetism, all circumferences of circles, in the center of which there is an electric charge μ (μ is the geometric charge), are by $2\pi\mu$ units smaller than in a Euclidean continuum. This results in a metric flow that rotates around the center.

This is a downright marvelous connection! Both interactions are explained in a way which reveals the underlying mechanism, and both prove to be direct consequences of the two interpretations of the fundamental law (1), with σ as metric density of the length or of the angle – thus being consequences

of a law, which *for us* represents the *origin of everything* and which has been derived in a purely metaphysical manner and without any regard of its possible physical usefulness!

Back to gravity. We interrupted the discussion of the Newtonian approximation.

From the point of view adopted here, the reason, why the application of the equation $dv/dt = -MG/r^2$ leads only to approximately correct results, is that it is not taken into account that the acceleration does not *act upon objects* but must be taken as an *accelerated metric flow*.

Exact results are obtained through the following model assumptions:

Gravitation of a central mass is a stationary metric flow, which is accelerated towards the center. *The continuum itself* flows towards the center. In the flow, waves with light speed exist. Objects are interference phenomena, patterns of superpositions of these waves.

Under these conditions, e.g. the light deviation or the perihelion precession can be calculated. Those who know the derivation of the perihelion precession by means of the general relativity theory, will be astonished that here it is done in a few lines.

Just as astonishing is that the representation is non-relativistic; It seems as if the true simplicity of the mechanism of the universe would reveal itself only to the absolute view from the outside!

Also the transition to the relativistic view is easy. Since the velocity of the metric flow and its differential length-measure are known, one can, at any point, transform to a local relativistic reference system. The totality of those systems is then the Schwarzschild metric.

In this definition of gravitation, at first the question remains open, *by what* the spherically symmetric metric defect is caused. I suppose that the superposition of waves, which the material objects consist of, leads to a metric densification, such that the exterior metric density will be lower.⁷

The idea that a gravitating material object corresponds to a metric defect suggests the assumption that a gravitating object, which consists of **antimatter**, corresponds to the opposite metric defect. It would then be evident why matter and antimatter annihilate each other.

So if, in the case of matter, the continuum lacks m units in all directions, then, in the case of antimatter, there must be m units too much in all directions. Therefore, the metric density σ is not

⁷ That would be a *non-linear* wave-effect.

smaller but greater than in the Euclidean continuum, and it applies $\sigma(r) = (r + m)/r$ or $\sigma(r) = (r - (-m))/r$.

Thus the geometric mass – and with it also the "normal" mass – of antimatter has the reverse sign: it is negative.

This means: If in O there is a mass $-m$, then any point is m units farther away from O than in the flat continuum.

The resulting metric flow is imaginary.⁸ The Newtonian approximation remains identical; in the exact description, however, gravity is not greater than in the Newtonian approximation (as is the case with matter) but smaller: the perihelion rotates in the reverse direction – it is not a precession but a retardation.

Near antimatter, time does not slow down but accelerates. Nonetheless the acceleration is directed towards the center.

In the case of antimatter, the metric of spacetime is not the Schwarzschild metric. Instead of the correction factor $(1 - 2m/r)$, the factor $(1 + 2m/r)$ appears.

An important difference between matter and antimatter is that in the gravitation field of antimatter – i.e. in the accelerated metric flow – there are no longitudinal waves that are associated with gravitation, or, to say it more precisely: these waves disappear after a short time.

To derive further physical relationships, the following assumption is required:

The light-speed waves, which occur in the metric flows, form standing waves, whose wavelength is equal to the Planck length.

As was to be expected in a universe where there are only waves, the fundamental length is a wave length.

Therefrom now the following can be deduced:

⁸ Since the energy of the field contains the square of the velocity v of the metric flow, also the energy is negative if v is imaginary.

Let there be in O a (geometric) mass m . It generates a spherically symmetric, stationary metric flow towards O. In the flow, there are standing waves with Planck length.

Because of the relativistic time-shift, for an observer resting relative to O the phase coincidence of the countermoving Planck-waves is canceled. Thus he does not observe standing waves but phase waves, to which the following applies:

The wave length of the phase wave is equal to the Compton wave-length λ_C of a particle with the mass m . Therefore, on a spherical surface around O with this radius an in-phase oscillation exists with the frequency of the particle.

The relation between the geometric mass m , the according wave-length λ_C and the Planck (wave-) length λ_{pl} , which follows from this metric-dynamic structure, is

$$m \lambda_C = \lambda_{pl}^2$$

Thus, the Planck-length is the geometric mean of geometric mass and according wave-length λ_C . This means there is a Z_m such that

$$m Z_m = \lambda_{pl} \text{ and } \lambda_{pl} Z_m = \lambda_C .$$

(E.g. in the case of an electron, $Z_m = 5.990 \cdot 10^{22}$)

The equation $m \lambda_C = \lambda_{pl}^2$ bridges over more than 40 orders of magnitude and provides a metric-dynamic substantiation of the relation between these fundamental quantities. Moreover, as will turn out subsequently, it is the gravitational analogue to the relation which is known from the atomic structure

$$r_e r_B = \tilde{\lambda}_{Ce}^2$$

where r_e is the classical electron radius, r_B the Bohr radius and $\tilde{\lambda}_{Ce}$ the Compton wave-length. Here, $\tilde{\lambda}_{Ce}$ is the geometric mean of r_e and r_B , and the factor, by which the quantities differ, is the fine-structure constant $1/\alpha$:

$$r_e \cdot 1/\alpha = \lambda_{ce} \quad \text{and} \quad \lambda_{ce} \cdot 1/\alpha = r_B \quad (\text{with } 1/\alpha = 137.036)$$

In the following, also this relation will be substantiated in a metric-dynamic way.

Let us look again at the equation

$$m \lambda_C = \lambda_{pl}^2$$

Since the Compton wave-length λ_C times the particle-frequency ν_m is equal to light speed, i.e. $\lambda_C \nu_m = c$, it follows

$$m c = \lambda_{pl}^2 \nu_m$$

This equation is the metric-dynamic equivalent to $M c^2 = h \nu$ or $E = h \nu$ and $E = M c^2$.

I summarize the basic metric-dynamic facts. (To be able to refer to it later, I call the following statement P1.)

(P1) In the metric flow caused by a central mass m , standing waves with Planck length exist. In a reference system that rests relative to O , phase waves occur. Accordingly, in this system, on a spherical surface around O with the radius of the Compton wave-length, an in-phase oscillation emerges with the frequency that belongs to m .

Of course this is not yet a model of the metric structure of a particle, but it is a reference to such a structure. And it is the first step of the metric-dynamic build-up of the atomic structure.

Before that, however, **electromagnetism** must be defined in a metric-dynamic way. Like gravitation, electromagnetism is a metric defect. Gravity is an alteration of the length measure, electromagnetism is an alteration of the angle measure. Compared with a Euclidean continuum, the metric density of the angle is altered.⁹

In this way, electric charge is geometrized analogously to mass. The geometric charge has the dimension length. It is defined by the metric fact that the circumferences of circles, in the center of

⁹ This metric "coexistence" of gravitation and electromagnetism can only be recognized in the flow-image of the two interactions, because only in this view, gravity relates exclusively to the alterations of the length measures in the flow-direction. Here, the universe consists therefore of *flow-lines*.

which there is a geometric charge μ , are by $2\pi\mu$ units different from those in the Euclidean continuum. Thus they are $2\pi(r - \mu)$.

In the case of positive charge is $\mu > 0$ (at the distance μ the circumference is 0), in the case of negative charge is $\mu < 0$ (at the distance μ the circumference is $4\pi\mu$).

The alterations of the lengths of the circumferences cause a metric flow. At gravity, the flow was radial, at electromagnetism, it is tangential, which means it rotates around the center. Both directions are possible. The velocity of the flow depends on the extent of the change in the arc differential in the same way as the gravitational flow depends on the extent of the change in the radial length differential.

In the case of positive charge, the flow is real, in the case of negative charge, it is imaginary.

Thus, positive and negative electric charges are related to each other in the same way as the gravitational "charges" of matter and antimatter.

Like the mass m , also the charge μ changes the time. With positive charge, time passes slower, with negative charge, it passes faster.

At first, this metric-dynamic scenario is again non-relativistic (like the gravitational one). However one can again change over to the relativistic view in the same way.

What immediately stands out is that the metric changes occur *in any plane* through the center. In each plane, the circumferences lack $2\pi\mu$, and therefore in any plane a rotating metric flow in both directions exists. These are precisely the facts that characterize the quantum-mechanical spin and make it appear as if it could not be interpreted in a realistic way.

But this applies only as long as it is seen as an attribute of an *object*. In the metric-dynamic view, however, the spin appears as an attribute of the *continuum*, and as such it is geometrically obvious because it is certainly possible to compose the continuum of planes and to assign to these planes attributes such as rotation.

That to a point must then be assigned the same velocity (of the rotating flow) *in any direction* on a plane (which lies tangentially to a sphere around the center), is not a contradiction. In the case of an *object*, it would be contradictory to assume that it moves in more than one direction, but not in the case of a point of the continuum – *actually* nothing moves. Here, the point is just a position and not an abstraction of anything existing.

From this metric-dynamic model of the electromagnetism can now be deduced the quantum mechanical **build-up of the electron shell**. As follows:

Let us assume, in a point O there is a geometric charge $\mu > 0$ (μ has the dimension *length*). It causes a rotating metric flow in any plane through O.

Now we imagine an *electron* positioned into this rotating continuum.

According to the arguments of the First Part, however, the electron is not a *particle* but an *oscillation state of the continuum*. And according to (P1), due to this oscillation state called "electron", an in-phase oscillation on a spherical surface around O with radius λ_C exists.

With respect to a plane that *rotates with the flow*, the phase-coincidence is canceled, and a phase wave emerges. (Note that this is only true with respect to the rotating plane. In the non-rotating system still a spherical surface oscillates in-phase.)

The attributes of the ground state of hydrogen can be derived from the condition, that the phase wavelength is equal to the circumference. From this follows first the Bohr radius, and then the frequency can be determined using the alteration of the time.

The values calculated in the metric-dynamic model correspond to the known values if the geometric charge μ is set equal to the classical electron radius r_e . Then the according rotation speed ensures that the above condition is met at the distance of the Bohr radius. With this, μ is identified as *geometric elementary charge*.

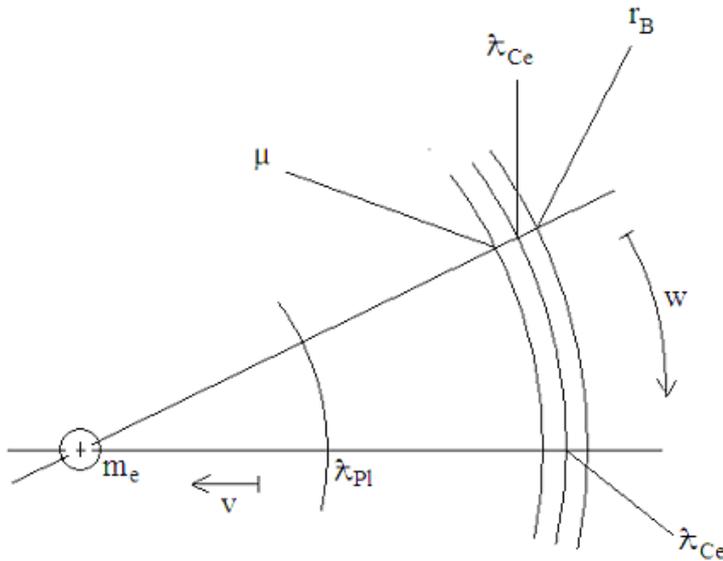
Therefore $r_e r_B = \lambda_{Ce}^2$ turns into $\mu r_B = \lambda_{Ce}^2$

Then applies $\mu 1/\alpha = \lambda_{Ce}$ and $\lambda_{Ce} 1/\alpha = r_B$.

Thus also these well-known relations are explained in a metric-dynamic way.

For a better overview of the whole scenario, which is composed of the condition of stationary phase waves in the radial flow $v(r)$ and in the rotating flow $w(r)$, here again the outline (S21) of II, 5.8.

(In spite of the logarithmic scaling, the proportions are not correctly reproduced. The actual values differ by 47 orders of magnitude: $m_e = 6.763 \cdot 10^{-58}$ meter, $r_B = 5.2918 \cdot 10^{-11}$ meter.)



In the same way as the ground state, also the other states can be derived. It is indeed possible to derive all orbitals of the quantum mechanical description from the just presented simple metric assumptions – not only the orbitals of the hydrogen atom but also of all other atoms; including the orbitals with angular momentum $\neq 0$ – by regarding them as *oscillation states of the continuum*.¹⁰

Precisely this assumption has been necessary for a local and objective interpretation of quantum mechanics. It has now been confirmed. Electrons are not "particles"; an additional electron simply means an additional nodal surface in the overall oscillation state.

So much for the reconstruction of the atomic structure.

Now sufficiently many known and unknown relationships have been derived in a simple and insightful way to provide the metric dynamic view the status of a plausible alternative to the usual interpretations. Its main advantage is that it combines gravitation and electromagnetism, matter and antimatter, positive and negative charge and some other hypotheses in a single geometric picture.

¹⁰ That in the main text they appear as approximations is caused by the fact that I performed the calculations only with respect to plane sections through the spatial oscillation states. For this reason, the results correspond to those of the "old" quantum mechanics, which has been based on the assumption of particles that rotate in a plane.

Moreover, all results are in accordance with the new interpretations of relativity theory and quantum theory, which have been derived in the First Part.

(It is clear that a fundamental new approach cannot be subjected to the postulate of completeness. Still, I shall say something about the absence of the other two interactions:

The so-called shell-model of the nucleus can be reconstructed by applying the method, to derive from the rotation speed those radii where standing phase waves of the Compton wave-length of the electron exist, to the Compton wave-length of the proton.

Since the Compton wave-length of the proton is smaller than the geometric charge, this method leads inwards, into an area where the flow velocity is greater than the speed of light, or – in the relativistic description – where the metric becomes complex. This suggests that to a certain extent the weak interaction can be defined analogously to the electromagnetic interaction, with the difference that – compared with the geometric charge $Z\mu$ (Z nuclear charge number) – the one is directed *inwards* and the other one *outwards*.

Regarding the strong interaction, the following can be stated: if, as assumed in the metric dynamic model, the waves of quantum mechanics are *actually existing waves*, then somewhere – i.e. at a certain order of magnitude – a limit of linearity must be reached. Presumably this is the case in the order of the atomic nuclei. If so, then the strong interaction must be understood as non-linear phenomenon that relates to equation (1) with σ as angular density parameter.)

As mentioned, in the metric dynamic universe the only basic quantities are metric density and metric flow. All other quantities are derived.

Therefore, the basic quantity "mass" must be eliminated by *replacing* it with the quantity "geometric mass" wherever it occurs, which means: in all physical quantities which contain the unit kg, and in all equations which contain such quantities.

Then mass has the dimension length, and accordingly the dimensions of all quantities change, which contain the unity kg.

E.g. the dimension of force changes from kg m s^{-2} into $\text{m}^2 \text{s}^{-2}$, and the same transformation – division by [kg] and multiplication by [meter] must be performed with all mass-containing quantities.

With this, the transition to a purely geometric universe is completed, and now it can be claimed rightly – as announced already at the Photoelectric effect – that the quantities energy and momentum are derived from the quantities frequency and wave-length.

The gravitational constant G loses its status as independent natural constant:

$$F = G \frac{M_1 M_2}{r^2} \quad \text{turns into} \quad F^* = c^2 \frac{m_1 m_2}{r^2}$$

Analogously, Coulomb's law that describes the force between two charges Q_1 and Q_2 at the distance r (β is a dimensionless constant)

$$F_E = \frac{Q_1 Q_2}{4\pi\epsilon_0 r^2} \quad \text{turns into} \quad F_E^* = \beta c^2 \frac{Z_1 \mu Z_2 \mu}{r^2} \quad (\mu > 0, Z_1, Z_2 \in \mathbb{Z}, \beta \in \mathbb{R})$$

Finally, as in the main text, some remarks about cosmology.

It is well known how the idea that the universe is expanding has originated. On cosmic objects, a red shift has been observed, which increases with distance. It has been concluded that the objects are moving away from us, and therefore also from each other.

However there is also another explanation for this redshift: The objects do not move away from each other but the scales with which we measure decrease with time.

Since the length-measure is defined by a wave-length, and because we could indeed use any wave as measure, this means that all material wave-lengths decrease with time.

In other words: Not the universe expands, but we shrink – and, of course, at the same time all other material objects.

At first sight this hypothesis seems crazy – but only as long as the currently believed prerequisites are taken for granted. The redshift itself does not permit a decision between the two hypotheses – both are suitable for its explanation. Therefore the decision depends entirely on the view of the universe that one has *before* one decides for one of the two hypotheses.

In a universe that consists of elementary particles and fundamental constants related to them, one will decide, of course, for the expansion hypothesis. But actually, this statement is not correct, because there has never been a decision, the alternative has never been considered.

However, if there are no particles but only *metric changes* and nothing else, it's much more plausible to assume a reduction of the wavelengths.

Within the framework of standard physics, it is assumed that the ratios between the physical quantities remain constant *and* that these quantities themselves remain constant too.

In the alternative model, the assumption of constant ratios is sufficient.

Thus the standard interpretation requires *more* preconditions.

What about the various connections between physical quantities? Is it not absurd to suppose that they are preserved during such a contraction?

No. Due to the previous conclusions it has become clear why a reduction of wavelengths concerns *all* waves: all wavelengths are interrelated. The just performed geometrization of the atomic structure demonstrates that in an impressive way.

Yet also another reason speaks for the alternative assumption: size is a *relative* concept. It can be applied to everything that exists. But the universe as a whole does not "exist": the criterion for existence is interaction. With what should the universe interact?

The universe as a whole is *not relational*. So if there is an equation in which the size of the universe is related to the size of an existing object, then a change in this relation must always be attributed to the change of the object size.

In short: There are only relative sizes. The *additional* assumption of absolute size is logical luxury which falls victim to Occam's knife.

With the assumption that the universe is not expanding but the wavelengths are decreasing, the vexing problem – not to say the annoying nonsense – of the so-called *dark energy* disappears immediately: If there is no expansion, there is no "dark energy".

Also the logical and ontological absurdity of the assumption of a "Big Bang" is then finally removed.

Last but not least, also the assumption of *dark matter* can be dispensed with. According to Newton's or Einstein's view of gravitation, the observed gravitational effects of galaxies cannot be caused solely by the known (visible) matter. Hence one is forced to assume the existence of additional (dark) matter or to change the gravitational law. In my own view of gravitation, however, this ostensibly "additional" force results directly from the theory: here, gravitation is understood as *metric flow* that is caused by mass. This means: space itself "flows" toward the masses, it "pursues" them.

From this follows: If the majority of the gravitating masses rotates, then space rotates too. To an external observer, stars that are *at rest* in this rotating space would then appear as *moving*. Therefore, if one wants to calculate the rotation speed resulting from that part of gravitation that directs toward the center of the galaxy, the rotation of space must be *added*.

How does this alternative universe develop? Basically in the same way as the standard universe – with one notable exception: the alternative universe is *closed*, and *one* form of self-organization is therefore the formation of standing waves. The vast cosmic voids are likely such waves, and the clusters of galaxies are the "nodal surfaces".

With this, the brief introduction of the metric dynamic physical universe is complete.

Its basis is not observed facts, but metaphysical considerations, whose consequences, however, must conform to the observational facts. All physical statements follow from the fundamental equation and some additional metric assumptions.

There are only two basic quantities: metric flow and metric density, and hence only two fundamental units: meter and second.

Reality is a differential fabric of spatial and temporal changes.

When I created the metaphysical scenario that forms the basis of my physical hypotheses, I did not in the least expect that the notions and concepts, of which it consists, could carry that far. Likewise, I was surprised when it turned out that in the reality which unfolds from it – as opposed to the current scientific reality – also the existence of mind and free will can be substantiated.

Observational facts, which are present in large numbers, permit only one conclusion: mind is brought forth by neuronal networks of sufficient complexity. To separate it from such networks and assign to it independent existence, lacks any justification.

The only reason for fantasies of this kind is the fact that the attempt to integrate mind into the scientific world view so far has failed due to two contradictions:

First, the assumption of free will contradicts the universal gapless validity of the laws of nature

Second, mental states are *qualia*: they are not only *information* but also *sensation*. It can be ruled out, however, that a physical state can become a sensation.

What can be observed in a neuronal network, is a neuronal excitation pattern. It can be described and understood as representation of internal or external circumstances.

But the sensation connected with it is not included in this description. What this pattern *is* – the quale, the unity of information and sensation – seems to transcend what can be observed in an inexplicable manner.

I start with the contradiction between natural causality and free will.

How does the causality of nature express itself in the description? Through natural laws and initial conditions. Laws are quantitative relationships between variables, i.e. equations, initial conditions are the values of the variables at a given time.

There are two types of systems: those in which the dynamic equations of the elements of the system are solvable and permit accurate prediction of the future, and those where these equations are unsolvable and the future is either not at all or only for a short time and approximately calculable on the basis of these equations.

An example of the first type would be a system of two bodies which are bound to one another by gravitation and isolated from the rest of the universe, an example of type two would be a system of thousands of such bodies.

Type two, however, must again be divided: there are systems with a large number of elements in which the equations of motion are not solvable, but where a prediction for the evolution of the system is still possible, because here, in addition to the natural laws, another law occurs, which owes its existence to the form or the structure of the system.

A simple example of such a law is the *oscillation law* of a jar. This law can be formulated independently from the physical structure of the jar. It is a law which is not derivable from the laws of nature, and which therefore must be added to the laws of nature in order to be able to describe the

dynamics of the jar.¹¹ This *law of structure* is the dominant law: it determines the global *and* the local dynamics, i.e. the movement of the individual elements.

Thus the form and structure of the object, its global attributes, determine the dynamics of the components and not vice versa. The concept of *causality bottom-up* must be complemented by the concept of *causality top-down*.

Another example is the *neuronal input-output law*. Through the form and structure of a neuron is determined how the electrical stimulation is generated, conducted, accumulated and eventually transmitted.

This law too is independent of its physical implementation. Precisely for this reason it is possible to replicate the neuronal dynamics by computer simulations.

Moreover, the neuronal input-output law also determines the dynamics of the neuronal network. The network thus forms a separate layer of reality which must be described as such. From this perspective, the neuronal network is a cybernetic system whose elements are neurons, the interaction of which obeys the neuronal input-output law. This law is a *law of structure*, and it can be regarded as interaction law of neurons.

As with the gravity scenario with thousands of bodies, we are confronted here with such a large number of elements (neurons) that interact with each other either directly or over a small number of intermediate steps, that it is impossible to predict the temporal development of the network, *unless* the circumstances are not as in the gravitational scenario but as with the jar, where, due to the occurrence of another law, the motion of an enormous number of particles is organized in a simple manner.

Is there such an additional law in the neuronal network? The answer is *yes*. As follows:

The neuronal input-output law determines the dynamics of a network only as long as this network is not connected to the outside world. However once such a link exists, the neuronal excitation patterns depend on external circumstances. They are then caused by information that reaches the net via the sensory organs, and *represent* something.

If a pattern exists for a certain time, then the neuronal connections that are active are amplified. Thus the pattern becomes an *attractor* in the state space of the neuronal network.

¹¹ If it were supposed, however, that from a state of the universe follow all subsequent states, it could still be argued that the oscillation law is derived. This assumption will be refuted subsequently.

The sequence of such patterns is at first determined by the sequence of events, the elements of which the patterns represent.

However, since the patterns are indeed attractors of the neuronal dynamics *itself*, there is the tendency that the network will produce them also *independently of external circumstances*, and that also their sequence is controlled internally by enhanced neuronal connections, i.e. by *associative* links.¹²

The state space of the jar, which has previously served as example, is structured by a few attractors, that is: by the possible oscillation states of the jar. Causality works top-down: the global conditions are the cause of the movements of the particles.

In the neuronal network, the situation is analogous: here, in the state space a large number of attractors exist. The entire dynamics of the network runs from attractor to attractor.

Again, causality acts top-down: global conditions – the structure of the state space, i.e. the attractors themselves and the transitions between them – determine the temporal evolution of the network and thus the local neuronal processes.

We now identify *mental processes* with the just described dynamics; thus we have determined *mind* as an autonomous layer of reality. It is dominant in the neuronal network, which means: it causes what happens.

It is therefore wrong, to regard mind as a *neuronal phenomenon*. Mind is a layer of reality, which lies *above* the neuronal layer, just as the neuronal layer lies above the molecular layer. Just as molecules are elements of neurons, neurons are elements of mental states. And just as the neuronal dynamics that results from the neuronal input-output law represents an autonomous layer of reality which cannot be derived from the molecular dynamics, also the mental dynamics represents an autonomous layer of reality which cannot be derived from the neuronal dynamics.

For the proof of free will, however, a further step is necessary.

There is no doubt that mental processes are subjected to rules. So have we only exchanged physical causality for another one?

¹² However this will only be the case, if the network contains *functionally unbound areas* in which such internal feedback-processes can develop. Otherwise, the sequence of attractors (representations) would remain entirely dependent on the architecture of the network and external circumstances.

No. The difference between the laws, which physical systems are subjected to, and the laws which mental processes obey, is that in physical systems, though new states can occur, the laws still remain the same, whereas mental processes can change their own laws, while they run.

The physiological basis of this fact is Hebb's law, which says that adjoining neurons that are simultaneously active reinforce their mutual stimulation. Conversely, unused connections are degraded.

Thus the neuronal encoding of mental contents is modified.

But the change in the structure of the phase space of the network, which takes place due to this feedback, must again be attributed to the dominant layer of reality, which means: it is a mental phenomenon and not a neuronal one. Hebb's law represents only the necessary condition for the fact that mind can change and determine its own laws.

Thus there is no system of laws and initial conditions, in which mental processes and decisions of the will are completely contained. To the question why a person has decided so and not otherwise, there is then only one permissible answer: *Because he/she wanted it that way.*

We have come to the conclusion: *Free will exists.*

Still, our train of thought is incomplete. We have assumed global entities and causality top-down to be autonomous phenomena. It is therefore necessary to show that the global conditions cannot be derived from previous states. (If they were derivable, then they would not be an independent element of reality and its description.)

So we ask:

Is there a procedure by which the future can be calculated from the present with a finite number of steps?

In this case, the future would be *completely* contained in the present – with all phenomena, including mental processes and acts of will; the claim of causality top-down would then be impossible, and freedom would be an illusion.

It is important that the question is only about the *existence* of such an algorithm and not whether *we* know it or whether we are able to execute it if we knew it. (Both can definitely be ruled out.) By its very existence, the assumption of freedom would be disproved.

So we must ask whether in that reality, which has been presented here in its basic features, such an algorithm exists.

As starting point serves again the difference between reality and description: Reality has the metaphysical quality *activity*; By contrast, descriptions of reality – as well as models and simulations – lack this quality: *by themselves*, they are passive.

That reality is *active* means that it executes at any position and at any time the fundamental, purely differential law – and this execution is a necessary *and* sufficient condition that the future evolves from the present. Because of its *activity*, reality need not step out from the infinitely Small and "know" the uncountably many relationships between the points of the continuum, which lie separated from one another. It is sufficient that it follows everywhere and anytime the adjoining differential spatial and temporal changes.

However, the way in which reality generates the future from the present cannot be imitated in descriptions. Descriptions are *passive* – nothing happens *by itself*, the law is not executed. Therefore, for us it is imperative to know the relationships between spatially or temporally separated points of the continuum *already now*, if we want to derive the future from the present. This means that we need a method that enables us to step out of the infinitely Small and make statements on finite areas. In other words: we have to *integrate*.

One glance at equation (1) is sufficient to see that this is not possible. In order to integrate, more information is needed. Moreover, in the general case cannot be presupposed that metric density and flow velocity are calculable functions.

It is therefore necessary that the area, about which something should be stated, contains *more order* than is already given by the law alone.

This means:

In the general case, there is no algorithm to calculate the future from the present. The future is not contained in the present. It does not follow from the present.

Thus the only way to know the future is to wait until it happens.

Is reality determined or not?

From a formal point of view, this is an unanswerable question. From an ontological point of view, however, reality is neither determined nor not-determined. This alternative is valid only for descriptions of reality. To reality itself, it is not applicable.

Simplifying, one could say reality was something "in between", but that would only obscure that also in this respect the essence of reality as a unity of *substance and accidents* is not conceptually accessible.

The facts presented above can also be expressed as follows:

In a description, the relations between spatially or temporally separated points of the continuum must be given *explicitly* or made explicit by an algorithm. In the reality, they remain *implicit*; only through the development of the future and the order that at the same time emerges, they become explicit.

What is this "emerging order"? It is being and its laws. Through self-organization, the *origin of everything* unfolds to being, to *objects*, and these objects then form the first layer of existence. To this layer also those laws belong that in current physics are considered as fundamental interaction laws.

An example for that is gravity of a central mass, which, in the metric dynamic view, follows from equation (1) and an additional assumption about the metric density.

But also in this layer of existence, the future is calculable only in simplified, idealized cases, as e.g. in the case of two bodies, which are isolated from the rest of the universe. In the case of 1000 bodies, the illusion of calculability disappears completely.

If this evolutionary game repeats itself, i.e. if from the simple objects and their interactions develop more complex objects and according new laws of structure, then again the same applies: only under simplified, in fact never entirely realized conditions the new laws also provide an algorithm for calculating the future.

Due to the formation of order through self-organization, reality repeatedly comes close to algorithmic describability in the course of its evolutionary development of objects and structures of increasing complexity, but without ever reaching it completely.

With this, the idea dissolves that reality is determined by causality bottom-up, i.e. by an elementary layer. In the general case, this kind of description permits either only an approximately correct prediction of the future or none at all – and I emphasize again: this restriction of predictability does not

exist because we do not know the appropriate algorithm for calculating the future, but because *there is none*.

In this way, space is created for causality top-down, i.e. for the assumption that *global conditions* are causes of local changes.

Causality top-down is described by laws that contain *global* parameters, causality bottom-up by laws with *local* parameters. Neither of the two descriptions is derivable from the other. Both types are necessary for the understanding of systems. But they do *not* unite to a deterministic representation.

This completes the first part of the task, to bring mind and matter under one concept. Mind is an autonomous area of reality, and it is free.

To arrive at this result, it was sufficient to regard mental activities as information processing. It was not necessary to factor in that all mental states are *qualia*, which means that they form an indivisible unity of *information* and *sensation*.

But now, this very fact becomes the focus, for the second part of the task of bringing mind and matter under one concept is to clarify the question:

How is it possible that a neuronal pattern turns into sensation? Why does a physical being transform into a quale?

Again, the explanation begins with the ineradicable *metaphysical difference* between being and that as which we perceive, think and describe it:

Actually existing objects consist of *substance and accidents*. In contrast, objects in a description consist *exclusively of accidents*.

With this, the substance is determined as that which is lacking in our descriptions of reality. This "lacking" – that, what the existing thing is *more* than the thing in the description – cannot be thought. It is necessary, however, always to include this difference in our understanding of reality.

So if we ask: *How can a physical being become a quale and contain sensation?* – then it must be remembered that this physical being – the neuronal excitation pattern – as *Existing* is in any case *more* than our concept of it; Our concept contains only the accidents and not the substance of this being.

Because of this fact now can at first be determined what the substance and the accident of the quale are: its accident is what we can capture and describe, that is: *meaning*, its substance is what eludes our thinking and our descriptions, that is: SENSATION.

SENSATION is thus the substance of the mental being. I call it *second substance*. However it is not independent of the first substance SPACETIME or juxtaposed to it, but emerges from it.

Now the question is: Why is the first substance SPACETIME transformed into the second substance SENSATION?

It must be kept in mind, that here the concept SPACETIME is a *metaphysical* concept which is not identical with the physical concept. The physical concept "spacetime" consists of nothing but its definition – it is as substance-less as the term "neuronal pattern" – whereas the metaphysical concept SPACETIME is a *substance concept*.

SPACETIME has the metaphysical quality *activity*, which manifests itself *for us* through the fact that the physical spacetime exists only *as changing*; without its accident "change", it is nothing. SPACETIME is what provides the physical entities – patterns of changes of spacetime – with *activity*.

With this, the conceptual gap between the first and the second substance is reduced: the first substance SPACETIME is what provides the material entities with *activity*, the second substance SENSATION – i.e. feeling, instinct, motivation, etc. – is what provides the mental entities with *activity*.

However this consideration is not more than a first approach to the problem of the transformation of the substance and not an answer to the question, why it occurs. To this answer leads the following train of thought:

The nature of what exists seems coherent throughout: everything that exists can be regarded as element of a cosmic evolution, in which the more complex things emerge from the simpler ones. Only if one penetrates to the foundations of existence, the irreconcilable difference between what is and its description reveals itself.

However, that which cannot be thought on being, does not prevent us from understanding the observed phenomena – but only up to the point of the evolution of nature where neuronal networks of high complexity develop, because then also a phenomenon emerges, which escapes not only the scientific but indeed *any* kind of description: *sensation*.

What is the reason for this gap?

Since the substance cannot be thought – neither as first nor as second substance – the argumentation must take place in the area of the accidents.

During the evolutionary development of nature, new, more complex layers of existence with new accidents emerge. Thus the accidents change.

The change of the substance must be connected with the change of the accidents. This means: the reason for the change of the substance must be found in the fact that – in the evolutionary transition from entities without mind to entities with mind – a change of accidents takes place, which is of *another kind* than the changes of accidents which previously occurred in the course of the evolution.

So what is it, what do the changes of accidents have in common, as long as they occur in the area of matter, and what distinguishes the change of accidents associated with the emergence of mind from all these other changes?

It turns out that the following applies:

Accidents, which occur during the formation of new, more complex layers of being, can – as long as these new beings do not possess mind – be reduced to accidents of simpler layers of being.

Here is an example: The accident *gravity* follows from the law of the continuum and an additional metric condition. It is therefore not necessary to regard mass as new substance, i.e. as new unthinkable metaphysical entity – as is the case in standard physics.

This deducibility of accidents can be found in all evolutionary layers of being up to simple neuronal networks that cannot bring forth mind.

In such simple networks, the information processing is stereotyped, in the form of a reflex or a learned program. Thus the neuronal processes can be understood as functions of the given architecture of the network and external conditions.

The behavior of animals that possess neuronal networks of this kind can then also be understood in this way.

Let us now consider neuronal networks that produce mind. Here, the neuronal processes are not stereotypical, stimulus and behavior are not always in a fixed connection. The sensory information is subjected to *further processing*.

In the previous train of thought by which free will has been substantiated, we found that a necessary condition for the emergence of mind is the existence of functionally unbound neuronal areas where internal feedback processes can take place. Here, the attractors of the dynamics of the network – neuronal patterns that represent something – form a network of higher order, i.e. they relate to each other and thus also change each other. The information content of these patterns is therefore increasingly determined by the *internal relationships* between the neuronal states, while the original functional dependency from the architecture of the network and external conditions fades away.

In this way, representations turn into *intrinsic meanings*.

So this is the desired difference between the changes of the accidents in the area of matter and the change of accidents in the transition from matter to mind:

Intrinsic meaning, the accident of mental states, cannot be deduced from accidents of simpler layers of being.

With this, it can now be explained why, *for us*, the emergence of mind means at the same time a transformation of the substance. As follows:

Everything that exists consists of substance and accidents. They are *inextricably* linked with each other.

The first substance SPACETIME is linked with the first accident *change*. Let us now consider an arbitrary accident that occurs on a higher layer of being. What is the associated substance, and wherein consists the connection between the two?

The answer is: As long as the accident can be derived from simpler accidents, it is – through these accidents and further, again simpler accidents – *ultimately* connected with the first accident and thus also with the first substance.

But if an accident appears that cannot be derived from simpler accidents – as is the case with mental accidents – then the connection with the first substance is severed. Therefore, the first substance can no longer be the substance that belongs to this accident, and this means that now *for us*, together with this accident, a new substance has emerged, or, in other words, the substance is transformed.

With this, we have reached our goal. The transformation of a material object into a quale is explained. Mind and matter are brought under one concept.

However, there is a third kind of entities: entities that are *produced* by beings with mind. An important example, which has been discussed here many times, is *descriptions of reality*.

Also entities of this kind fit into our conceptual framework. They are defined through the fact that they consist *only of accidents*. The physical prerequisite that they need – the paper on which the description is noted, or the computer in which the simulation runs – is not the substance that belongs to the accidents of such entities but only the *material basis* of these accidents.

This is also the metaphysical reason why the *simulation of mind* is impossible: Since the accidents of the simulation lack the substance, no transformation of substance can occur. The states of the simulation do not turn into qualia, information does not turn into sensation.

Thus, the summary of the trains of thought that lead to a complete concept of reality, a concept that encompasses all that exists, is completed.

As in the introduction, I shall close with some unsystematic remarks.

The difference. How could the difference between the understanding of reality that follows from my basic assumptions and the current view of reality be described, if it should be summarized in the shortest possible way? Presumably in the following manner:

According to the current scientific believe, reality is composed of *elementary objects* whose existence is associated with the occurrence of *absolute quantities* (natural constants). The basis of this view is a concept of existence that stems from the objects of our everyday experience.

By contrast, the reality that I present is not built upon *existence* but upon *change*. *Existence* is a derivative concept. Everything that exists has originated. Objects are patterns of changes of spacetime. If an object is elementary, then it is indivisible not as substantial entity but as *shape*, as e.g. a standing wave. There are no absolute quantities, but only *relations* between quantities.

In standard physics, there are several fields or interactions. The path to simplicity leads over the unification of these interactions.

The metric-dynamic model *begins* with the Simplest. There is only one fact that weaves reality. It is fact and law, Individual and General at the same time. It is *necessary*, and with it also that what it weaves: reality.

In the conventional view of reality, the natural causality is all-encompassing. Despite quantum mechanics and chaos dynamics, there is no room for mind and free will.

In my view, reality is a *differential spacetime fabric*. The differential law, however, is not an algorithm; causality bottom-up is incomplete and must be complemented by causality top-down. There is room for mind and freedom. The attempt to capture reality through an algorithm leads to a depletion of reality: The metaphysical quality *activity* and the substance SENSATION disappear. *Mind* is then impossible.

The most important difference, however, is the following one: In the current description of nature is not differentiated between an existing object and its description. The formalism has absorbed the reality. Reality itself has disappeared. *For us*, it therefore withers to a mathematical system whose development is completely determined by laws, which exist from the very beginning and whose origin remains unexplainable.

From my perspective, the conventional understanding of nature therefore suffers from a fundamental metaphysical defect, because only the conceptual determination of the *metaphysical difference* between reality and description makes reality accessible to us and enables us to achieve a *complete concept of reality*. This reality *is not* a mathematical system. Except for the one fundamental fact or law that follows from the necessity of the *origin of everything*, all laws have *emerged*. The future is open.

The fabric of reality is made of infinitely small meshes. This means: The world is not "what is the case", not a set of "facts". Although the world presents itself to us in this way, we know at the same time: everything that is the case is made by the differential law that generates reality.

"Facts" are a too coarse network, by which reality cannot be fully captured. Mind, sensation and freedom fall through its meshes. With this, also statements like: "Everything has a sufficient reason" become obsolete. Whatever could be formulated as "reason" for an "event", as "cause" of an "effect", can only represent an approximation of what actually happens, because "reason" as well as "event" are *ultimately* made of uncountable sets of differential circumstances which cannot be combined to finite verbal or mathematical statements.

Therefore, already the division of what happens into causes and effects is inadmissible. There is neither the "present", defined as set of present facts, nor the "future", defined as set of future facts, but only the differential process which contains both, present and future, as well as the transition between them.

The metaphysical concept "activity". Thought objects are passive, existing objects are active. For this reason, to that which actually existing objects consist of – to the *substance* – must be attributed the metaphysical quality *activity*.

Here, however, not a certain mysterious metaphysical entity called "activity" comes into play – this attribution just means that the concept "being" changes from a *static* into a *dynamic* one. Being is then no longer something that *can* be active but something that *must* be active; without *activity*, it is no being. There is no longer existence *and* activity but only both together. Being doesn't need to be *activated*; it *is* active. The static concept of existence is a consequence of the *a priori* separateness of substance and accidents. The insight that *in themselves* they form an indivisible unity leads necessarily to a dynamic concept of existence, in which existence itself – seen as pattern of changes of the flow of AGENT – turns into a process.

Formally, the transition from a static to a dynamic concept of existence corresponds to the transition from time *points* to time *differentials*; there is then no present instant and no future instant but only the differential progress in time. Time differentials are the basis of a dynamic reality, and they give processes a direction: what happens within a time differential carries in itself the germ of the following development. In contrast, a reality that is seen as succession of time points would be static and directionless.

The metaphysical concept "necessity". A friend told me, the derivation of the necessity of being from being itself reminded him of the story of Munchausen, who saved himself from the swamp by pulling on his own hair.

Although I like the comparison, I do not think it is justified. Munchausen obviously missed *something* he could hold on to for pulling himself out of the quagmire. But we have this *something* we can base our conclusion upon: *that* something exists is simply a fact. What exists must have *originated*. Thus one is led to the *origin of everything*. It does neither exist nor not-exist. Now if there were *nothing at all*, then also the *origin of everything* would *not exist*, and this possibility has just been excluded.

I suspect, the difficulty to comprehend this conclusion follows from the fact that here a well-known inference schema is overruled. As follows:

Let p be a predicate such that for every existing object holds that either p or *not* p is true. Let X be an object for which neither p nor *not* p is valid. Then the usual conclusion is that X does *not exist*. But if the predicate p is "*exist*", then this conclusion is inadmissible, because it leads to a contradiction: if X does neither *exist* nor *not exist*, then obviously it cannot be concluded that X does *not exist*. Thus, the

only remaining possibility is to assign to X an ontological status that is neither *existence* nor *non-existence* but indeed *necessity*.

So it is the particular, fundamental rank of the predicate *exist*, which forces us to step out of the usual inference schema and to introduce the metaphysical concept *necessity*. But only if the concept "exist" is used in its *ontological* and not only in its *logical* sense, this procedure is admissible.

The concept-pair "*in itself*" and "*for us*". When it comes to the difference between thinking and reality, this pair of concepts is almost inevitable. However, there is the danger that too great a distance between thought and reality is suggested.

So I want to emphasize again, that reality is fully disclosed to us – however with the one fundamental exception that that, from which every being originates and which is *in* every being providing it with *activity*, cannot be thought as that what it "is".

On the other hand, precisely the inseparability of substance and accident guarantees that being reveals itself to us through its accidents. There is no reason to assume that there is anything on being which must remain hidden to us.

The concept *for us* also gives the impression that our thinking is not objective. However, there is no doubt that the physical things are *for each other* exactly what they are *for us*, if one uses for the comparison only the information content of our concepts, and from that in turn only the physical part.

A billiard ball is for another billiard ball, which it hits, exactly that physical object as which we consider it. Even if we are not equipped with the correct theory of the interaction, still the perceived event corresponds to the actual event.

This can be claimed because the things interact with each other only through their accidents or interactions, i.e. in the same way as they interact with us. Therefore, via the sensory information precisely what happens is transferred to us. Thus our image of reality is *objective* – but only if we manage to liberate our concepts of what our mind has added to their objective meaning, and what it has changed on them. As history up to the present demonstrates, this is a difficult task. However, it is important to recognize that no *fundamental metaphysical* obstacle stands in the way to an objective view of reality.

Only at the very basis of things, our thinking fails, but that is beyond the border of the area where objectivity can be defined at all. And also here, as noted above, there is nothing hidden or mysterious,

nothing that could give rise to further speculations or justify religious, esoteric and scientific projections and fantasies.

Epistemological doubt. With what has just been said, some kinds of epistemological doubt are associated, which however are so absurd that I would not mention them if they were not so common.

There are doubts about the objectivity of our perceptions of space and time that sometimes go so far that even the geometric structure of our immediate environment is called into question. This is utter nonsense! If the space around us were not exactly as we perceive it, then could not be explained how, in a child's development, tactile and visual space representations evolve together and finally coincide, then it would be a mystery why cameras with optical devices, which are similarly designed as our eyes, produce images that we recognize as what we have seen, and... here, a long list could follow. Anyone who thinks he is deceived about the spatial and temporal circumstances should be taken seriously and receive traffic ban!

Even the more general doubt whether there is space and time at all is absurd. Without space, there is no being. Without time, there is no change, which means again no being. And these two assertions apply *in any case* – no matter what kind of being we have in mind.

Space and time arise directly from the first, fundamental statement: *One change is equal to another change*. One change *becomes* space, the other *becomes* time, and being is always a *pattern of such changes*.

This is true with respect to *any possible* reality. It is not necessary to start with space and time of the physical world; instead *any* parameters could be introduced. However, no matter how the two changes are initially understood, finally they will be in any case equivalent to space and time of the universe as we know it. It is – in this sense – the *only possible* reality.

Space and time are thus undoubtedly objective, and, in our environment, they are exactly as we perceive them. Only when it comes to the question of the structure of space on very large or very small scales or in the vicinity of large masses, or to the question of the passing of time dependent on high relative velocities, we need to modify and extend our view of space and time.

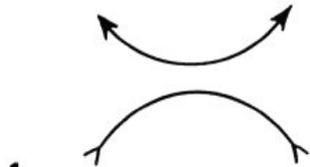
But again, here the same applies as before: only at the *origin of everything* may be asked, whence space and time come. If something exists, however, then there are space and time. They are *objective*.

Constructivism. The constructivist doubt about the perceived reality is based on the assumption that we do not map the world but construct. Our mental picture is therefore not a picture of reality, but only the result of a game that the neurons play with each other.

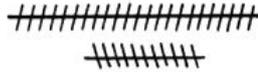
There to the following has to be said:

Of course we are not just mapping the world. It is obvious that a mere map would not suffice to orient oneself in an environment with constantly changing situations. For that it is necessary first to disassemble the environment into objects and relations, and then to rebuild it. To accomplish this, a complex neuronal apparatus is required. This apparatus operates economically and can be deceived. Such mainly optical illusions are entertaining, but they do not substantiate epistemological doubts. (Whoever holds the opposite opinion should, as I said, be taken seriously and excluded from participation in the traffic.)

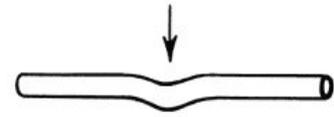
An outline for illustration¹³:



1
Note that the lines do not appear parallel



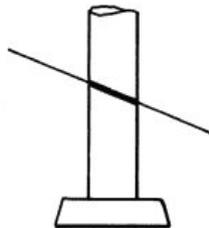
2
Note how one line appears longer



3
Note how the pipe appears bent under the arrow



4
Note that the boxes appear to be different sizes



5
Note how the line appears thicker where it passes through the column

6
Note how quickly the figure disappears when you look directly at it

¹³ <http://joyreactor.com/post/491308>

Only the assumption that the neuronal reconstruction of reality is *correct* provides an explanation for the fact that I can cross the street without injury; Not to mention that the constructivist argument itself indeed presupposes that our image of neurons is correct and annuls therefore its own prerequisite. It is a destructive cycle of almost ridiculous smallness.

We encounter phrases such as: "We are connected with the world not directly but only through neurons" or: "Consciousness is an online simulation". These are vain and empty words, signifying nothing. We *are* the neuronal system, provided that the term "neuronal system" is understood not only scientifically, but in its full metaphysical meaning. Thus we are directly connected with the environment, as well as any other entities.

Epistemological confidence. After so much criticism of doubt, I should now express my own views on the question of what we can recognize.

I regard the often used comparison appropriate, that our knowledge is comparable to the interior of a sphere whose surface forms the border to ignorance. However I see the sphere not in a Euclidean, but in a closed spherical space. Here, the maximum volume of the sphere is finite, and the volume of the region lying outside the sphere, which represents the non-knowledge, approaches finally zero.

So I am confident. Though the *calculability* is subject to narrow restrictions, I see no fundamental limit for our *understanding* – with the exception of that one, behind which lies what cannot be thought; but also there, nothing is hidden.

Thus the world is *recognizable*. I even think one could, if one were only smart enough, conclude the correct understanding and proper description of the world by pure – metaphysical, reasonable, logical and mathematical – thinking.

I myself am unable to do so, but the conclusions I have presented here justify this hypothesis – in particular through the way they have been conducted.

However, to know everything will fail just because of the sheer volume of facts. It is impossible to know all details of the evolutionary game of nature, from which life and mind arise. But it is quite possible to understand it in its fundamentals.

The same applies to the formation of a complex organism such as ours from the fertilized ovum. In this case, however, I am convinced that we are still far away from the knowledge of some basic principles.

I accept that if

- as a philosopher, one encounters problems which for centuries, if not even for thousands of years have remained unsolved, like the question "Why is there anything and not nothing?", or the seemingly irreparable contradiction between freedom and natural causality –
- or, as a physicist, one believes that the known physics describes only a small fraction of all that exists while the rest remains *dark*, or one believes in the reduction of the wave function –

then one tends to regard the basic questions as unanswerable, the understanding as limited *on principle*, and the space of the unknown as immensely large.

But I go by my own experience with knowledge, which I have summarized in this book.

It makes me optimistic.

Vienna, August 2011

Post Script

If THE TRUTH actually had stood on the old slip of paper that the little girl had found in the woods – now we know what would have been written on it:

Reality is woven from a single rule.

That, which weaves and is woven, does neither exist nor not-exist. Therefore it is necessary and with it that what it weaves: reality.

The weaving-rule is fact and law, individual and general at once.

It reads: the change of space is equal to the change of time.

It is a differential rule. Nothing follows from it alone, and therefore the future is open.

Everything which exists is a pattern of spacetime alterations.

Each pattern is caused and causative. It obeys the weaving-rule, and the rule obeys its form.

Through the unfolding of reality, new layers of being evolve, with new attributes and new rules. The known natural laws are such rules.

We too are patterns of spacetime alterations. We too obey rules. But we can change our rules. We are free.

The real thing differs from the described thing by its activity.

Activity changes in the evolution of being. It turns into sensation.

Probably we would not have understood it.