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

Part Two

Physics from Metaphysics

The Elementary Concept of Reality

The Metric-Dynamic Universe

Contents:

Attunement

Highly-esteemed Reader! – What is the primordial ground of reality?

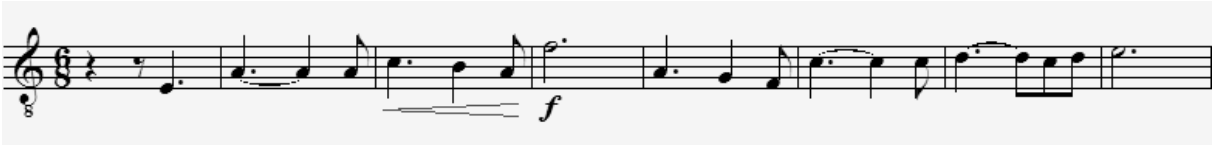
Since I am not completely satisfied with the approximately valid *standard model* and also not quite happy with the correct answer "42", and because overzealous animal rights activists have thwarted the execution of my plan to let 10^{500} apes type until they produce a theory which is more prolific than the *superstring theory,* I decided to search for an answer on my own.

But now I fear that the result of my search might appear too strange to you. So I racked my brain for how I could pump you up into a rather yielding mood.

And, lo! – out of my racked brain a fortune cookie emanated that contained a proposal for a ritual the execution of which will put you into such a devotional euphoria that you are immune to the feeling of alienation and to an inadequately critical attitude.

Ready?

Then please sing *maestosamente e con forza* three times in succession the following motif:



And now we have to hurry! – We must make it through the first few sections before the effect wears off!

1. The Primal Ground of Reality

1.1. Announcements

In this Part, as announced in the introduction, the physical description of reality will be derived from metaphysical considerations.

How is this to be done?

By reversing the direction of physical reasoning: The observable phenomena, which – according to usual conviction – represent the starting point of the description of nature, will be the endpoint, and that which is considered the ultimate goal of physical knowledge – the law which includes everything that exists – will be the starting point. This is possible, because the ontological and logical conditions of the primal scenario, from which everything existing follows, are of such simplicity that the law that belongs to this scenario follows conclusively from these very conditions.

If the description of nature originates, as has been the case in the historical development of physics, from experiences that come from observations of objects in our environment, then at first the elements of the description seem obvious. What could be clearer than the concept *force,* or the concept *work,* defined as path integral of force, or the concept *energy,* defined as ability of an object to perform work?

As the development of physics demonstrates, however, these matters of course turn out to be illusions. By leaving the mesocosm the vividness of the anthropomorphic notions fades away more and more, until at last only mathematical definitions and measurement regulations remain. At the same time, any demand for an interpretation beyond this restriction disappears. The conceptual network which originated from objective experiences and was designed for understanding nature degenerates to a mere adjunct of mathematics.

The consequence is that the interpretation of physical theories finishes up in a blind alley, from which there is – as was shown in the First Part – only one escape: the status as *basic concepts* must be withdrawn from some of the notions that stem from the world of things, and other concepts must take their place.

However the retreat into mathematics is problematic not only for this reason, but mainly because – as will turn out in the following – it is ultimately the difference between a mathematical object and an

actually existing object which permits to answer the two questions: *Why is there anything at all and not just nothing?"* and *"What is that which exists",* and which enables us to determine this Simplest and most General from which being evolves and from which the description of physical being can be derived.

More concretely, the program of the Second Part reads as follows:

At first, the scenario is determined that represents the *Primal Ground of Reality* and of its description.

From this scenario follows the *fundamental equation,* where "fundamental" means that this equation describes the *process that generates the reality*, so that everything which is derivable at all can be derived from it.

From this purely philosophically motivated and substantiated initial equation, a very short path leads to special relativity as well as to Newton's and Einstein's gravity. The according structural concept, however, changes completely in all three cases.

In an analogous way – and just as directly – the same equation is also the basis for the definition of the electromagnetic interaction. From this starting point, a simple atomic model can be created which, as far as it will be carried out here, is identical with the quantum mechanical model.

Also with the electromagnetic interaction, a fundamental change of the concept of the underlying structure takes place.

Conventionally spoken, one could call the method a *geometrization* of physics. However it is far more: physical concepts and relations are not just geometrized – they are *newly substantiated:* the concepts are reduced to one single concept, and the relations are reduced to one single relation.

I will perform the reconstruction not systematically but in all cases far enough that the connections to the respective theories – in the form as they are currently understood – as well as the differences can be seen clearly.

At last follows an outline of the universe as it ensues from the hitherto acquired results. In this image of the cosmos and of its development, the concepts *dark energy* and *dark matter* find a simple explanation.

Given the strange intemperance of these announcements, it seems appropriate to add a personal note:

I started my cognition-project only with the intention to eliminate what – from my perspective – had to be seen as intolerable interpretational shortcoming of present physics. The realization of this project led to the conclusions contained in the First Part of this treatise.

I've never thought of designing a new kind of physics – such an idea would have seemed absurd to me.

At some point, however, I started thinking – at first not seriously, rather incidentally, in a moment of playful audacity: if there is *anything* at all, *how* must this "anything" be designed? – and from then on, everything developed straightforwardly. More and more physical regularities were revealed to me in the simplest geometric form, and all that happened with such compelling logic that, finally, I could not get rid of the impression that that, what unfolded before my eyes, could actually be a picture of the universe *as it is.*

Before I start with the actual train of thought, I will outline shortly, what I consider unsatisfactory regarding the *standard model* and also the speculative developments beyond.

1.2. Criticism of modular Universes

The considerations of this section are not yet part of the reconstruction of the description of nature; so for the actual reasoning, they are of no importance. However for my own thinking, they have been necessary, and I shall present them here, because they seem appropriate as introduction – insofar as they put into question what at present is considered so evident that it is not even an object of discussion: the assumption of *elementary objects.*

What is meant by the term "modular universe"?

Just that: the model of a universe in which there are entities that are considered *elementary* (e.g. particles or fields), in the sense that they are indivisible, their existence cannot be substantiated and the quantities connected with them (attributes of the elementary entities, ratios of the values of these attributes) cannot be derived.

Such *elementary entities* and *natural constants* are then unexplainable *by definition.*

The question arises, *how many* of such irreducible quantities, such "free parameters" are acceptable at all: 10^{500}, or 26, or perhaps only 3? (Also the number of elementary entities and the number of free parameters can be free parameters.)

The answer is:

None at all. ***Each*** *free parameter that cannot be derived for reasons of principle is an indication that the fundamental level of description is not yet reached.*[1]

The uneasiness that captures most physicists in view of the free parameters of the Standard Model concerns not just the number of these variables; much rather it relates to the questionability of a *non-contingent being* – where *non-contingent* means: not originated and not reducible.

There is no non-contingent being. Everything which exists is contingent. This applies to the fact of its existence itself as well as to its attributes.

The network of contingency is *all-encompassing.* On the side of the description, this means that – at least in principle – it must in any case be justifiable why any being exists at all and why it has exactly those attributes.

However, this principle of contingency is of the same nature as the principle of objectivity or the principle of locality: it cannot be completely substantiated but only be recognized. Just in the same way as it is logically possible to assert that there are connections mediated by nothing, it is also logically possible to assume, the primal ontological ground of the universe consisted of a number of elementary objects – and apparently most physicists indeed share this opinion.

I consider both assumptions implausible. To me the idea, the universe could resemble a building set with a certain number of basic elements, seems (almost) as absurd as the assumption of un-mediated connections. I think, basically nobody would be content with the idea that there are quantities which are unexplainable *on principle.*

However, at present there is actually no alternative: the two most common assumptions, God or chance may be responsible for the specific values of the free parameters of the standard model, are indeed no explanation. As already mentioned in the introduction, they can be compared with jokers in a card game: they can be used to take the place of any required explanation, but actually they explain nothing at all. The notion "god" merely glorifies our ignorance, and the assertion of randomness only postpones the need for a *real* explanation and shifts it to a deeper – at best simpler – level where the same questions occur again.

[1] It should be noted, however, that some of these parameters could have emerged from self-organization. Parameters of this type would not be derivable directly from fundamental equations.

So if one wants to meet the postulate of universal contingency and, at the same time, to avoid the two unsatisfactory alternatives, then one has to abandon the assumption of elementary entities.

Then, however, one seems to fall victim to an infinite regress: if *all* entities have originated from other entities, then there is no ontological starting point.

Thus one seems to be trapped in the well-known antinomy: either one *defines* such a starting point – just like the elementary entities in physics or like the *ens a se* (the *unmoved mover*) in religion – or one gets into the infinite regress. Evidently, in both cases the possibility of an explanation of that which exists disappears.

It will turn out that this antinomy can be solved in the same way as the antinomy regarding the question: "Can objects be divided infinitely or is there a limit of divisibility?"

The answer was given in the First Part (which however was not explicitly mentioned there): There are indeed indivisible elements of reality, but not in the sense presupposed in the antinomy, where the continued partition of a *solid, substantial body* is put into question. Instead, any indivisible object is a *gestalt phenomenon*, a dynamic pattern, which can only exist *as a whole* and is *therefore* indivisible – just as a vortex or a standing wave in a tube.

It can be seen clearly how the antinomy could be solved: by a change of the presuppositions of the question, which previously appeared quite natural – and the same applies to all antinomies, thus also to the seemingly unavoidable alternative *elementary entities* or *infinite regress*.

So let us get on the path to the primal ground of reality, the last precondition of all being.

1.3. Why there is Anything and not Nothing; The Origin of Everything

Preparation: the Difference between Reality and Description

The difference between *objects of reality* and *objects of a description of reality* is as trivial as fundamental:

Everything that *exists* exerts *effects.* Expressed in everyday language: it has attributes; expressed in the language of physics: it interacts with something else that exists. Thus the characteristic of *actually existing objects* is that they *change* their environment. One could say: they are **active** *by themselves,* or *out of themselves.*

In contrast, *thought objects* – regardless of whether they are elements of a verbal or a mathematical system – *do not* exert effects; their effects are merely *imagined.* Only if they are used by somebody, they can become part of a process, i.e. of a thought train, a conclusion or a calculation. *By themselves,* or *out of themselves,* they are **passive**.

Effects must emanate *from something.* Thus in the case of *existing objects* there must be a *carrier* of the attributes.

Think of the example which served to illustrate these facts already in the First Part: water waves. Obviously, they are waves *of the water* – and it would be very strange to say that there were no water, and the waves were just the periodic conversion of kinetic into potential energy and vice versa.

Or another example: the Cheshire cat in *Alice in Wonderland.* It disappears, and only its grin remains. Lewis Carroll is playing here an absurd and entertaining game with our knowledge that there can be no grin without cat. He ignores the necessity that there must be *something that* grins.

Exactly the same applies to light waves. Who asserts that light waves *are* the periodic conversion of electric and magnetic field plays the same game as Carroll: Just as the grin presupposes the *cat*, or as the kinetic and potential energy presuppose the *water,* also the electric and magnetic field presuppose a *carrier.* This carrier cannot simply be replaced by the effects that emanate from it.

However on the side of the description, there is no such problem: Of course it is admissible to describe water waves as periodic transformation of the two forms of energy, and it is entirely correct to describe light as a vibration of the electric and magnetic field vector, and at last it is no problem to draw the

grin without the cat and depict its effect on Alice – and I do not mean that as a joke: it is in fact always the same situation, and in each case it reveals the difference between reality and description in the same way.

This difference can be expressed in the following way:

Actually existing objects consist always of *substance and accidents.*

Here, the notion *substance* stands for exactly that, which represents the answer to the questions: *"What is the carrier of the attributes?"* or: *"From what do the effects emanate?"* Its meaning will become clearer in the course of the subsequent thought train (and of some other ones that will follow later). The same applies to the notion *accident;* here, it means just *attribute.*

In contrast, *objects of a description system* consist *solely of accidents.*

Let us look at a mathematical object: it consists of nothing but its definition, i.e. exclusively of attributes. A mathematical object exists only *as* its definition*,* it has *no existence* without this definition. Its designation is merely the "shortcut" of its definition, the "placeholder" of its attributes. There is *no carrier* of the attributes.

An example: natural numbers consist of the Peano-Axioms, by which they are defined. Every operation with natural numbers relates to this definition. If it is removed, then what remains is not objects without a definition but *nothing.*

In other words: mathematics is only structure, reality is structure *and* substance.

Another illustration: The notion *field* can designate a mathematical object or the object in the real world which is represented by the mathematical object. To understand both objects as *one and the same object* means identifying mathematics and reality. By this very act, reality is deprived of its substance. The maximum congruence between description and reality is not *identity* but only *isomorphism* – and this applies only to accidents.

The Search for the Origin

Now the preparations are made for asking the crucial question: the question which leads out of the realm of being and directly back to the fundamental level of reality – to the *origin of everything.* It reads as follows:

What is the carrier of the attributes?

As long as the respective object is *composed,* that is: a complex aggregate of simpler components, a *reductionistic* answer can be given.

But what is in the case of an object that cannot be further reduced (divided)? *What is* that from which its effects emanate?

The carrier of the object attributes is defined as that from which the effects emanate, or, to put it another way: as that what the object is *without* the accidents, or again in other words: as that which remains if (mentally) *all* attributes (interactions) are removed.

However the presence of attributes is a *necessary condition* for ascribing *existence* to an object: something which interacts with nothing else does not exist. Therefore, the carrier of the object attributes does not meet the criterion for existence.

Let us therefore *firstly* state:

The carrier of the object attributes ***does not exist.***

On the other hand the following applies:

As mentioned above, from a mathematical object do not emanate any effects: out of itself it develops no activity. Therefore, from a mathematical object actually nothing (or just an empty notion, or a name) is left, if the attributes are removed.

But from an *actually existing* object emanate effects, and, therefore, from an existing object cannot remain just nothing if its attributes are removed. Something, from which effects emanate, cannot just *not exist,* because from something that does not exist cannot emanate effects. *Nothing* cannot be carrier of attributes.

Let us therefore *secondly* state:

The carrier of the object attributes ***does not not-exist*** *either.*

Thus it follows: ***The carrier of the object attributes does neither exist nor not-exist.***

That from which the effects of an object emanate, is *attribute-less,* therefore *indistinguishable,* i.e. identical for all objects. Thus we can interpret it as *precondition of* ***every*** *being* and – since it is not just a *logical,* but an *ontological* precondition[2] – at the same time as ***origin*** *of every being,* and therefore it holds:

The *origin of everything* does neither exist nor not-exist. It is neither something nor nothing.

Every being can *be* or *not be.* But for the *origin of everything,* which itself is no being, this alternative does not apply. But behind the alternative *be or not-be* or *something or nothing* there is no further alternative. Therefore that, to which the alternative *be or not-be* does not apply, *is* ***necessary****.*

This means: **The *origin of everything* is necessary, and with it that what emanates from it, that is: being.**

Because if there were nothing, then also the *origin of everything* would **not exist**, and this was ruled out just before.[3]

This is the answer to the *first* of all questions, to the question: *Why is there anything and not nothing?*

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[2] 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, that, which an entity consists of, is always the ontological precondition of this entity.

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[3] Would this be simply a *logical* conclusion of the usual kind, then the contradiction could still be eliminated by the assumption that the *origin of everything* does not exist: if a contradictory object disappears, then also the contradictions linked with it disappear. In the case of the *origin of everything*, however – which is no object! – this conclusion is ontologically inadmissible. As follows:

Let A be the assumption that nothing exists. Let B be the assumption that the ontological status of the *origin of everything* is non-existence. Then A and B are identical. But since B is ontologically wrong, A must be ontologically wrong too.

Explanations, Additions

Actually existing things are always *active,* thought or described things are *passive.*

Real things consist therefore of substance *and* accidents, described things *only* of accidents. Although in a description the *kind of activity* of a thing can be displayed through its attributes, the *activity itself* is still lacking.

Since only the real things possess substance, their activity must stem from the substance; Substance must be that what makes the real things active.

Activity, however, cannot be an accident. Therefore, I call *activity* a *metaphysical quality.*

On actually existing objects, the substance is thus not only the precondition for their existence, but, at the same time, also that, from which the *activity* of the object comes, that, what drives the respective accidents.

So we can state:

Substance is the *origin of everything.* It is *necessary,* and it is *activity.*

In itself, the *origin of everything* is pure substance – it does not divide into substance and accident. Since we cannot think the substance alone, the *origin of everything* cannot be thought as it is *in itself.*

If one still tries to grasp it mentally, then one gets beyond the boundary of thinking, and then contradictions occur. These contradictions are unavoidable and prove therefore that there is an insurmountable difference between reality and our thinking. However this difference can be determined conceptually, and this makes it possible to draw conclusions. The first conclusion was that the *origin of everything* does neither exist nor not-exist and is therefore necessary. The second conclusion was that it is *activity.* Further conclusions will follow.

What is the *origin of everything for us?* Since we can only think within the scheme of substance and accident, we must also think the *origin of everything* in this way. This means: we must assign to it the metaphysical quality activity *as accident*, i.e. think of it as *something that* is active. However, since *in itself* it is *inseparably* linked with activity – so that activity is an essential element of its ontological status –, it seems to disappear if activity is separated from it. Therefore, *for us,* the *origin of everything* at first appears as *activity of nothing* – where, however, it is immediately evident that that which here

appears as *nothing* cannot simply be identified with the purely conceptual nothing, because it would be nonsensical to assign activity to the purely conceptual nothing. Thus I shall denominate it AGENT. Therefore, AGENT is that which disappears if one tries to think it, but of which is known at the same time that it cannot be nothing.

At first, all these conclusions appear strange because they lead an a priori condition of our thinking to a contradiction.

If contradictions follow from certain conditions, then usually this means that the conditions contain errors. However, here it is an *a priori* thought structure which proves to be wrong – so to speak: thinking cancels itself out. Thus one is confronted not with just a logical contradiction but with a limit of thinking. Therefore, from the contradiction a conclusion can, no: *must* be drawn that leads out of the realm of the thinkable: by deducing what is *not* the case – what the *origin of everything* is *not* – one arrives at *necessity* as its ontological status.

To make the matter a little more familiar, I will now try to present it again, however in a slightly different form.

For us it is impossible to think *existence* other than consisting of substance and accidents. Thinking originates from experiences on perceptible objects. Therefore, the substance-accident scheme appears self-evident in the case of a perceptible object: as answer to the question: "*From what* do the effects emanate?" it seems to be sufficient to *point to* the object. Only if one tries to follow the scheme to its limit, then it becomes clear that the notion "substance" – as it was defined here: as that which is carrier of attributes – cannot be thought without contradictions.

On the one hand the following applies: If one follows the logical *a priori* structure of notional thinking, then one remains only in the area of accidents. The fact that that, which is thought, *exists* has disappeared, or say: it is always presupposed.

Removing attributes means proceeding towards the General, and thus removing *all* attributes leads to the most General, the notion of pure being. But this notion is completely empty and therefore inappropriate to represent the carrier of attributes. So one gets – just as in mathematics – the answer *nothing,* and necessarily so, as mathematics represents the evolving of our thinking according to its own rules.

But if now, on the other hand, the fact of *existence* is taken into account, then it is immediately clear that this answer cannot be true, because, as mentioned above: nothing cannot bring forth any effects.

Thus one arrives at a contradiction, if one tries to think the *origin of everything.* But since reality must be without contradictions, the occurrence of this contradiction can only mean that there is a fundamental, insurmountable limit of our thinking.

However this contradiction can be used: exactly for the reason that the *origin of everything* cannot be thought, we know something about it – namely that it does not divide into substance and accident, from which in turn follows that it does neither exist nor not-exist and is therefore necessary.

The scheme of substance and accident has its equivalent in the *subject-predicate structure* of possible statements about being. There is always a subject about *which* something is predicated, i.e. which does something or with which something is done. Thus the structure of language reflects the division of what being is *for us*: into that *from which* the effects emanate and the effects themselves. *For us,* this separateness is irrevocable – and yet we also recognize that it is actually impossible.

Of course one can ask, if the train of thoughts performed in this section relates indeed to anything real. There are several reasons for a positive answer:

1. If our thought train related to nothing real, then one would remain captured in the realm of the existing. This case has been discussed in the previous section: it leads to the assumption of elementary entities, which is tantamount to the assumption of *non-contingent being,* i.e. to the renunciation of any explanation of being. The thought train presented here is the only way out.

2. Without this thought train, one would again face the question *why there is anything and not nothing.* But the idea that this alternative could actually be there is outright absurd. It would be a scandal of reason if this question remained unanswered. The fundamental principle of the *completeness of reality* would be violated. However, the only possibility is to proceed beyond the alternative *be or not be*, because everything that exists is contingent, and only that which neither exists nor not-exists is *non-contingent* and therefore necessary.

3. Of course it is of decisive importance, whether it is possible to get from the *origin of everything* to being itself, i.e. if this formation process can be understood and formalized, and to what extent being can be derived from it.

More concretely, the question is, whether there is a path from where we are at the moment to the foundation of physics, and, if yes, what the advantage of this new substantiation of physics would be.

That will be decided in the following.

Minimal Positive Metaphysics

If one aims to advance to the essence of being on the path of progressing abstraction, on the "via abstractionis", as has been attempted time and again in the philosophy since Plato and Aristotle, then one gets over ever-higher levels of generality at last to the most General with nothing in hand.

Although one can denominate this most General, e.g. one can call it "God" or "the Absolute" or "pure being", its concept is actually completely empty, and nothing can be said about it.

Not least it is this insight which has led to the prevailing conviction that metaphysics is impossible.

However, if one does not proceed on this path to the *most General* – which belongs to the realm of thought and of descriptions – but on the path to the *most Elementary* – which lies in the realm of the really existing objects – by continually asking what the things are actually made of, until one reaches an indivisible entity, then one recognizes that the concept of that what this entity is made of is not empty as the concept of the most General, but that the following logical and ontological conclusions are possible:

At first it can be understood very clearly that that what the things are *ultimately* made of, the *substance*, cannot be something which *exists: e*xistence is always substance *and* accident; The earth exerts *always* gravitation, it is there only *with* gravitation, without gravitation it does not exist. Substance alone does not exist, accident alone does not exist. In the concept of existence, both are inextricably united.

Therefore, for an answer to the question of what the substance is, one must leave the realm of the *Existing* and, at the same time, the realm of the *Thinkable*, and this fact in turn leads to the insight that that what everything consists of must be something whose *ontological status* is neither existence nor non-existence, but ***necessity***.

Additionally, it proves imperative to assign ***activity*** to it, because existing objects, contrary to thought objects, are *active,* and this activity can only stem from that which the existing things are made of – in contrast to the thought things, which are in fact made of nothing.

I repeat these conclusions in order to make as clear as possible what the difference is between the metaphysics presented here and former (unsuccessful) attempts to derive positive metaphysical statements (i.e. statements with a specific content).

That, at which one ultimately arrives by continually asking what the things consist of, the substance, is the *origin of everything.* The *origin of everything* cannot be thought as that what it "is".

In this respect, the assertion of the impossibility of "positive" metaphysics is thus confirmed.

But at the same time it is also refuted by the following insight:

The *origin of everything* cannot simply be *nothing,* because the things – exactly for the reason that they are *active* – cannot consist of nothing, since nothing is not *active*, and from this follows that, though the *origin of everything* can indeed not be thought, it is still possible to know something ***about it,*** i.e. precisely these two conclusions:

The *origin of everything* is ***necessary***, and it is ***active***.

Thus on this path one arrives yet at a positive metaphysics, and it will turn out that it is exactly this "minimal" metaphysics which physics needs in order to substantiate its propositions.

In the following sections of this chapter will be shown that these two conclusions are necessary and sufficient conditions for the derivation of a law that forms the basis of the universe – a universe, that is, which organizes itself through flows and waves.

In the following chapters of the Second Part will be proven that from this law some of the most important physical theories and hypotheses can be deduced, and, moreover, in all cases in such a way that the underlying mechanism can be understood.

Thus the *origin of everything,* seen as that which is *necessary* and *active,* is exactly that "principle of such general validity and at the same time of such important content that it can serve as sufficient fundament for the exact sciences".[4]

The "minimal positive metaphysics" which has been derived here forms the necessary ontological basis of physics, in the sense that all "Why-" and "What-is-" questions can be traced back to it. As long as such a basis is lacking, all these questions must remain unanswered – as has indeed been the case until now. Physics without metaphysics is incomplete, and this incompleteness permanently gives rise to futile speculations.

[4] Max Planck: Sinn und Grenzen der exakten Wissenschaft. Leipzig 1947, Johann Ambrosius Barth Verlag, zweite verbesserte Auflage, Seite 4

The Connection with the First Part

At the end of the First Part, I said:

"The universe can be understood analogously to an oscillating body, which organizes itself into wave patterns.

But it is just an analogy, and it will be replaced by a more abstract concept in the Second Part."

This "more abstract concept" has just been determined: it is not a body that organizes itself but *that which neither is nor is not, the origin of everything.*

1.4. What is that which exists? – The first Proposition; The first Equation

Our intention is to use the hitherto reached conclusions as basis for a description of reality. For this purpose, that, what we know about the *origin of everything*, must be brought into the form of a statement.

Starting point must be what the *origin of everything* is *for us.* This has already been defined as follows:

For us, the *origin of everything* is *activity* of AGENT.

(Here, however, it should be noted that by this act of *objectification* the difference to what the *origin of everything* is *in itself* is *not* removed: *in itself,* it does not divide into *substance and accident.* More on this unresolvable difference and its consequences will follow in the Third Part.)

Activity involves *change.* If nothing changed, it would be absurd to speak of activity.

With this, we have arrived at our first subject and first predicate:

The *first subject* is AGENT. The first *predicate* is *change.*

What changes? Since, in our thought train, we are still *before* any existence – though we have just brought the *origin of everything* into the form of something existing, it is still true that it neither exists nor not-exists – the change can only affect AGENT itself.

So we start with a change of AGENT on itself. If nothing followed from this change, then the predicate would disappear, and there would again be just nothing, in contradiction to the necessity of the *origin of everything.*

Thus something must follow from the change, and what follows must again be a change of AGENT on itself.

Therefore, the first statement appears at first in the form:

From <u>one</u> change follows <u>another</u> change.

However only if the reverse is also true – which means: only if the first change follows from the second one, too –, then the perpetual chain of changes is generated which is necessary to avoid that there would again be nothing. From this follows:

<u>One</u> change is equal to <u>another</u> change.

The next step is to bring this statement into a mathematical form. It appears appropriate to express the changes by differential quotients. [5]

Thus the *simplest* mathematical form of the first statement reads as:

$$\boxed{\frac{d\sigma}{dA} = \pm \frac{d\zeta}{dB}} \qquad (0)$$

– where at first nothing is said about the kinds of changes. Also the space, which is necessary for establishing equation (0), is not determined. It is sufficient to postulate that it permits all operations that must be performed in the following.

Why is only the simplest mathematical form allowed?

Because our goal is to bring the necessity of the origin of everything *in itself* into the form which it must have *for us.* For this reason, the fundamental statement and also the fundamental equation can only contain what is necessary – in the sense that without it there would be nothing, which we have

[5] A more precise derivation of the first equation – with extensive substantiations of all steps – can be found at the beginning of the Third Part.

ruled out previously. Necessary, however, is only the simplest form of the equation. Any further addition could not be justified.

How are the variables in (0) to be understood? What are these variables?

Since it is proven that there is not nothing, we can presuppose everything that is a necessary condition for existence (would any of these conditions be missing, then would be nothing).

Existence needs in any case *spatial extension.* (*No* extension is tantamount to *non*-existence; then equation (0) couldn't even be established.)

Thus, the differentials in the denominator can be interpreted as length differentials

Therefore $$\frac{d\sigma}{dr} = \pm \frac{d\zeta}{ds} \qquad (0')$$

– where r and s have the dimension *length.* σ and ζ are dimensionless.

Another necessary condition of existence is *motion.* Without motion, everything would remain the same and therefore nothing would exist.

So the question is: How can equation (0') be transformed into a dynamical equation?

The *simplest* way is the following one:

We set $\zeta = v/c$ and $s = c\,t$, where v and c have the dimension *velocity;* v is the variable, c is a constant.

This leads to $$\frac{d\sigma}{dr} = \pm \frac{d\frac{v}{c}}{d(ct)} \qquad (0'')$$

and finally

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

So **this is the law, from which reality is woven**, or, in other words, ***the fundamental equation***, where fundamental means that everything can be derived from it, which is derivable at all. (The interpretation of σ follows below.)

What moves at velocity v? AGENT. v is the flow of AGENT.

With this, the question is answered what being is:

Everything that exists is a pattern of changes of the flow of AGENT. [6]

The empty notion AGENT, however, has now, due to the objectifying act of ascribing an attribute to it and by the conclusions that follow from that, turned into a *space-time continuum.* Or, to say it more precisely: the *origin of everything* has – due to the act by which we have made it thinkable *for us* – become a continuum, the law of which is represented by equation (1).

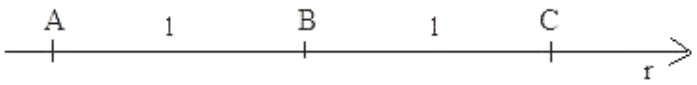
With equation (1), also the first natural constant has appeared: the velocity c; c^2 is the proportionality constant in the relation between the alteration of σ and the alteration of v. However it is clear that the magnitude of c can be *freely chosen* and does not have to be substantiated, because the process that *generates* reality contains c, which means that reality is derived from c and not c from reality. As indicated by the choice of the letter, c will be identified with the speed of light.

Now to the interpretation of σ.

I call σ ***metric density***. What this means shall at first be demonstrated by an example:

Let r be a one-dimensional continuum.

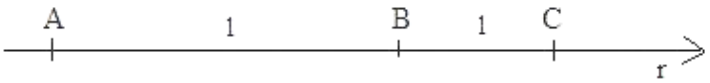
Let A, B and C be three points of this continuum; the distances between A and B and between B and C be equal to 1.



(S1)

[6] *As definition,* however, this applies to more complex forms of being only if their accidents are reducible. Further details on this restriction will follow in the Third Part.

Here, σ is constant. Now we change the conditions in the following way:



(S2)

The distances are still 1, but the length of the scale has increased between A and B, and between B and C it has decreased. This means, the *metric density* σ between B and C is greater than between A and B.

For the moment, this intuitive definition of σ is sufficient. The exact definition will be given below, in the description of gravity.

What follows in (S2) with respect of B? According to (1), a continuum flow must occur, which I call ***metric flow***, i.e. B is accelerated. The direction of the acceleration depends on the sign of the right term in (1). For the moment, we follow the idea that B is accelerated back towards the medium point between A and C. (Later, the other case will appear just by itself.) This means that in (1) the negative sign must be chosen:

$$\boxed{\frac{d\sigma}{dr} = -\frac{1}{c^2}\frac{dv}{dt}} \qquad (1')$$

Important is the difference between the metric density σ and the "normal" density ρ: In the case of ρ, there is a definite value ρ_0 so that the magnitude of the acceleration depends on the magnitude of the deviation from this value. Thus here an *absolute* scale exists; ρ has a *memory*.

So if (S2) depicted a change of the normal density, then the magnitude of the density change would depend on the initial value of ρ. In order to eliminate this dependency, instead of (1') would have to be set

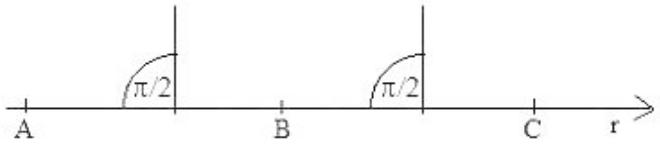
$$\frac{d\rho}{dr}\frac{1}{\rho} = -\frac{1}{c^2}\frac{dv}{dt}$$

In contrast, the metric density σ cannot have such an absolute value – it would be nonsensical to attribute an (absolute) density to the continuum. Thus here exists no absolute scale, and the term $1/\sigma$ can be dispensed with.

Therefore we can state: the continuum has *no density*; σ has *no memory*.

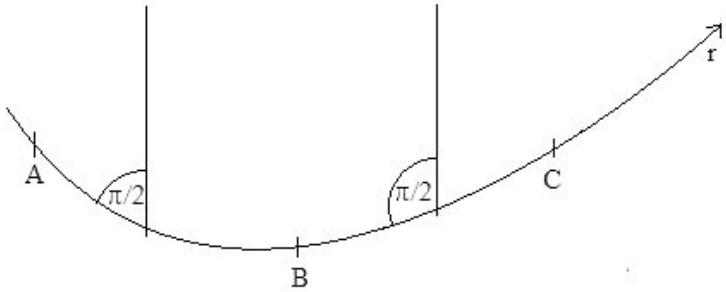
There is no absolute metric density, only density relations. From this follows in turn that there is no absolute size, only size relations.

Up to now, we discussed only a change of velocity that depends on the change of the *length scale,* which was illustrated by the points A, B and C in (S1) and (S2). However, in the case of a continuum with at least two dimensions, there are also changes of the *angle scale.* Let us first look at the "undistorted" case:



(S3)

The angle between the axis r and the direction of the second axis is constantly $\pi/2$. This holds true also in the next outline, however now the angle scale has changed in the following way:



(S4)

Let η be an angle parameter analogously to σ, i.e. a *metric angle density.* In (S4), this angle density decreases with increasing r.

Also in this case, we go out from the idea that B undergoes an acceleration back to its initial position. Thus we get to

$$\boxed{\frac{d\eta}{dr} = -\frac{1}{c^2}\frac{dw}{dt}} \qquad (2)$$

– where w is the velocity of the flow normal to r.

So σ has *two interpretations* in equation (1): as metric length density and as metric angle density. (The other denomination η was only introduced in order to differentiate between the two cases.) Both cases are equally fundamental.

1.5. Waves

From the dependency of σ and v, which is expressed by (1'), ensues a reverse dependency as follows:

In the below outline, v decreases in the direction of the flow. Therefore, at a length element at P, the inflow is greater than the outflow.

(S5)

As can be seen in (S5), the following applies

$$\frac{dv}{dr} = -\frac{d\sigma}{dt} \qquad (1a)$$

For comparison, the one-dimensional continuity equation for a length element *in the flow*:

$$\frac{dv}{dr} = -\frac{d\rho}{dt}\frac{1}{\rho} \qquad \text{(here, } \frac{d\rho}{dt} \text{ is the total derivative)}$$

The comparison[7] shows, that (1a) applies in general only if $\frac{d\sigma}{dt}$ is understood as total derivative. However we will differentiate σ only partially with respect to time. Therefore we must presuppose that the change of σ along r is negligible, and that, accordingly, the total derivative $\frac{d\sigma}{dt}$, which contains also a dependency of r ($\frac{d\sigma}{dt} = \frac{\partial\sigma}{\partial t} + \frac{\partial\sigma}{\partial r}\frac{dr}{dt}$), can be replaced by the partial derivative $\frac{\partial\sigma}{\partial t}$.

So we look at the case σ(r) = constant and start with a local change of σ or v. The following process will then be determined only by this first disturbance (and not by an already existing r-dependency of σ), in other words: by the equations (1') and (1a):

$$\frac{\partial\sigma}{\partial r} = -\frac{1}{c^2}\frac{\partial v}{\partial t} \qquad (1')$$

$$\frac{\partial v}{\partial r} = -\frac{\partial\sigma}{\partial t} \qquad (1a)$$

Differentiating (1') with respect to t leads to $\frac{\partial^2\sigma}{\partial r\,\partial t} = -\frac{1}{c^2}\frac{\partial^2 v}{\partial t^2}$

Differentiating (1a) with respect to r gives $\frac{\partial^2 v}{\partial r^2} = -\frac{\partial^2\sigma}{\partial r\,\partial t}$

[7] Also here, the term 1/ρ appears due to the fact that the magnitude of the change of the density depends on the deviation from an absolute standard value. In the case of σ, there is no such absolute scale but only relative changes, and therefore this term is again superfluous.

From this follows $$\boxed{\frac{\partial^2 v}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 v}{\partial t^2}} \qquad (3)$$

Thus we get waves in v, the velocity of which is c.

Following the same pattern, we get also waves in w:

From the equation $$\frac{\partial \eta}{\partial r} = -\frac{1}{c^2}\frac{\partial w}{\partial t} \qquad (2)$$

follows $$\frac{\partial w}{\partial r} = -\frac{\partial \eta}{\partial t} \qquad (2a)$$

and this leads to the wave equation

$$\boxed{\frac{\partial^2 w}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 w}{\partial t^2}} \qquad (4)$$

Due to the symmetry of the equations (1') and (1a) with respect to σ und v, and also of the equations (2) and (2a) with respect to η and w, we obtain analogously also *metric waves*:

In σ: $$\boxed{\frac{\partial^2 \sigma}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 \sigma}{\partial t^2}} \qquad (5)$$

And also in η: $$\boxed{\frac{\partial^2 \eta}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 \eta}{\partial t^2}} \qquad (6)$$

It should be noted that all these waves are waves within the longitudinal flow. With respect to the waves in σ and v, this follows from the fact that equation (1a) applies only to a length element in the flow itself.

Regarding equations (2) and (2a) – which relate to the transversal flow w – the following can be stated: if there is a longitudinal flow $\neq 0$ along r, then the relations described by these equations – and thus also the waves in η and w – apply to systems that are moving with the flow.

What are these waves?

The question arises, what the relation is between the waves just derived and waves of standard-physics.

Since we identify c with light speed and, accordingly, all waves travel at light speed, they must be related to electromagnetic or gravitational waves.

For the moment, however, such a relation is not in sight.

1.6. Notes

Short Summary

First, a brief sketch of the previous train of thought.

Being is not reduced to elementary entities but to *that what neither exists nor not-exists* and what is therefore *necessary.*

This is the *origin of everything.* It is inseparably bound to *change.* In order to make it *thinkable,* change must be ascribed to it *as attribute.*

As *that which* changes, it can then become the basic concept of the description of everything.

Change can be concretized on the basis of the necessary conditions of existence, which means: the quantities that change can be determined. This leads to the first physical law (1).

In this law, *length (or angle) scale* and *motion* are put into a mutual relationship, such that a change of scale leads to a change of motion and vice versa.

The differential law (1) weaves a continuum of flows and waves. From the differential scale the *metric* emerges, and the differential changes of motion result in the *metric flow.* In the flow there are *metric waves*.

Thus with the few hitherto taken steps we have arrived at a concept of a universe, which organizes itself in the form of flows and waves.

Relativity

Though equation (1) is not relativistic in the usual sense, it is still appropriate as basis for special relativity, as it contains only the time-dependent change of the velocity v. The absolute value of v has no relevance.

If one starts with equation (0'):

$$\frac{d\sigma}{dr} = \pm \frac{d\zeta}{ds}$$

and replaces s by ct, then follows

$$\frac{d\sigma}{dr} = \pm \frac{d\zeta}{d(ct)}$$

σ was interpreted as metric density. Therefore, in this equation, two metric densities are put into relation: a *spatial* density (the density of the r-axis or, alternatively, the angle density along r) and a *temporal* density (the density of the ct-axis).

If this equation is compared with (0")

$$\frac{d\sigma}{dr} = \pm \frac{d\frac{v}{c}}{d(ct)}$$

then can be seen that the ratio of v and c represents the metric density of the time-axis.

Combined with the previous statement, this means that the metric flow v contains the total metric information, i.e. the information, how lengths and times vary depending on the flow.

Of particular importance is that the concept established at the beginning – the *origin of everything* – is appropriate to solve the conceptual problems which exist since the introduction of the theory of relativity.

They have been mentioned already in the chapter on relativity in the First Part. It is the questions: *What oscillates in light waves?* and: *What mediates the temporal connections between systems located arbitrarily far from each other?* The absolute system (ether) does not exist anymore, only coordinate systems – but they *do not exist* and can therefore not mediate anything.

Thus one faces the paradoxical fact that although light exists *as a wave,* there is still nothing *which* oscillates. If there were an area of reality where there would be nothing but light, and then the light were removed, literally *nothing* would exist.

This, however, corresponds exactly to that which applies to the *origin of everything*: it is defined as *change* of AGENT – it exists *for us* only *as changing,* whereas *without change* it disappears.

In itself it is unthinkable: it does not divide into substance and accident. But it is inseparably bound to change. It is only there *as* change.

By ascribing change *as attribute* to it in order to turn it into the subject of a statement, we generate a paradox, because now we must think it also *without* change, and this is an inadmissible thought.

This means: the "undistorted" continuum of the special theory of relativity is an *idealization,* however in a much stronger sense than the notion "idealization" is commonly used: the undistorted continuum does not just represent a state which is never realized in nature, but rather a state, in which the respective area of reality would simply *not exist.*

In short: the undistorted continuum of the special theory of relativity does not exist. Reality is always change, and, as the equations hitherto established show, *metric change.*

Even shorter: though there is an oscillation, there is still nothing that oscillates.

(It should be mentioned that, in the First Part, the relativistic space time measures have been derived from the assumption that everything which exists must be understood as superposition of waves with light speed.)

So is there an absolute system?

Yes. But it is no ether, nothing "within" space, also not space itself, and no quantum vacuum. It is even not a reference system in the sense of special relativity.

Rather it is – as will be shown in the next chapter – a system of *accelerated metric flows*.

These flows occupy the whole universe – or, to put it correctly, they *are* the whole universe. Within them, time does not change and passes faster than in any local reference system that moves relative to the local metric flow. [8]

Thus special relativity is a pure description tool, which is justified only if the metric circumstances are in sufficient approximation identical with Euclidean metric. Ontologically, however, the undistorted continuum *does not exist.* What exists is a continuum in permanent metric change, and in such a continuum indeed exists an absolute system.

Thus the ontological status of a metric continuum, or say just: a metric, can – a little inaccurately – be seen as positioned *between* existence and non-existence: If nothing changes, nothing exists, but if there are changes, then they will, as described by the equations (1) and (2), be transported, so to speak, from point to point – and ultimately they will form a continuum that consists purely of *metric changes* and in which metric circumstances are connected with each other over arbitrary great distances.

With this, the conceptual paradoxes of the relativity of motion are completely cleared up.

As could be seen, for the explanation it was necessary to step out of the realm of physics. The paradoxes cannot be solved by physical concepts. Thus physics requires metaphysics; otherwise it would remain incomplete.

The results of this chapter prove the hypothesis that has been established in the First Part: *There is nothing but light speed.*

[8] This applies only to a universe without antimatter. More on that follows in chapter three "antimatter".

Now, however, the image is more complete, because now also the law is known which the waves are based upon, and because there are not only metric waves but also metric flows. But that had to be expected, since any local change, the periodic form of which can propagate wave-like, must also exist in a non-periodic form.

The Role of Mathematics

I take the assertion that "the undistorted continuum does not exist" as an opportunity to briefly discuss the ontological status of mathematics at this point of our trains of thought.

This assertion itself is definitely non-mathematical. It is an ontological assertion about a mathematically defined state – and this exemplifies precisely the relation in which mathematics and ontology stand here in general: the fundamental relation (1) is not brought forth by mathematics; indeed the reverse is true. As follows:

As will be shown subsequently, the fundamental law creates stationary states, i.e. space-time patterns that can be understood as objects. These objects can be counted and measured.

Counting and measuring, however, are the beginning of mathematics, which therefore, just as logic, owes its existence to experiences with objects.

Mathematics is based on – and develops from – that what reality is *for us:* relations between objects.

But reality *in itself* is continuous change. Therefore, description and reality touch one another only if the analysis, coming from counting objects, has finally – by successive definition of new kinds of numbers – captured the world of the infinitely small; only there, in the form of the differential quotient, thought as result of an unlimited process of size reduction, mathematics and reality *in itself* meet one another.

So we find ourselves in an epistemological circle. In order to describe the *origin of everything,* we must presuppose mathematics. However only in the description mathematics comes before the fundamental relation, in the reality the opposite is true: the fundamental relation is not only the origin of everything that exists but also the origin of mathematics.

In the Third Part I will discuss this issue in more detail. However it seemed important to me to outline the basic facts already here, because the role of mathematics is changed by these facts; at the

beginning, not mathematics but ontology has the final word, and at first it is even unclear whether and how far mathematical concepts – which, as just mentioned, originate in experiences on things – apply to circumstances that belong to a realm which lies logically and ontologically *before* the appearance of objects.

Scale and Motion

The only quantities hitherto used are *length, angle* and *time,* the only variables are *metric length density, metric angle density* and *velocity.*

This will remain unchanged in the course of my presentation. The universe outlined here is a *metric dynamic* universe, where only the above quantities are considered fundamental. All other quantities are derivative.

This is also important for the reason that physical circumstances are only conceivable to us if they can be reduced to metric and motion. The reason of the *disappearance of reality* described in the First Part lies not least in the fact that all other physical quantities – as e.g. energy or mass – have completely lost their ontological meaning. All that remains is their mathematical definition.

Already in the First Part, the reduction of the quantities *energy and momentum* to the quantities *frequency and wave-length* has proven to be necessary for the realistic interpretation of the interaction between radiation and matter. For the realistic interpretation of quantum mechanics in general was then required to understand *all* observables as derived from wave-attributes.

Here, this program shall be continued and concretized by the explicit deduction of physical notions and laws from metric dynamic circumstances.

On the first Law

Finally it should be stated that equation (1) does *not* represent an interaction.

It follows from two facts:

1. There is no existence without change.

2. There cannot be nothing; existence is necessary.

Therefore, equation (1) expresses exactly what the *origin of everything* is *for us*, i.e. what is logically and ontologically presupposed for everything that exists.

This means that this equation comes *before* any interaction; it is positioned, so to speak, on a "deeper" ontological level. It is a necessary condition for the development of *metric patterns* – in the simplest case stationary states of the metric flow – which represent *objects*. Only the effects that these objects exert upon one another can then be understood as interactions.

If we now proceed to the description of interactions and structures, the following must always be kept in mind: Whatever exists, whatever happens – it is in any case *exclusively* the first law that executes itself. There is only this one law. Each causal connection stems from it. *Everything* is a consequence of the differential causal chains that are described by equation (1).

From this follows:

Structures can only develop through self-organization. If they exist over a certain period of time, then they must be regarded as *attractors* of the continuum dynamics.

Thus the concept "attractor" replaces the concept "particle" and becomes the ontological basis of the concept "object". It is of utmost generality: it is applicable to (almost) all beings, from the simplest to the most complex ones, from "elementary particles" up to "mental states", that is: *qualia*.

Also the processes that occur in *interactions* result directly from the execution of the first law – in this case, however, under the assumption of *additional order* which can be defined by metric conditions. Therefore also the interaction laws are a consequence of self-organization of the continuum: *they emerge together with the objects* and express their mutual influence.

In this Second Part of my work, I shall deal only with the simplest stationary states and specify their metric definitions. Hence gravitation, electromagnetism and atomic structure can be derived.

In the Third Part, however, the concept "attractor" and the conclusions connected with it will play a central role.

2. Gravitation[9]

The program of this chapter is to demonstrate that the concepts *metric density* and *metric flow* permit an alternative view of gravitation, which can be understood as *basic mechanism of gravitation.* In the following, the spherically symmetric, stationary case will be examined; A simple metric assumption leads at first to predictions that are identical with the Newtonian approximation, and then – without additional assumptions, only through a more precise analysis of the scenario – also to predictions that match those of the theory of general relativity.

However, the view of gravitation changes completely, because in the metric dynamic universe there is no force as in the Newton model, no space-time metric as in the Einstein model, and finally also no mass measured in Kilogram (or energy measured in Joule) as cause of gravitation, but only metric length-density and metric flow.

2.1. The metric-dynamic View of Newton's Approximation

We look at an n-dimensional continuum ($n > 1$). Let r be the distance of an arbitrary point P from a point O, which we choose as origin of our coordinate system. Let m be a given distance ($m > 0$).

We presuppose equation (1') $\quad \frac{d\sigma}{dr} = -\frac{1}{c^2}\frac{dv}{dt}$

The question is: How can the gravitation of a central mass resting in O be defined as a purely metric-dynamic phenomenon?

Our goal is to model a spherically symmetric, steady state, which is defined by the fact that the acceleration points in the direction of the center O, decreases with increasing distance from this center and becomes 0 at infinity. We achieve this through the following metric assumption:

$$\sigma = \frac{r - m}{r} \qquad (\sigma \text{ is the metric density of the length}) \qquad (7)$$

[9] In Section 2.4, there are two errors; The result – the Schwarzschild Metric – is nonetheless correct, because the errors annul each other. In Section 2.5, the sketch (S9) and the according explanation are wrong. For the correct versions see my paper *Does Dark Matter Exist?*

– where r is the distance PO *before* the metric change, (r – m) the distance PO *after* the metric change.[10]

(7) differentiated with respect to r gives

$$\frac{d\sigma}{dr} = \frac{m}{r^2} \qquad \text{According to (1')} \qquad \frac{d\sigma}{dr} = -\frac{1}{c^2}\frac{dv}{dt}$$

follows $$\boxed{\frac{dv}{dt} = -c^2\frac{m}{r^2}} \tag{8}$$

If in (8) m is interpreted as *geometric mass* $\left(m = \frac{MG}{c^2} \right)$

then applies $$\frac{dv}{dt} = -\frac{MG}{r^2} \tag{9}$$

Thus, equation (8) is the *Newtonian gravitational acceleration* in the case of a central mass M.[11]

The cause of Newton's gravity is the force exerted by a central mass. **In the metric dynamic model, the mass M is replaced by a metric defect m**, from which follows a change of the metric density, which in turn results in an acceleration towards the center.

What is actually accelerated? – Other than in Newton's model, here dv/dt in equation (8) or (9) is not an acceleration that acts on *objects*. Rather it is *the time-dependent change of the radial metric flow* v: **the continuum itself flows accelerated towards the center**.

We determine the size of this flow. First we must rearrange (1'):

$$\frac{d\sigma}{dr} = -\frac{1}{c^2}\frac{dv}{dt} \quad \rightarrow \quad d\sigma = -\frac{1}{c^2}\frac{dr}{dt}\,dv$$

[10] Details see Section *2.3. The Transition to the Metric View.*

[11] According to equation (8), the gravitational acceleration is proportional to the metric defect m and to $1/r^2$. The proportionality constant is c^2. This means: in the metric dynamic description of gravitation, there is no independent gravitational constant.

Since the continuum itself flows towards the center, $\frac{dr}{dt}$ must be understood as v, and then follows

$$d\sigma = -\frac{1}{c^2}\, v\, dv \qquad (10)$$

Integration gives $\sigma = -\frac{1}{c^2}\,\frac{v^2}{2} + C$

According to (7) $\sigma = \frac{r - m}{r}$

follows $1 - \frac{m}{r} = -\frac{1}{c^2}\,\frac{v^2}{2} + C$

The integration constant C follows from the condition $v = 0$ for $r \to \infty$.

Therefore $C = 1$

Thus we get $\frac{v^2}{2} = c^2\,\frac{m}{r}$

and finally $\boxed{v = \pm c\sqrt{\frac{2m}{r}}} \qquad (11)$

(11) corresponds to Newton's equation for the gravitational velocity (in the case of a fall from infinity) at a geometric mass m ($m = MG/c^2$). Here, however, v is not interpreted as velocity of a falling object but as *velocity of the radial metric flow.* It must have the same direction as the acceleration in (8). Therefore, in (11) the negative sign must be chosen.

As is known from the considerations of 1.4 and 1.5, in the flow there are metric waves traveling with light speed relative to the flow.

Note: Actually, the wave equation (3) does not apply here, because σ depends on r. If the neighborhood of any point P, however, is chosen small enough, so that the metric correspond to a Euclidean metric with sufficient accuracy, then it can be asserted that in this neighborhood waves with the speed of light exist.

Now there are two possibilities; either we continue to look at the scenario from a Cartesian coordinate system – let us call it K – and additionally take into account that v is the velocity of the continuum flow, or we use a local system as starting point for the transformation to a relativistic reference system.

The second option we will discuss later. First, we turn to the first variant.

2.2. The exact View from outside; some simple Calculations

Let us pause for a moment to think about what we actually observe, and what position we take.

We look at the scenario from a non-relativistic Cartesian coordinate system K.

Since the waves with light speed which we observe are waves *in the flow,* the light speed is *not constant* with respect to K. E.g. light moving towards the center has the velocity c + v, and light moving in the opposite direction the velocity c – v.

So we are not observers who belong to the *real* scenario. K is *nothing but* a coordinate system, and we look at the metric flow where – as seen from us – waves with velocities c + v and c – v propagate, in the same way as we would look at a river where – as seen from the bank – waves move faster in the direction of the flow than waves that move against it.

Thus our point of view is not the usual relativistic observer viewpoint. We reside so to speak *outside* of the universe – and nothing can be objected against such a viewpoint, if something observable can be derived and if the return to an observer system is possible.

The change from the viewpoint of Section 2.1, where the Newtonian gravitational acceleration was derived purely formally, can be described as follows:

Now we take into account that the waves, which the acceleration acts upon, do not exist in the coordinate system K but *in the flow.* The metric continuum itself flows accelerated towards the center and disappears there like in a drain, and the waves with light speed flow with it.

However, as stated in the First Part, *everything that exists* is a pattern of superpositions of these waves. Thus there is nothing but these waves, and therefore the paths of objects must follow from the analysis of the paths of the waves with light speed within the accelerated flow – and the results must be *exact,* because the scenario is determined without the use of any approximations.[12]

This shall now be demonstrated by some well-known examples.

As can be seen already at first glance, some phenomena are particularly easy to understand from our point of view:

E.g. from (11): $$v = -c\sqrt{\frac{2m}{r}}$$

follows that at r = 2m the velocity of the flow is equal to light speed. This means that at r = 2m waves traveling with light speed against the direction of the flow cannot move outwards but are standing still. This is a particularly simple case of analyzing a light path!

Moreover, it is immediately clear that within a radius of 2m no static relativistic reference system can be established, since here is v > c. The light paths, however, can also in this area easily be analyzed.

We will now perform some calculations.

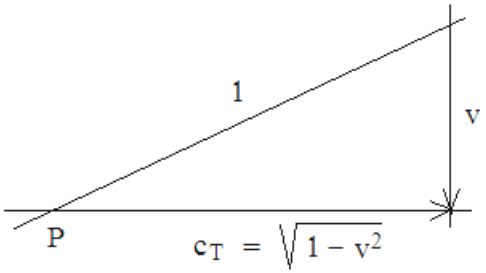
Closed circular Path of the Light

First we determine the distance from O where light propagates at a closed circular path. (This is already a significant test of our model, because the solution is located near the center, which means: in an area where approximations – e.g. the Newtonian approximation – differ greatly from GR.)

In order to determine this distance, we must factor in the shifting of the light rays by the flow.

(In the following, c is set equal to 1)

[12] In the approximation without the flow, the assumption that objects are wave superpositions has no consequences: it does not matter whether the acceleration acts on the waves or directly on the objects. However determining the object paths *in the flow* is only possible on the basis of this assumption, as will be shown in the following.



(S6)

v is the velocity of the flow, c_T is the tangential velocity of the light at a point P that lies on the sought circular path. (With respect to K, the speed of the light is changed due to the flow.)

According to (11), the absolute value of the flow is

$$|v| = \sqrt{\frac{2m}{r}}$$

According to (8), there is an acceleration field

$$\frac{dv}{dt} = -\frac{m}{r^2}$$

In a system *without flow,* the equilibrium condition for a circular path in the case of this acceleration is

$$\omega^2 r^3 = m \qquad (\omega \text{ angular frequency})$$

From this follows $v_T = \omega r = \sqrt{\frac{m}{r}}$ (v_T absolute value of any tangential velocity)

Thus the equilibrium condition is

$$v_T = \sqrt{\frac{m}{r}} = |v| \frac{1}{\sqrt{2}} \qquad (v \text{ flow velocity})$$

So we must find the distance r where the *flow-corrected* speed of the light c_T assumes this value of v_T.

It holds that $c_T = \sqrt{1-v^2} = \sqrt{1-\frac{2m}{r}}$

Therefore, taking into account the flow v, the equilibrium condition is

$$c_T = \sqrt{1-\frac{2m}{r}} = \sqrt{\frac{2m}{r}}\,\frac{1}{\sqrt{2}}$$

From this follows $1-\frac{2m}{r} = \frac{m}{r}$

and, finally $r = 3m$

So we obtained the well-known result.

Perihelion Precession

The same scheme can be used for calculating the perihelion precession:

We start again with the equilibrium condition for a circular path:

$$v_T = \sqrt{\frac{m}{r}}$$ (v_T absolute value of the tangential velocity)

As before, due to the flow, the tangential velocity must be corrected. If v_T is reduced by the factor

$$k = \sqrt{1-v^2} = \sqrt{1-\frac{2m}{r}}$$

– then this reduced[13] v_T is now – with respect to the acceleration field

$$\frac{dv}{dt} = -\frac{m}{r^2}$$

– *too slow* for a circular path. Thus we must move nearer to the center, i.e. we must find the distance r', where v_T is increased by the factor 1/k, so that at this distance the equilibrium condition is met again (with sufficient approximation).

So we set $$\sqrt{\frac{m}{r}}\,\frac{1}{\sqrt{1-\frac{2m}{r}}} = \sqrt{\frac{m}{r'}}$$

Then $$\frac{m}{r} = \frac{m}{r'}\,(1-\frac{2m}{r})$$

This gives $$r' = r - 2m.$$

Thus the equilibrium condition for the flow-corrected tangential velocity is met at the distance r – 2m.

Instead of $\omega^2 = \frac{m}{r^3}$ we must therefore set

$$\omega'^2 = \frac{m}{(r-2m)^3} = \frac{m}{r^3\,(1-\frac{2m}{r})^3}$$

$$\omega'^2 \approx \frac{m}{r^3}\,(1+\frac{2m}{r})^3 = \omega^2\,(1+\frac{2m}{r})^3$$

[13] Since *every* motion must be seen as composed of light paths (there is only light speed!), the correction factor remains the same in all cases. Always light paths are corrected; any v < c, which is not a flow velocity, must be understood as an interference phenomenon.

$$\omega' = \omega\ (1+\frac{2m}{r})^{\frac{3}{2}}$$

$$\frac{\omega'}{\omega} = (1+\frac{2m}{r})^{\frac{3}{2}} = 1 + \frac{3}{2}\frac{2m}{r} + \frac{3}{8}(\frac{2m}{r})^2 + ... \approx 1 + \frac{3m}{r}$$

Thus the perihelion precession is equal to $\frac{3m}{r}$, and this is exactly the result that follows from the theory of general relativity.

Light Deviation

Here, nothing at all must be calculated. The result can just be *seen*.

The Newtonian light deviation can be presupposed. Let the deviation angle be δ.

As before, the acceleration

$$\frac{dv}{dt} = -\frac{m}{r^2}$$

must be taken into account. According to our presupposition, it gives the angle δ. Then the shifting of the light rays by the flow must be factored in. However since the flow velocity

$$v = \sqrt{\frac{2m}{r}}$$

is equal to the fall velocity in the case of the Newtonian acceleration, it is evident that the displacement caused by the flow makes the same contribution to the deflection of the light as the acceleration.

Thus the deflection is twice as large as in the Newtonian approximation, which means it is equal to 2δ.

2.3. The Transition to the Metric View

As mentioned at the end of section 2.1, a local system S_F that moves with the flow can also serve as starting point for the transition to a relativistic observer system S_E . ("Local system" means: of such a small extent, that the length-differentials remain constant in sufficient approximation.)

The first step is to connect the scenario just created with the usual metric concepts used for the description of gravity.

For this purpose, we define σ as follows:

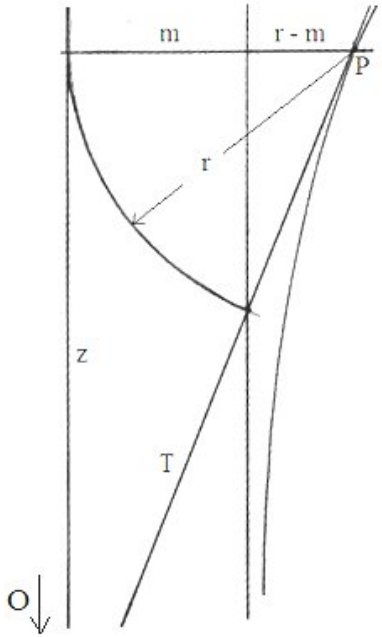
Let dr be the radial length differential of the "undistorted" continuum, dr' the length differential of the distorted gravitational continuum. Then we define

$$\sigma = \frac{dr}{dr'} \tag{12}$$

With (7) $\sigma = \frac{r - m}{r}$

follows $\frac{dr}{dr'} = \frac{r - m}{r}$ or $dr' = (1 - \frac{m}{r})^{-1}\, dr$ (13)

The following outline illustrates the metric conditions:



(S7)

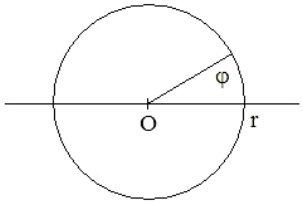
z is the axis of the auxiliary dimension. P is a point on the curve that represents the altered radial measures (dr' corresponds to the length differential of the curve). T is the tangent at P.

As can be seen in the outline, it holds that $(r - m)/r = dr/dr' = \sigma$. (In the following, I will use dr_N instead of dr'.)

Thus we know at any point the slope dz/dr of the curve. Integration, however, is not possible – the curve lies "at infinity". However this is not relevant – the outline serves only for illustration.

In the multidimensional case it is – due to the spherical symmetry of the scenario – sufficient to describe the metric conditions on an arbitrary plane through O.

Let r and φ be polar coordinates:



(S8)

Then the *non-relativistic* system S_N, that represents the metric conditions of the continuum in the case of a central geometric mass m, is characterized by

$$S_N : (dt_N = dt,\ dr_N = (1 - \frac{m}{r})^{-1} dr ,\ d\varphi_N = d\varphi) \qquad (14)$$

Compared with an undistorted continuum, only the radial differential dr is changed. The time differential dt and the angle differential dφ remain identical.

Note: From the construction of the tangent in the outline (S8) follows that the point P, whose distance from z *before* the metric alteration is equal to r (with $r \geq m$), lies – with respect to the length scale dr_N that applies in P *after* the alteration – at the distance r – m. This holds true for all P, also for those that lie arbitrarily close to the intersection of the curve with the r-axis. Therefore it can be stated:[14]

$$r_N = r - m$$

Seen in this way, the S_N-continuum lacks m length-units at any direction from O. According to (7), σ represents the ratio between the distance PO *after* the alteration and the same distance *before* the alteration (measured with the scales that apply in the respective system):

$$\sigma = \frac{r - m}{r} = \frac{r_N}{r} \qquad (15)$$

[14] One could also simply imagine moving from P along the curve up to the r-axis. Then one has, measured by dr_N, covered the distance r – m. At the point where one arrives at the end, dr_N/dr will be infinite, which means, the differential dr_N is no longer infinitely small but finite, and accordingly the distance to the center measured by it will be zero. Thus the total distance between P and the center O amounts to r – m. (A bit more on that issue will follow in the subsection "The Area r < m".)

This permits an alternative definition of the metric of S_N:

$$\frac{dr}{dr_N} = \frac{r - m}{r} \quad \Leftrightarrow \quad \frac{dr}{dr_N} = \frac{r_N}{r} \tag{16}$$

The hitherto used description of gravity is *non-relativistic.* Thus there are no alterations of lengths and times due to a relative movement. Therefore, what has been said about the measures of the system S_N that rests relative to O holds also true for a (local) system that moves with the flow.

2.4. The Transition to Einstein's Gravity: The Schwarzschild-metric

Now we will perform the transition to a relativistic reference system S_E that rests with respect to O.

Since the flow velocity is known, it would be possible to transform from a local *relativistic* reference system S_F that moves with the flow to a local relativistic system S_E that rests relative to O. For this purpose, however, the length of the differential dr_F of S_F is required. How can dr_F be determined?

The radial differential of the Newtonian reference system S_N is known. Here, the description is non-relativistic, and therefore this differential is equal to the differential of a local *non-relativistic* system S_{F_0} within the flow, where the (local) light speed is nonetheless *constant*.

Thus, according to (14) $\quad dr_{F_0} = \left(\frac{r - m}{r}\right)^{-1} dr \tag{16'}$

and, after (16) $\quad dr_{F_0} = \left(\frac{r_{F_0}}{r}\right)^{-1} dr \tag{16''}$

According to this definition, the metric is determined only by *one single factor*: by the quotient of the radial distances *without* gravity (r) and *with* gravity (r – m or r_{F_0}).

Thus now we have to ask: How does this factor change at the transition from the non-relativistic to the relativistic flow-system? If the distance of a point P from O with respect to S_{F_0} is equal to r – m, what is then the distance PO with respect to the *relativistic* flow-system S_F?

This can be answered in the simplest way as follows. The velocity of the flow is

$$v = -c\sqrt{\frac{2m}{r}}$$

At the distance 2m, the flow reaches light speed. Thus at this distance, any finite radial distance of the resting system – as seen from the flow system – becomes zero, such that any point, which lies at the distance 2m from O, will have – seen from the flowing, relativistic continuum – the distance zero. With this, for any point at a distance r with $r \geq m$, the distance from O has decreased by 2m. Therefore, in the relativistic view, the continuum does not lack m but 2m units at any direction from O.

Thus, at the transition from S_{F0} to S_F, in the factor by which the metric is defined the quantity m has to be replaced by 2m. (This change affects only the length differential, the time- and angle- differential remain unchanged.) Therefore it holds that

$$dr_F = \left(\frac{r - 2m}{r}\right)^{-1} dr \qquad (17)$$

Can we actually dispose of the radial length differential in this way? Would not the velocity and acceleration of the flow have to change?

No. v and dv/dt were determined without relating to the metric conditions in the flow. They followed from the basic equation (1')

$$\frac{d\sigma}{dr} = -\frac{1}{c^2}\frac{dv}{dt} \qquad \text{and from (14)} \qquad \sigma = \frac{r - m}{r}$$

Only by the definition (12)

$$\sigma = \frac{dr}{dr'}$$

the connection between metric conditions and velocity or acceleration was introduced. This definition of σ, however, must be abandoned after the transition to a relativistic view. In a relativistic reference system, σ is no longer a metric density.

According to (17), a local system S_F within the flow is characterized by

$$S_F : (dt_F = dt,\ dr_F = (1 - \frac{2m}{r})^{-1} dr ,\ d\varphi_F = d\varphi) \qquad (18)$$

(As before, only the radial differential is changed.)

Now we can (for any r with r > 2m) transform to a local system that rests relative to O.

This can simply be carried out by multiplying the length differential of S_F with the factor k of the Lorentz transformation ($k = \sqrt{1-\frac{v^2}{c^2}}$) and dividing the time differential by this factor.[15]

According to (16) $\quad v = \pm c\sqrt{\frac{2m}{r}}$

applies $\quad k = \sqrt{1-\frac{v^2}{c^2}} = \sqrt{1-\frac{2m}{r}} \qquad (19)$

Then the radial length differential dr_E of S_E is

$$dr_E = dr_F\ k = dr\,(1 - \frac{2m}{r})^{-1}\ (1 - \frac{2m}{r})^{\frac{1}{2}} = dr\ (1 - \frac{2m}{r})^{-\frac{1}{2}}$$

And the time differential dt_E is

$$dt_E = dt\ (1 - \frac{2m}{r})^{\frac{1}{2}} \qquad (\text{note } dt_F = dt)$$

[15] Even if the Lorentz transformation was not known from standard physics, it could be presupposed here, since in the First Part – in the chapter on relativity – it was shown that it follows from the assumption: *everything which exists and which happens is an interference phenomenon, a pattern of superpositions of waves with light speed.*

The totality of these local systems represents the Schwarzschild metric:

$$ds^2 = (1 - \frac{2m}{r})\,dt^2 - (1 - \frac{2m}{r})^{-1}\,dr^2 - r^2\,d\varphi^2 \qquad (20)$$

(20) applies to any plane through O.

r dφ remains again unchanged. The perimeters have never been altered.

2.5. Summary, Additions

The results of the previous sections justify the following assertion:

In the metric dynamic view, the gravitational field of a central geometric mass m ($m = MG/c^2$) is a spherically symmetric steady state, which is defined by an accelerated radial metric flow v(r) towards the center

The velocity of the flow is $v = -\sqrt{\frac{2m}{r}}$

The acceleration is $\frac{dv}{dt} = -\frac{m}{r^2}$ (m geometric mass, c = 1)

The cause of the flow is a metric change: the continuum lacks m units in all directions from the center, i.e. every radial distance – measured with the scales of the system – is by m units smaller than in the undistorted continuum.

Within the accelerated flow there are waves with light speed. The paths of objects can be determined on the basis of the hypothesis that all objects are superpositions of such waves.

(This method has been demonstrated here using the example of the perihelion precession.)

Gravity defined in this way leads in the spherically symmetric case to results that match those of the general relativity theory. From the metric of the local non-relativistic reference systems within the flow, the metric of the local relativistic reference systems can be derived. The totality of these local systems represents the Schwarzschild metric.

It is not likely, however, that the congruence with the results of the general relativity theory is limited to the spherically symmetrical case.

Thus we define:

Gravity is the generic term of all dynamic phenomena which can be attributed to the longitudinal metric flow v that results from equation (1'):

$$\frac{d\sigma}{dr} = -\frac{1}{c^2}\frac{dv}{dt}$$

From this follows that the waves of the equations (3) and (5)

$$\frac{\partial^2 v}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 v}{\partial t^2} \qquad \frac{\partial^2 \sigma}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 \sigma}{\partial t^2}$$

are *gravitational waves.*

This assertion seems at first strange, especially because of the restriction to changes of the *longitudinal* metric flow. It should be noted, however, that the above wave equations have such a simple form only due to two reasons: *first* they describe waves that propagate *with* the flow, and *second* they are not valid with respect to a relativistic reference system but with respect to a *non-relativistic* reference system, so to speak as seen from outside of the universe.

The difference between the metric dynamic model and general relativity can be expressed in the following way:

In the general theory of relativity, there is a space time coordinate grid, and distortions of the grid lead in general to a change of all components; length and angle changes are not separable.

In the flow model, there is not a space time coordinate grid but only a spatial flow consisting of *flow lines*. In the flow, time never changes. In the spherically symmetric case, the flow velocity corresponds – as has been shown – to the Newtonian fall speed (at the fall from infinity). The only other variable is the metric density along the flow lines. This means: only the longitudinal metric changes are relevant; changes of the metric angle-density do not occur.

The universal Flow-Field

In the case that there is not only a single mass but many masses distributed over a metric structure (e.g. a universe) the following applies:

The acceleration field of any mass, i.e. the field which the flow velocity depends on, is *exactly* $-m/r^2$.

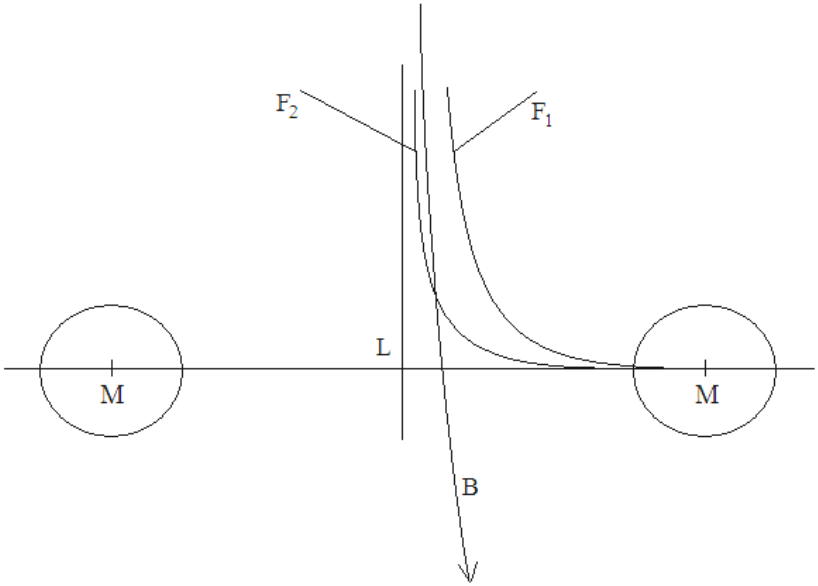
In order to determine the flow lines, first the points must be located where the total acceleration (the sum of the accelerations of all masses) is equal to 0. If, in such a point, the outwardly oriented acceleration increases in all directions, then this point is a *source* of the universal v-field.

From these sources, the flow lines lead into all directions. A subset of the flow lines ends in *sinks,* i.e. in the singularities within black holes.

The flow lines follow at any point exactly the direction of the total acceleration, and the flow velocity at a certain point is always equal to the integral of the acceleration along the flow line from the source up to this point.

Other than in the spherically symmetric case, however, the flow lines do not correspond to the paths of test-bodies in the Newtonian field, since in the case of test bodies inertia forces (conventionally spoken) must be taken into account, whereas the flow lines are always parallel to the direction of the acceleration.

Here an example for illustration:



(S9)

L is the medium point between the two equal masses M. F_1 and F_2 are flow lines. B is the path of a test body. It can be seen that no flow line intersects the straight connecting the two masses (no acceleration leads across this straight). L is not a source: in L, the total acceleration is indeed 0, but the outwardly oriented acceleration does not increase in all directions.

The flow lines, which, coming from above, lead through L, would be rectangular at L – however this is just a hint that the picture of the smooth metric flow cannot apply up to arbitrarily small distances.

Actually, the two masses do not rest but rotate around L. Therefore, the flow lines F_1 and F_2 spiral around the symmetry axis through L.

This torsion of the flow lines is an important fact, because the strength of gravity is changed by it.

The objects determine the flow lines. Reversely, they are embedded in the flow lines, such that their dynamics is determined by the flow field.

In the flow, time never changes. Because of equation (1') and due to the definition $\sigma = dr/dr'$, any flow velocity v is connected with a certain length differential dr'(v) in the flow (see equation (34') at the end of the next chapter on antimatter). Therefore, if the flow velocity is known, it is possible to change over from the local flow system to a relativistic observer system through the Lorentz transformation. And if size and direction of the flow are given at any point, then the metric of the respective area is determined by the totality of the local observer systems.

Of particular importance is that, in the metric dynamic view, gravity is not limited to phenomena that occur due to mass or energy. The universe is understood as process of self-organization by flows and waves, and it must be assumed that the phenomena which are usually denominated "gravitation" are just *one variant* of all the dynamic phenomena that follow from the longitudinal metric flow, and that they might even be an exception.

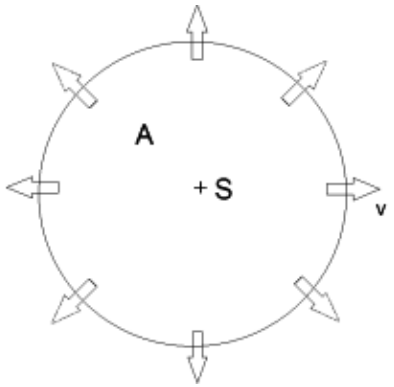
More on this question will follow in the chapter on cosmology.

Also in the description of gravity, the concepts *metric density* and *metric flow* have proven sufficient. It was not necessary to involve any other physical concepts.

Note:

In all considerations about the metric flow, it must be kept in mind that there is *no absolute metric density* but only relative density alterations.

The following outline illustrates this fact:



(S10)

Here, a metric flow exists that leads from A to the outside and is equal in all directions. Let us assume this flow to be time-independent. Then in A – despite the flow – the metric density does not decrease.

With this, the following fact is connected:

What was previously called *source* of the flow field is not a source in the usual sense: in the point S, the metric flow starts with the velocity zero. Thus there is no real "inflow".

The Choice of the Sign

In the equation for the velocity of the radial metric flow

$$v = \pm\sqrt{\frac{2m}{r}}$$

we have taken into account only the negative sign. In the case of the positive sign, the direction of the flow would be opposite to the direction of the decreasing metric density, in contradiction to the original assumption in 1.4.

Logically, however, also the positive sign is possible. Then one would have to start with an outwards directed flow $v = \infty$ at the singularity. Thus abandoning this possibility corresponds to the usual assumption that there are no "white holes".

The Area r < m

Because of the relations (see Section 2.3.)

$$\sigma = 1 - \frac{m}{r} = \frac{dr}{dr'} \qquad dr' = (1 - \frac{m}{r})^{-1}\, dr$$

the metric density in a point P at the distance m from the center O is equal to zero. The differential dr' becomes finite at this point, so that this distance, measured by dr', is also equal to zero. (At the transition to a relativistic reference frame, m must be replaced by 2m.)

In the Schwarzschild metric, the problem that there is no space at all within 2m can be solved by transformation to another coordinate system. However, in the metric flow concept of gravity this is not admissible, because here the time within the flow does not change.

Of course one can first change over to the Schwarzschild metric and *then* carry out the coordinate transformation. Since the flow concept, however, stems directly from the *origin of everything* and claims therefore to be not just a formal alternative version of gravity but to correspond also ontologically with the real conditions, this approach is unsatisfactory.[16]

Thus I will outline in short, how the metric facts could be interpreted using the resources of non-standard analysis.

We start with the question: If the metric density becomes zero at m, would the continuum *rip* at this point?

Not necessarily. It depends on how it is defined. A continuum whose points correspond to real numbers would rip. But it is possible to define numbers that lie *between* the real numbers. For this purpose, one first defines positive numbers q_1 such that for all these numbers and for all positive real numbers q applies: $0 < q_1 < q$. (Any q_1 is greater than 0, but smaller than any positive real number. The differentials of standard analysis can be defined by such numbers.) Then numbers of the form $(\pm q + q_1)$ lie between the real numbers. Now one repeats the whole procedure with respect to these new numbers and obtains again new numbers $(\pm q + q_1 + q_2)$, which in turn lie between the numbers $(\pm q + q_1)$. Intervals whose lengths correspond to a number q_2 are called *second order differentials*.

A continuum that corresponds to numbers $(\pm q + q_1)$ does not rip if it is stretched so far that distances with a length q_1 (the "normal" first order differentials) become finite, because then intervals with a length q_2 fill out the now finite first order differentials: the numbers $(\pm q + q_1)$ lie still dense and thus prevent the ripping.

Now to the question: Is there actually no space within m?

In the continuum that consists of real numbers, the answer is *yes*. If a point P lies at the distance m, then this distance, measured by the differential dr' – which is now *finite* –, becomes actually zero.

[16] It is always possible, however, to fall back on the simple description based on the "absolute viewpoint from outside", which was performed in Section 2.2.

However, in a continuum of the type just described, this is not the case. Here, the distance between P an O is not equal to zero but equal to a number q_1, and second-order differentials ensure that the metric relations remain defined.

In this way, the concept of metric density can also be applied to the area $r \leq m$. This is necessary, because the circumferences of circles with radii $r \leq m$ remain unchanged, which means they are equal to $2\pi r$ – and they are also seen as such from the outside space –, so that the space in this area cannot simply disappear.

Note on black holes

In the usual general relativistic approach, the action of gravitation leads to the formation of a singularity within the black hole.

From the metric-dynamic point of view, however, that does not seem plausible. Here, gravitation is understood as *metric compression*, caused by self-organization of the metric structure – that is: of the universe.

In the usual approach, gravitation is simply "there" and does not stop acting, whereas in the metric-dynamic approach, it is *caused* by metric waves, and it can not be assumed that the waves can condense *themselves* to a singularity.

Therefore, in the metric-dynamic view of gravitation it is more probable that inside of black holes there is no singularity but a wave phenomenon that perpetuates the metric state by which the black hole is defined.

2.6. The hybrid System

At the transition from the Newtonian approximation of gravity to Einstein's version it was necessary to correct the factor, by which the metric is defined, from $(1 – m/r)$ to $(1 – 2m/r)$.

However what would be the case, if the special relativity theory was part of physics, but the transition from Newton's gravity to the general relativity theory would *not* have taken place?

Then the non-relativistic point of view would have to be maintained – exactly how it was done in Section 2.3 – and the metric factor would remain $(1 – m/r)$.

If the metric flow was factored in *under this condition*, then to its velocity would apply

$$\boxed{v = -\sqrt{\frac{m}{r}}} \qquad (21)$$

– because only then the flow velocity would be equal to the light speed at r = m, such that the distance of this point from O would be zero, as required by the metric of the system S_N (see (14), (15), (16)).

Formally, this result is achieved if, on the one hand, the equation is applied that is valid in the relativistic view:

$$dr' = dr\,(1 - v^2)^{-1} \quad \text{or} \quad dr/dr' = (1 - v^2)$$

and, on the other hand, the definition of σ is maintained

$$\sigma = \frac{dr}{dr'}$$

With $\sigma = 1 - \frac{m}{r}$ this leads to

$$1 - \frac{m}{r} = 1 - v^2$$

and therefore $v = \pm\sqrt{\frac{m}{r}}$

As a consequence, the *relativistic* local flow system S_F of (18)

$$S_F : (\, dt_F = dt,\ dr_F = (1 - \frac{2m}{r})^{-1}\, dr\,,\ d\varphi_F = d\varphi\,)$$

changes to S_F', which is characterized by:

$$S_F' : (dt_F = dt,\ dr_F = (1 - \frac{m}{r})^{-1} dr ,\ \ d\varphi_F = d\varphi)$$

Thus, in the hybrid system, the relativistic local reference system S_F' in the flow corresponds to the local flow-system S_{F0} that emerges from the Newtonian system by a Galilean transformation.

(As a reminder: the differential measures of S_{F0} are identical with the ones of the Newtonian system of (14):

$$S_N : (dt_N = dt,\ dr_N = (1 - \frac{m}{r})^{-1} dr ,\ d\varphi_N = d\varphi))$$

Why this hypothetical variant?

Because in the following it will actually be necessary to apply the value from (21) to the flow velocity.

The reason is that, in current physics, all interactions except gravity occur within the flat space-time. From the metric-dynamic point of view, however, this is exactly the state in which gravity has been before Einstein: the state before the metric substantiation of the interaction.

So if we aim at reconstructing various known physical relations based on the concept of metric and flow, these reconstructions will only be possible using the flow value of equation (21). The factor 2, which occurs only due to the transition from a description in the flat space-time to a relativistic description based on a change of the space-time metric, does not appear.

I call such a system a "hybrid system", because it contains, on the one hand, the pre-metric view – which is indeed necessary for reconstructing relations that belong to this view – and, on the other hand, also the metric flow that is the basic concept of the reconstruction.[17]

[17] By the way, I have always been wondering about the fact that the Schwarzschild solution of Einstein's field equations corresponds only to the Newtonian approximation in the case of sufficiently weak gravity, if, at the end of the derivation, as integration constant not m, but 2m (exactly: $\ln(2m)$) is chosen. The geometric mass m and the Newtonian mass M are connected only by natural constants ($m = MG/c^2$). So why should a factor 2 occur?

2.7. Concluding Remarks

If the fundamental law (1) represents indeed the *mechanism of the universe,* then gravitation must follow from this law.

In this chapter, it was demonstrated that this is true.

The fundamental law has two interpretations: the one relates to changes of the length scale, the other one to changes of the angle scale. Gravitation can be identified with the laws that follow from the changes of the length scale. In particular, the gravitation exerted by a central mass corresponds to a stationary spherically symmetric flow towards the center.

However I presented not a theory but only the design of a theory. This design proved successful in some applications. (It seemed appropriate to me to choose the first two historical tests of general relativity.)

In the simple cases analyzed here, the results correspond to those of general relativity. Does this mean the new theory will be merely a variant of the general theory of relativity?

No, because there is the following fundamental difference:

Compared to a Euclidean continuum, the continuum of the general theory of relativity is distorted, but it is (at least in general) *static,* whereas the metric dynamic continuum is *dynamic:* it organizes itself through flows and waves. Therefore the metric dynamic view leads to a completely different cosmology. This will be discussed later. At this point, I shall emphasize another difference that is of particular importance:

Due to the fact that, in the metric-dynamic view, gravitation relates only to the changes of the length measures, there is room for other interactions within three-dimensional space.

The angles are not involved. Therefore it is possible to assign the electromagnetic interaction to the changes of the angle measures. (This will be carried out in the 5th chapter.)

I think, the explanation is exactly the fact that, in the non-relativistic description, there is no factor 2. It appears only at the transition to the relativistic view.

It is certainly surprising that this separation becomes visible only in the *non-relativistic* version of the new approach to gravity. So it seems that the astonishing simplicity of the circumstances reveals itself only to the "absolute" view from "outside"!

The new outline of gravity is incomplete in one important respect:

Objects, which cause gravity, were described as stationary flow-states, which correspond to "black holes". However gravitating material objects – particles – are presumably not black holes but space-time patterns generated and maintained by waves.

This means that the metric flow, which was deduced here, applies only beyond a certain distance from the center.

A consequence of this incompleteness is that the description of objects which cause gravitation is not identical with the description of objects on which gravitation acts:

Objects, which gravitation acts upon, are interpreted as superpositions of waves with light speed and are in this way embedded in the flow field.

However objects, which cause gravitation, are not described as wave superposition but as steady states, where waves do not occur.

This difference could only be eliminated by a model that contains the processes that lead to the generation of steady wave-states, in other words: by a wave-model of particles that informs how a spherically symmetric defect of the metric is realized and how it is maintained.[18] Some preparatory steps towards such a model will be made in Chapters 4 and 5.

Finally, it should be pointed out that the conceptual origin of general relativity – the equivalence of gravity and inertia – is implemented in the metric-dynamic model directly and in the simplest possible manner:

Here, holding an object in a gravitational field caused by a mass at a constant distance to this mass, means permanently accelerating the object against the accelerated flow towards the mass, and this is of course the same as accelerating the object in an area without gravity.

[18] A natural assumption would be that the superposition of waves, by which the material object is formed, causes a metric densification.

As was shown, however, only the assumption that the objects themselves are nothing but superpositions of metric waves leads to correct results, i.e. to results that match those of GR.

To illustrate these circumstances, we ask at last: Why are we held down to the earth by gravity?

Seen from the metric-dynamic point of view, the answer is:

Because an accelerated metric flow moves through us with a velocity of 11.2 km/s. We ourselves are (ultimately) patterns of waves with light speed in the flow, and this has two consequences: *first*, the waves (ourselves) must be accelerated against the flow – which is ensured by the electromagnetic interaction with the surface of the earth – and *second,* the waves must always move a bit against the flow – and this is the reason why time progresses more slowly. (The paths of the waves are longer than they would be without flow.)

3. Antimatter

3.1. Matter and Antimatter as opposite metric Deformations

Under what circumstances disappears a metric deformation, which, associated with a metric flow, forms a stable, steady state? If and only if it meets the opposite metric deformation.

Matter and antimatter annihilate each other. From the metric-dynamic point of view, this means that the metric differences of matter and antimatter cancel each other out.

We assume the metric defect described in the previous chapter to be the one of matter. The simplest formulation of this defect is that the continuum lacks a (metric) sphere with Radius m: in the metrically altered continuum, any radial distance from the center of gravity O is by m units smaller than in the Euclidean continuum.

Therefore, in the case of antimatter must be assumed that any radial distance from the center is by m units *greater* than in the Euclidean continuum; there is (so to speak) a metric sphere with radius m *too much*.

So let r be the distance of an arbitrary point from the center O in a Euclidean continuum, r_A the distance of the same point from O, measured in the continuum altered by antimatter. Then the following applies:

$$r_A = r + m \tag{22}$$

This means: If matter has the geometric mass $m > 0$, then the equal (symmetrical) amount of antimatter has the mass $-m$.

In the case of matter, the metric density $\sigma(r)$, according to (7), is given by

$$\sigma = \frac{r - m}{r}$$

Thus, in the case of antimatter, we have to set

$$\sigma = \frac{r + m}{r} \tag{23}$$

We denominate the altered radial differential no longer dr_N, but dr_A. According to the definition of σ

$$\sigma = \frac{dr}{dr'}$$

applies then: $dr_A = (1 + \frac{m}{r})^{-1} dr$ (24)

3.2. Gravitation in the Case of Antimatter

Now we will determine the gravitation of antimatter, that is: the gravitation which follows from the metric defect that represents the opposite of the metric defect in the case of matter.

In order to determine the metric flow, (1') has to be rearranged as in 2.1. (c is set to 1)

$$\frac{d\sigma}{dr} = -\frac{dv}{dt} \longrightarrow d\sigma = -\frac{dr}{dt} dv \tag{25}$$

Again we set $\frac{dr}{dt} = v$

Accordingly $d\sigma = -v\, dv$

Integration gives $\sigma = -\frac{v^2}{2} + C$

According to (23), however, no longer applies

$$\sigma = \frac{r - m}{r}$$

but instead $$\sigma = \frac{r + m}{r}$$

Therefore $$1 + \frac{m}{r} = -\frac{v^2}{2} + C$$

The integration constant C follows again from the condition $v = 0$ for $r \to \infty$.

From this follows $C = 1$

This leads to $$\frac{v^2}{2} = -\frac{m}{r}$$

and, finally $$\boxed{v = \pm i\sqrt{\frac{2m}{r}}} \qquad (26)$$

In the case of antimatter, the metric flow becomes imaginary.

Then, because of $v = \frac{dr}{dt}$, also r must be imaginary. (The time remains always unchanged.)

If we replace in (1') v by iv and r by ir,

– thus $$\frac{d\sigma}{dir} = -\frac{div}{dt}$$

then we get to $$\boxed{\frac{d\sigma}{dr} = +\frac{dv}{dt}} \qquad (27)$$

If (1') is understood as relation of real-valued quantities – that is: of measurable quantities – then in the fundamental equation, in the case of antimatter the sign changes.

To determine the (real) flow-acceleration, we differentiate

$$\sigma = \frac{r + m}{r} \qquad \text{with respect to r.}$$

This gives $$\frac{d\sigma}{dr} = -\frac{m}{r^2}$$

According to (27) $$\frac{d\sigma}{dr} = \frac{dv}{dt}$$

applies then $$\boxed{\frac{dv}{dt} = -c^2 \frac{m}{r^2}} \qquad (28)$$

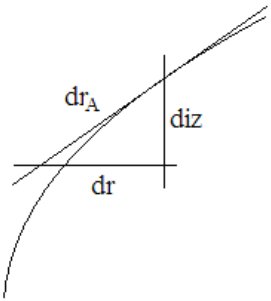
In the case of antimatter, the flow-acceleration is identical with that of matter. Thus the Newtonian approximation is in both cases identical.

Why do imaginary numbers occur in the case of antimatter? The reason is that here – as follows from (24)

$$dr_A = (1 + \frac{m}{r})^{-1} dr$$

– the radial differential dr_A, compared with the differential of the Euclidean continuum, is *shortened.*

Therefore, the usual description by an auxiliary dimension is only possible if this dimension is imaginary:



(S11)

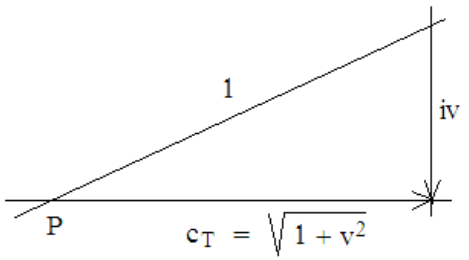
In (S11) is $dr_A^2 = dr^2 - dz^2$

Thus, only if the auxiliary dimension is imaginary, applies $dr_A < dr$.

Or let us look at the flow:

$$v = -i\sqrt{\frac{2m}{r}}$$

If we now, as before in the case of matter, judge the velocity of the flow, as it is seen non-relativistically "from outside", then this correction will lead – as can be seen in the following outline – to an *increase* of the light speed



(S12)

Here, the flow-corrected light speed c_T is greater than the normal light speed. This is simply because, in the case of antimatter, the circumferences of circles around the center O are *shorter* than in the

Euclidean continuum. Therefore, the time that light requires for one orbit, is shorter – or, alternatively, light appears to be faster (of course only from a non-relativistic point of view.)

But from that follows now a change against the usual view:

In the case of antimatter, gravity is smaller than in the case of matter of identical mass |m|.

If e.g. the calculation of the perihelion precession is carried out exactly as in section 2.2, however now, according to (S12), using the factor

$$k \;=\; \sqrt{1+v^2} \;=\; \sqrt{1+\frac{2m}{r}}$$

then the result is

$$\frac{\omega'}{\omega} \;=\; (1-\frac{2m}{r})^{\frac{3}{2}} \;\approx\; 1 - \frac{3m}{r} \qquad (29)$$

Thus there is no precession but *retardation*: the ellipse rotates in the reverse direction, i.e. against the direction of motion.

Though the correction of the Newtonian approximation is completely analogous to the one in the case of matter, it leads not to an increase but to a decrease of gravity.

Now we determine the metric circumstances in a relativistic reference system S_A that rests relative to the center point O.

At first we must factor in – just in the same way as in the case of matter – that from a relativistic point of view the metric defect is not m but 2m. Any radial distance from the center is by 2m greater than in the undistorted continuum.

The length differential of the flow-system S_F is therefore (compare (17)):

$$dr_F \;=\; dr\,(1 \,+\, \frac{2m}{r})^{-1} \qquad (30)$$

The time differential remains unchanged: $dt_F = dt$

Therefore, a local system S_F in the flow is characterized by

$$S_F : (dt_F = dt,\ dr_F = (1 + \frac{2m}{r})^{-1} dr ,\ d\varphi_F = d\varphi) \qquad (31)$$

Now, from S_F can be transformed to a local (relativistic) observer system S_A, which is at rest relative to O, however not, as in the case of matter, with the factor

$$\sqrt{1 - \frac{2m}{r}} , \qquad \text{but with} \qquad \sqrt{1 + \frac{2m}{r}}$$

The reason for this change is that from

$$\frac{v}{c} = \pm i \sqrt{\frac{2m}{r}}$$

follows with respect to the factor of the Lorentz transformation:

$$k = \sqrt{1 - \frac{v^2}{c^2}} = \sqrt{1 + \frac{2m}{r}}$$

Thus the radial length differential dr_A of S_A is:

$$dr_A = dr_F\ k = dr\ (1 + \frac{2m}{r})^{-1}\ (1 + \frac{2m}{r})^{\frac{1}{2}} = dr\ (1 + \frac{2m}{r})^{-\frac{1}{2}}$$

and the time differential dt_A is:

$$dt_A = dt\ (1 + \frac{2m}{r})^{\frac{1}{2}} \qquad (\text{note} \quad dt_F = dt)$$

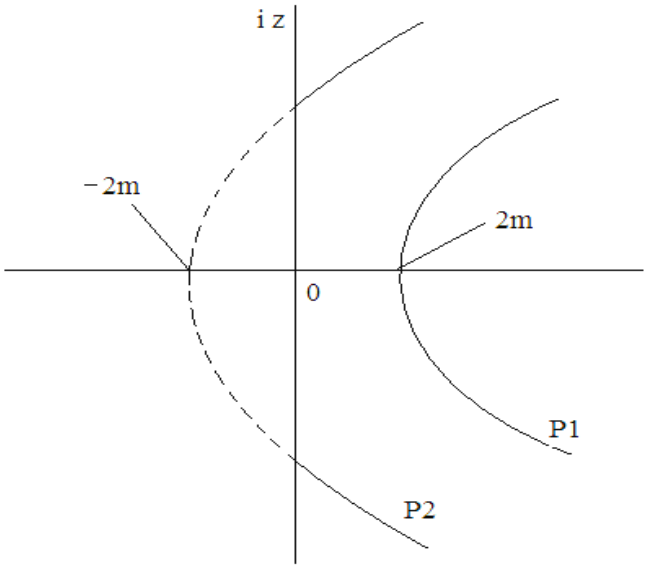
From this follows the metric:

$$ds^2 = (1 + \frac{2m}{r})\,dt^2 - (1 + \frac{2m}{r})^{-1}\,dr^2 - r^2\,d\phi^2 \qquad (32)$$

In the case of antimatter, the metric is not identical with the Schwarzschild metric. In particular, the passing of time is not decelerated but accelerated.

Thus, here objects are accelerated in the direction of the area of accelerated time.

For illustration of the metric circumstances, here an outline of the parabola P2, which – analogously to the Schwarzschild parabola – depicts the metric with the aid of an embedding dimension i z:



(S13)

P2 is the parabola, which illustrates the metric facts of (32). The auxiliary dimension i z is imaginary. (The Schwarzschild parabola P1 is shown only for comparison; for P1, the auxiliary dimension would of course have to be real.)

In the flow-concept, the metric circumstances are symmetrical for matter and antimatter. Nonetheless this leads to a different gravity.

3.3. Asymmetry of Matter and Antimatter

In addition to the different strength of gravity (in the case of the same m), there are also the following asymmetries between matter and antimatter:

In the case of matter, the following equations apply:

$$\frac{\partial \sigma}{\partial r} = -\frac{1}{c^2}\frac{\partial v}{\partial t} \tag{1'}$$

$$\frac{\partial v}{\partial r} = -\frac{\partial \sigma}{\partial t} \tag{1a}$$

From these equations ensues the wave equation:

$$\frac{\partial^2 v}{\partial r^2} = \frac{1}{c^2}\frac{\partial^2 v}{\partial t^2} \tag{3}$$

But in the case of antimatter, the positive sign on the right side in (27)

$$\frac{d\sigma}{dr} = +\frac{1}{c^2}\frac{dv}{dt}$$

prevents the derivation of the wave equation from (27) and (1a). Instead follows

$$\frac{\partial^2 v}{\partial r^2} = -\frac{1}{c^2}\frac{\partial^2 v}{\partial t^2} \tag{3'}$$

This means: *In the continuum that is metrically altered by antimatter, there are no stable longitudinal waves*.

In the metric dynamic view, where everything that exists is understood as wave superposition, this represents a fundamental restriction.

*The most important asymmetry, however, concerns the **formation** of matter and antimatter:*

In the metric dynamic universe, matter-particles evolve through metric densification processes, which are part of the global metric self-organization that occurs in the whole universe. Into such areas of increased metric density, flow lines enter which then either disappear in a sink – in the singularity of a black hole – or end in a point within this area, such that the flow velocity *decreases* more and more, until it reaches zero in that point.

The beginning of each of these flow lines lies in a point, where the flow velocity *increases* in all directions. Further above, I called such a point a *source,* though this designation is actually not correct, since also here the flow velocity starts with the value zero.

With respect to the problem of the asymmetry of matter and antimatter, however, only the following is relevant:

The velocity of the flow along these flow lines, from the beginning to the end, has always a real value, with other words: the universe organizes itself exclusively through *real* longitudinal flows.

Antimatter, however, is characterized by the occurrence of an *imaginary* longitudinal flow.

From this follows:

Seen from the metric dynamic view-point, the assumption that always the same amount of matter and antimatter is generated cannot be maintained: within the global self-organization, matter evolves without antimatter being generated at the same time.

Locally, however, this assumption remains true: if locally a metrically densified area is generated, then a symmetric area of reduced metric density will evolve, which is surrounded by an area of imaginary metric flow; a *local* change of the metric density is not possible without the opposite local change. Therefore, in laboratory experiments, only particle-antiparticle pairs can be generated.

3.4. Summary

I close with a short summary.

Let K^n (n>1) be a n-dimensional continuum, distorted by a geometric mass m.

If m > 0, then m is the geometric mass of *matter,* and any distance from the center O is by m length units *smaller* than in the undistorted continuum

If m < 0, then m is the geometric mass of *antimatter,* and any distance from the center O is by m length units *greater* than in the undistorted continuum.

In this way it is immediately clear why matter and antimatter with identical absolute value of m annihilate each other when they meet: the metric changes are opposite to one another and cancel each other out.[19]

The acceleration field, which corresponds to the Newtonian approximation, is in both cases identical:

$$\frac{dv}{dt} = -c^2 \frac{m}{r^2}$$

The metric flow toward the center is in the case of matter real, in the case of antimatter imaginary:

Matter: $v_M = \pm c \sqrt{\frac{2m}{r}}$ Antimatter: $v_{AM} = \pm i\, c \sqrt{\frac{2m}{r}}$

The squares of the flows cancel each other out: $v_M^2 + v_{AM}^2 = 0$

From the fact that the metric flow caused by antimatter is imaginary follows that the gravitation of antimatter with mass -m is not identical with the gravitation of matter with mass m, but *weaker.*

[19] The fact that energy is emitted in the form of waves at such an impact proves that matter and antimatter consist of waves, and it proves also that the respective metric changes are caused by these waves.

The metric of the surrounding continuum is

$$ds^2 = (1 + \frac{2m}{r})\,dt^2 - (1 + \frac{2m}{r})^{-1}\,dr^2 - r^2\,d\phi^2$$

Thus time passes *faster* in the continuum distorted by antimatter.

There are further asymmetries between matter and antimatter:

1. In the case of antimatter, there are no waves of the longitudinal metric flow v and of the metric density σ.

2. ***Locally****, always the same amount of matter and antimatter is generated;* ***globally****, however, only matter is formed.*

At last a note on the connection between metric density σ, flow velocity v and length differential dr (c is set to 1):

From $\sigma = 1 - \frac{m}{r}$ and $v^2 = \frac{2m}{r}$

follows $v = \pm\sqrt{2}\,\sqrt{1-\sigma}$ (33)

σ can assume any real value, v can assume any real and any imaginary value. If σ is equal to 1, then v is equal to 0. If $\sigma < 1$ (at matter), then v is real. If $\sigma > 1$ (at antimatter), then v is imaginary. With the exception of the sign, the mapping is bijective.

With $\sigma = \frac{dr}{dr'}$

follows $dr' = dr\,(1 - \frac{v^2}{2})^{-1}$ (34)

At the transition to a relativistic view, for the length differential in the flow (see section 2.4, (17) and (18)) applies:

$$dr_F = dr\,(1 - v^2)^{-1} \tag{34'}$$

and, with respect to a resting observer:

$$dr_B = dr\,(1 - v^2)^{-1/2} \tag{34''}$$

(33) to (34'') apply in general, not only in the spherically symmetric, stationary case.

4. Planck-Length, geometric Mass and Particle-Frequency

In this short chapter, the hypothesis shall be formulated which, in the metric dynamic model, substantiates the fact that in nature the values of various observables appear only in discrete sequences, which can be expressed as integer multiples of a fundamental unit.

In the metric-dynamic scenario that follows in 4.2, the connection between Planck-length, geometric mass and the two quantities frequency and Compton wave-length that are linked to this geometric mass will be explained. This means: the Planck-length can be derived from Compton wave-length and geometric mass in a metric-dynamic way.

4.1. The metric dynamic Quantization Hypothesis

We have already deduced that in the metric flows longitudinal waves exist. (See wave equations (3) und (5)). Now, in regard to these waves, we make an additional assumption.

In the metric flows, whose stationary, spherically symmetric states turned out to be the gravity of a central mass, standing waves exist. Their wave-length λ is equal to the Planck length. They represent the basis of the material structures.[20]

Thus $\lambda := \text{Planck length} := \lambda_{Pl}$

where $\lambda_{Pl} = \sqrt{\frac{hG}{c^3}} = 4.051 \ldots 10^{-35}$ (meter).

What in standard physics is a quantum of action is here a quantum of length.

To demonstrate the consequences of this metric quantization, I will immediately join the first application. It bridges more than 40 orders of magnitude and provides a metric dynamic reasoning of some well-known relationships between fundamental quantities.

[20] If the universe was a closed metric structure, then the image of standing waves would be *the first and simplest* idea which would come to mind if one thought of consequences of self-organization. (Only the extraordinary small wave-length would be surprising.) The problem, which occurs due to the assumption that the universe is *open,* will be discussed in the chapter on cosmology.

4.2. Phase Waves in the radial Flow; Connection between Mass and Frequency

Let us look at a stationary, spherically symmetric flow v into a center of gravity Z.

Seen from an observer who rests at Z, the standing Planck-waves in the flow are *not* standing waves. From his point of view, the flow is a moving system. Therefore, the phase coincidence is canceled by the Lorentz transformation.

$$\text{Thus} \quad f(r,t) = \sin(2\pi\, t\, \nu_{Pl}) \cos(2\pi\, r\, \frac{1}{\lambda_{Pl}}) \qquad (\nu_{Pl}\, \lambda_{Pl} = c) \tag{35}$$

– which represents a standing wave *in the flow system* – turns, seen from the resting observer, into

$$f'(r,t) = \sin 2\pi\,(t\, \nu_{Pl}\, \frac{1}{k} - r\, \nu_{Pl}\, \frac{v}{c^2}\, \frac{1}{k})\ \cos 2\pi\,(t\, v\, \frac{1}{\lambda_{Pl}\, k} - r\, \frac{1}{\lambda_{Pl}\, k}) \qquad (k = \sqrt{1 - \frac{v^2}{c^2}}) \tag{36}$$

For the resting observer, the standing wave in the flow transforms into a wave superposition, which consists of the two waves

$$\Psi_1\,(\lambda_1,\, \nu_1) \quad \text{and} \quad \Psi_2\,(\lambda_2,\, \nu_2)$$

where

$$\lambda_1 = \lambda_{Pl}\, \frac{c}{v}\, k \qquad\qquad \nu_1 = \nu_{Pl}\, \frac{1}{k} \tag{37}$$

$$\lambda_2 = \lambda_{Pl}\, k \qquad\qquad \nu_2 = \nu_{Pl}\, \frac{v}{c}\, \frac{1}{k} \tag{37'}$$

Now we determine the distance r_1 from Z, which is equal to one wave-length λ_1 of the phase wave Ψ_1, which has emerged from the transformation.

In addition to the phase shift described by (36), we must take into account that the length differential in the flow is greater than that of the resting system by the factor $1/k = (1 - (v/c)^2)^{-1/2}$. Therefore, the wave-lengths in the flow are enlarged by the factor 1/k.

Thus we set

$$r_1 = (\lambda_{Pl} \frac{c}{v} k) \frac{1}{k}$$

(On the r-dependency of v, λ_1 and k see the note further below.)

$$r_1 = \lambda_{Pl} \frac{c}{v} \qquad (38)$$

How big is the flow v(r)? Here, the conditions correspond to the ones of the hybrid system described in section 2.6. Therefore, the flow-value from (21) must be chosen:

$$\frac{v}{c} = -\sqrt{\frac{m}{r}}$$ (m is the geometric mass)

With $\frac{c}{v} = \sqrt{\frac{r_1}{m}}$ (here, only the absolute value of v is relevant), (38) turns into

$$r_1 = \lambda_{Pl} \sqrt{\frac{r_1}{m}}$$

Therefore

$$r_1 = \frac{\lambda_{Pl}^2}{m} \quad \text{or} \quad r_1 m = \lambda_{Pl}^2 \qquad (39)$$

Note: In determining the distance r_1 as equal to one phase wave-length – would not have to be taken into account that the flow v, which the wave-length depends on, is *not* constant within r_1?

This is not necessary, as can be shown in the following way: to determine *all* distances, where the phase shift is equal to 2π, instead of (38) must be set more generally

$$r_n = n\ \lambda_{Pl}\ \frac{c}{v} = n\ \lambda_{Pl}\ \sqrt{\frac{r_n}{m}}$$

with the consequence

$$r_n = n^2\ \frac{\lambda_{Pl}{}^2}{m}$$

Now imagine $r \rightarrow r' = \sqrt{r}$.

Then all wave lengths of the phase wave become equal to $\sqrt{r_1'}$: the first wave length ends at $\sqrt{r_1'}$, the second one at $2\sqrt{r_1'}$ etc. Thus it can be seen that there is only *one single phase wave.* After the re-transformation $r' \rightarrow r$, the wave length of the phase wave increases with r, such that the first wave length ends at r_1, the second one at $4\,r_1$ und die n^{th} one at $n^2 r_1$.

Let us again look at relation (39):

r_1, the distance from Z, is equal to λ_1, the wave length of the phase wave (that exists in the resting system because of the Lorentz-Transformation of the standing wave in the flow), if

$$r_1 = \frac{\lambda_{Pl}{}^2}{m}$$

This, however, means: r_1 is equal to the *Compton wave-length* λ_C, because

$$\lambda_C = \frac{\lambda_{Pl}{}^2}{m}$$

(E.g. in the case of an electron:

$$m_e = 6.763\ \ 10^{-58}\ \text{(meter)}, \quad \lambda_{Pl} = 4.051\ \ 10^{-35}$$

$$\frac{\lambda_{Pl}^{\,2}}{m_e} \;=\; 2.426 \;\; 10^{-12} \;=\; \lambda_{Ce} \;\;)$$

Moreover, at the position r_1, in addition to the almost unchanged Planck-frequency

$$\nu_1 \;=\; \nu_{Pl} \;\frac{1}{k}$$

another, much smaller frequency appears (see (37'))

$$\nu_2 \;=\; \nu_{Pl} \;\frac{v}{c}\;\frac{1}{k} \;=\; \nu_{Pl} \;\sqrt{\frac{m}{r_1}}\;\frac{1}{k} \qquad (40)$$

which, because of $\nu_2\,\lambda_1 \;=\; \nu_2\,\lambda_C \;=\; c$, corresponds to the frequency ν_m of a particle with the geometric mass m.

The flow, which the phase wave originates from, is spherically symmetric. This means:

On the surface of a sphere with radius λ_C there is an in-phase oscillation with the frequency of the particle.

Of course this is not yet a model of a particle. On the other hand, however, it is also more than just a mathematical relation between particle mass and particle frequency, because it contains a structural element: the concept of an in-phase oscillation on the surface of a sphere. (Exactly this concept will be required in the next chapter.)

The just derived relation between the frequency ν_m, the wave-length λ_m (with $\nu_m\,\lambda_m = c$) and the geometric mass m is not only true in the case of a particle, but also in general.

Therefore it can be asserted: The equations (41) and (41')

$$\lambda_m\, m \;=\; \lambda_{Pl}^{\,2} \qquad (41)$$

and, because of $\lambda_m \nu_m = c$

$$m c = \lambda_{Pl}^2 \nu_m \qquad (41')$$

are the metric-dynamic equivalent of $M c^2 = h\nu$ or $E = h\nu$ and $E = M c^2$.

(In section 6.2, equation (41') will assume exactly this form, that is: $M c^2 = h\nu$.)

If one sets alternatively $\lambda\!\!\!^{-}_{Pl} = \sqrt{\frac{\hbar G}{c^3}} = 1.616... \; 10^{-35}$ (meter), then applies (with $\lambda\!\!\!^{-}_m = \lambda_m / 2\pi$)

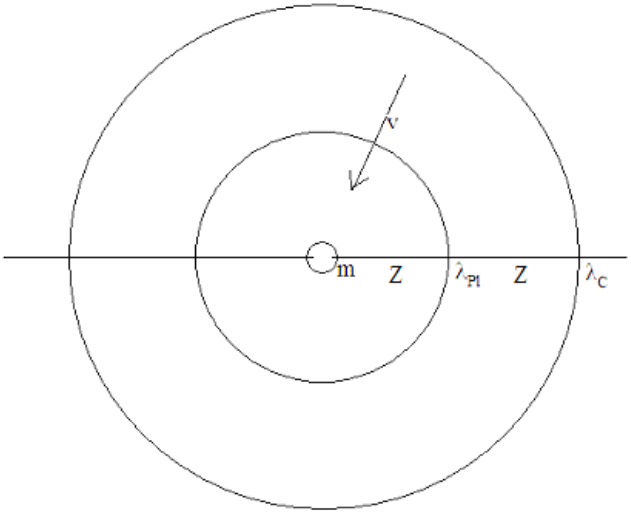
$$\lambda\!\!\!^{-}_m \, m = \lambda\!\!\!^{-}_{Pl}^2 \qquad (41'')$$

Note

In (41) can be seen that λ_{Pl} is the geometric mean of m and λ_C.

This means: There is a simple indication that a relation between three quantities in a metric flow, the velocity of which is inversely proportional to $r^{1/2}$, is possibly mediated by a phase wave: if all three quantities are expressed as lengths, then one length must represent a metric defect, and another length must be the geometric mean of the other two. (At the reconstruction of the atomic structure, we will encounter another such case.)

Scaled logarithmically, the quantities m, λ_{Pl} and λ_C, the relation of which is mediated by the radial flow v, can be illustrated as follows:



(S14)

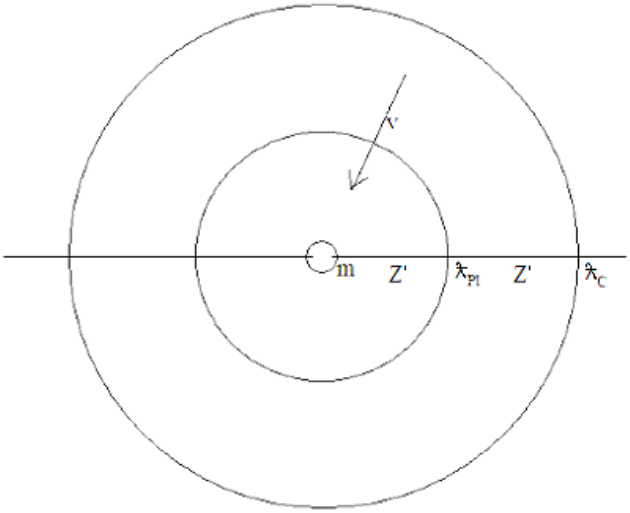
Z is a multiplicative factor that belongs to gravity in a similar way as the fine-structure constant $1/\alpha$ to electromagnetism. (More on that will follow starting in section 5.7.)

It holds that: $m\,Z = \lambda_{Pl}$ and $\lambda_{Pl}\,Z = \lambda_C$ (42)

For the electron is $Z_E = 5.990\ 10^{22}$

For the proton is $Z_P = 3.262\ 10^{19}$

In (S14), λ_{Pl} and λ_C can be replaced by $\lambda\!\!\!^{-}_{Pl}$ and $\lambda\!\!\!^{-}_{C}$. Then the depicted facts do not correspond to (41), but to (41"):



(S14')

Here is $m\,Z' = \lambda\!\!\!^{-}_{Pl}$ and $\lambda\!\!\!^{-}_{Pl}\,Z' = \lambda\!\!\!^{-}_{C}$ (42')

For the electron is $Z'_E = 2.390\ 10^{22}$

For the proton is $Z'_P = 1.3014\ 10^{19}$

The just designed model represents a *phase wave structure,* by which the relation between the quantities *Planck-length, mass and frequency* – not only in the case of a particle but in general – is substantiated in a geometrical way or, to put it more exactly: in a metric-dynamic way

5. Electromagnetism; Model of the Atomic Structure

5.1. Preliminary Note

Gravitation – in the form of the general relativity theory – and electromagnetic interaction – in the form of quantum electrodynamics – differ from each other in several respects. Here is a table with some facts:

G *is* the distorted space-time	EM occurs *within* the flat space-time
G is always positive	EM is positive and negative
G is a pseudo-force; all objects move on geodesics	The interaction takes place through exchange of particles
The frequency-difference of two identical particles located at different distances from a mass can be explained in *two* ways: by the different passing of time and by the energy difference	The frequency-difference of two electrons located at different distances from the positively charged nucleus can be explained in only *one* way: by the energy difference
G cannot be isolated	EM can be isolated, but in the environment of a completely isolated charge there are still detectable effects on the phases of electrons
G acts universally	EM acts only upon charged objects

Even if there are some formal similarities, the just listed differences appear so essential that it is doubtful whether the areas of the phenomena described by the two theories can be combined into a single representation – at least as regards the current form of the theories. They appear like two buildings, each of which follows a compelling inner logic, but which obey completely different functional and aesthetic principles. Involuntarily, one is reminded of Wolfgang Pauli's phrase: "What God has separated, man should not put together."

However I do not believe that the incompatibility of the two interactions is imposed by God or nature. Rather I think that it is an artifact of our approach to nature, which dissolves into nothing if this approach is changed in an appropriate way. In fact, all the characteristic features of both interactions arise so to speak "by themselves" if just the program is continued that started with the metric-dynamic representation of gravity.

Gravity turned out to be the accelerated metric flow that follows from changes of the longitudinal metric density. In the spherically symmetric case, gravity is a stationary state of the longitudinal metric flow, caused by a change of the differential radial measure dr.

With this, the interpretation of the longitudinal parameters metric density and metric flow is finished – in the sense that they are bound to gravity and cannot be used anywhere else. However besides the parameters metric length density and longitudinal metric flow, in the metric dynamic universe there are only two further parameters: metric angle density and transversal metric flow.

That results inevitably in the assumption that electromagnetism, in the spherically symmetric case, is a stationary state of the *transverse* metric flow, caused by a change of the differential angle measure dφ. This simple assumption will lead us now – completely without quantum theory – deep into the realm of the quantum theoretic phenomena.

5.2. Definition

Everything which follows below refers to the spherically symmetric case of a central geometric mass m or a central geometric charge μ. ($m \in \mathbb{R}$, $\mu \in \mathbb{R}$. Both m and μ have the dimension *length.*)

Three spatial dimensions are presupposed. r and φ are polar coordinates at an arbitrary plane through the center O. σ is the metric density of the length, η is the metric density of the angle. c is set to 1.

Gravitation is *change of the metric density of the length.* In the case of a central geometric mass $m > 0$, the metric length-density $\sigma(r)$ decreases towards the center O. The distance between O and any given point is smaller by m units than in the undistorted continuum. (2m in the relativistic view.)

Electromagnetism is *change of the metric density of the angle.* In the case of a central geometric charge $\mu > 0$, the metric angle-density $\eta(r)$ decreases towards O. The circumference of any given circle around O is smaller by $2\pi\mu$ units than in the undistorted continuum. (This means: here, a whole circle has *less* than 360°. The circle with radius μ has 0°, i.e. its circumference disappears.)

To illustrate the almost complete analogy between gravity and electromagnetism (in regard to the parameters metric length density σ, longitudinal metric flow v and radial differential dr on the one side, and metric angle density η, transversal metric flow w und angle differential $d\varphi$ on the other side), I shall confront the definition of EM and the elementary facts ensuing from it with the analogous circumstances of G.

Gravitation		Electromagnetism	
$\boxed{\sigma = \frac{r - m}{r}}$	(7)	$\boxed{\eta = \frac{r - \mu}{r}}$	(43)
m is the *geometric mass*		μ is the *geometric charge*	
$m > 0 \Leftrightarrow$ matter		$\mu > 0 \Leftrightarrow$ positive charge [21]	
$m < 0 \Leftrightarrow$ antimatter		$\mu < 0 \Leftrightarrow$ negative charge	
$\boxed{\sigma = \frac{dr}{dr'}}$	(12)	$\boxed{\eta = \frac{d\varphi}{d\varphi'}}$	(44)
		From (43) and (44) follows	
$\boxed{dr' = (1 - \frac{m}{r})^{-1} dr}$	(13)	$\boxed{r\,d\varphi' = (1 - \frac{\mu}{r})^{-1} r\,d\varphi}$	(45)
		The ratio of the arc lengths $r\varphi'$ and $r\varphi$ is the inverse of the ratio of the arc differentials $r\,d\varphi'$ and $r\,d\varphi$:	

[21] For the moment, assigning $\mu > 0$ to *positive* charge is a decision at will. Further below it will turn out that this assignment is necessary for achieving congruence with quantum mechanical specifications and results.

$$\frac{r'}{r} = 1 - \frac{m}{r} \qquad (15)$$

This means: Any radial distance is by m units smaller or greater:

$PO = r \quad \Leftrightarrow \quad (PO)' = r - m$

(S' is a non-relativistic system; thus, at the transition to a system that moves relative to O, no changes of measures occur.)

The arc differential $r\,d\varphi$ and the time-differential dt remain unchanged:

$r\,d\varphi' = r\,d\varphi, \quad dt' = dt$

$$\frac{r\,\varphi'}{r\,\varphi} = 1 - \frac{\mu}{r} \qquad (46)$$

From (46) follows: The circumference $2\pi r$ of a circle around O is by $2\pi\mu$ shorter or longer:

$U = 2\pi r \quad \Leftrightarrow \quad U' = 2\pi(r - \mu)$

(S' is an non-relativistic system; thus, at the transition to a system that rotates around O, no changes of measures occur.)

The radial differential dr and the time-differential dt remain unchanged:

$dr' = dr, \quad dt' = dt$

5.3. The metric Flow that rotates around the Center

In the following, the reference systems S, S' and S_F will be used.

S is the Euclidean (charge-free) reference system. S' is (as was S_N at the description of gravity) the reference system, which is at rest relative to O and whose metric is changed by the charge. S' is non-relativistic, so with respect to S', the light speed is not constant. (This is again "the exact view from outside"; see section 2.2.) S_F is (as it was at the description of gravitation) a local system that moves with the flow. (S_F has the same differential measures as S'. As is always the case, relative to the flow the local light speed is constant. Therefore, from S_F can be transformed locally into a relativistic reference system.) Since statements on any system S_F apply always to all S_F, I shall label, for the sake of simplicity, also the "rotating system" – i.e. the total system which contains all local systems that rotate with the flow around O – by the identifier S_F.

Equation (34')

$$dr_F = dr\,(1 - v^2)^{-1}$$

shows the general relationship between the flow velocity v and the length differential $d\,r_F$ in the flow. Thus this relationship must also apply to the transversal flow velocity w and the length differential in the transversal flow.

In the spherically symmetric case, the transversal flow rotates around the center (see outline (S15) further below), and therefore the length differential in the transversal flow is identical with the arc differential $r\,d\varphi_F$. Thus according to (34') applies

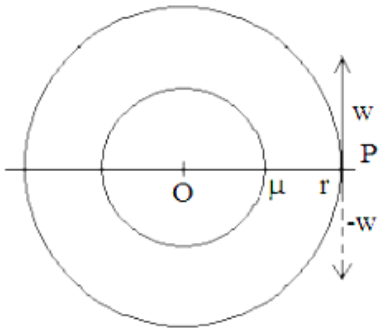
$$r\,d\varphi_F = r\,d\varphi\,(1 - w^2)^{-1} \tag{47}$$

Then $$1 - w^2 = \frac{r\,d\varphi}{r\,d\varphi_F} = \eta = 1 - \frac{\mu}{r}$$

and thus[22] $$w = \pm\sqrt{\frac{\mu}{r}} \tag{48}$$

In the case of positive charge $\mu > 0$, w is real, at negative charge $\mu < 0$, w is imaginary.

Here is an outline that illustrates the transversal flow. In the spherically symmetric case, this flow rotates around O. Depicted is an arbitrary plane through O. P is a point at the distance r from O.



(S15)

[22] Also here, as in the previous chapter, the conditions of the hybrid system are met, since the usual description of the electromagnetism takes place in the flat space-time. Thus the factor 2 does not apply. (See 2.6.)

Since (S15) applies to *any* plane through O, to the point P must be assigned the velocity w(r) *in any direction* on the tangent plane to the sphere, where P is located.

I shall refer to this peculiar fact, which exhibits already quantum mechanical features, a little later extensively.

What has been said so far can be summarized as follows:

The *gravitational field* of a geometric mass m is defined as the stationary, spherically symmetric state which is caused by the fact that, if $m > 0$ (in the case of matter) *any distance from the center O* is by m units smaller – or, if $m < 0$ (antimatter), by m units greater – than in the flat continuum. This metric alteration causes a *radial flow* v(r) which is real or imaginary. (The circumferences of circles around O remain unchanged.)

The *electromagnetic field* of a central geometric charge μ is defined as the spherically symmetric state which is caused by the fact that, if $\mu > 0$ (in the case of positive charge) *the circumference of any circle around O* is by $2\pi\mu$ units *shorter* – or, if $\mu < 0$ (in the case of negative charge) by $2\pi\mu$ units *longer* – than in the flat continuum. This metric alteration causes a *flow* w(r) *that rotates circularly around the center O* and which is real or imaginary. (Radial distances remain unchanged.)

5.4. Positive and negative Charge

In the metric dynamic model, the relationship between positive and negative charge is analogous to the relationship of matter and antimatter. The metric deformations are in both cases opposite to each other. Thus it can be geometrically understood why the consequences of positive and negative charge cancel each other out.

In the case of matter and antimatter, the metric alterations relate only to the radial distances r, in the case of positive and negative charge, they relate only to the arc lengths $r\varphi$.

The following applies to S' and therefore also to S_F that has the same differential measures as S':

If, according to (45), positive charge is defined by $\quad r\, d\varphi_F = (1 - \frac{\mu}{r})^{-1}\, r\, d\varphi \quad (\mu > 0)$

– with the consequence that to the circumference U_F of a circle around O in the continuum altered by the charge μ applies:

$$U_F(r) = 2\pi(r - \mu)$$

– then the equally large negative charge is defined by

$$r\, d\varphi_F = (1 + \frac{\mu}{r})^{-1}\, r\, d\varphi$$

from which follows $U_F(r) = 2\pi(r + \mu)$

As was the case with matter and antimatter, the squares of the metric flows (of positive and negative charge) cancel each other out:

Positive charge: $w_{pos} = \pm\sqrt{\frac{\mu}{r}}$

Negative charge: $w_{neg} = \pm i\sqrt{\frac{\mu}{r}}$

Therefore: $w_{pos}^2 + w_{neg}^2 = 0$

5.5. The Transition to an Observer System

Exactly in the same way as in the description of gravity, a local system S_F in the flow can be used as basis for the transition to a (relativistic) observer system S_R.

According to (47) and (48), a local system S_F that rotates with the flow is characterized by

$$S_F : (\, dt_F = dt,\ dr_F = dr,\ d\varphi_F = (1 - \frac{\mu}{r})^{-1}\, d\varphi\,) \qquad (49)$$

Only the arc differential is altered. (The arc differential $r\,d\varphi_F$ is identical with the length differential of the local flow system S_F.) The radial distances remain unchanged. The time in the flow is always the same, and it corresponds to the time outside of the field.

Now from S_F (i.e. from the neighborhood of any point P in the flow with $PO > \mu$) can be transformed to a local observer system S_R that is not rotating but resting relative to O.[23] The transformation factor is that of the Lorentz-Transformation

$$k = \sqrt{1 - w^2} = \sqrt{1 - \frac{\mu}{r}} \tag{50}$$

S_R moves with velocity $-w$ relative to S_F. Thus the length differential of S_F must be multiplied by k, and the time differential must be divided by k.

Then follows for the (tangential) length differential $r\,d\varphi_R$ of S_R

$$r\,d\varphi_R = r\,d\varphi_F\ k = r\,d\varphi\,(1 - \frac{\mu}{r})^{-1}\ (1 - \frac{\mu}{r})^{\frac{1}{2}} = r\,d\varphi\,(1 - \frac{\mu}{r})^{-\frac{1}{2}}$$

$$r\,d\varphi_R = r\,d\varphi\,(1 - \frac{\mu}{r})^{-\frac{1}{2}} \tag{51}$$

and for the time differential dt_R

$$dt_R = dt\,(1 - \frac{\mu}{r})^{\frac{1}{2}} \qquad (\text{note: } dt_F = dt) \tag{52}$$

The radial differential dr remains unchanged.

[23] Here, the intermediate step to a *relativistic* flow system, which was required in the description of gravity, can be dispensed with, because the factor 2 that is substantiated by this step does not appear at all under the conditions of the hybrid system. (See 2.6.)

From (51) follows that, with respect to a resting observer, to the circumference U_R of a circle around the center O applies:

$$U_R = U \left(1 - \frac{\mu}{r}\right)^{\frac{1}{2}} \tag{53}$$

From (52) follows that the transversal (here rotating) metric flow w(r) of the electromagnetism changes the passing of time in the same way as does the radial metric flow of gravity:

For an observer who rests relative to O at a distance r from O, in the case of positive charge the passing of time is retarded by the factor k of (50). In the case of negative charge, in (50) and (52) applies $\mu < 0$ and the passing of time is accelerated. If positive and negative charges are equally large, then the squares of the metric flows that cause the time alterations cancel each other out, and the time is again equal to the time outside of the field.

5.6. The fundamental Difference between Gravitation and Electromagnetism

With respect to all hitherto deduced facts and laws, gravity and electromagnetism appear strictly analogous to each other. Now we turn to an important difference of the two interactions, in fact exactly *that* difference which is the reason why they seem to be incompatible in the usual view. As follows:

In the case of gravity, the radial metric change of the continuum results in a radial metric flow, which is *accelerated* towards the center. This acceleration itself corresponds already to the Newtonian approximation. The complete concept of gravity contains additionally also the assumption of waves in the accelerated flow.

Therefore, gravity acts *by the accelerated flow itself.* In this sense it can be asserted that gravity *is* the accelerated flow.

In the case of electromagnetism, the circumferential metric change of the continuum results in a metric flow that rotates around the center. This flow increases with decreasing distance from the center, however it is *constant* for any specified distance.

Therefore, electromagnetism *cannot act directly via the flow.*

So *how* does it work? – There is actually only one possibility: its effects must be mediated by waves that occur in connection with the respective metric-dynamic field, which means: by electromagnetic waves. Apparently, this corresponds to the usual notion of the interaction.

(However the interpretation changes in accordance with the assumptions of the local and objective interpretation of quantum mechanics presented in the First Part. There, the Photoelectric Effect and the Compton Effect were described by the simplest model of such an interaction. The main point was: photons are not particles. With respect to electromagnetism, this means: the "virtual" photons have no equivalent in the reality.)

With this, it is also explained why the electromagnetic interaction can be isolated, whereas this is impossible with respect to gravity: The paths of the waves, through which the electromagnetic interaction is mediated, can be interrupted.

But this does not apply to the flow: it comes *before* anything that exists, such that it flows through everything. Thus it cannot be shielded. This is also the reason why, even in the case of total electromagnetic isolation, nonetheless in the charge-free space observable phase-shifts of electron matter waves occur: this is exactly the effect which must be expected due to the rotating flow of the electromagnetism. And since, as mentioned just before, gravity *is* the flow, it is evidently impossible to isolate it.

Thus, the different mechanism of action of the two interactions follows directly from their definition. In spite of their common origin at the fundamental law (1), the one manifests itself directly as acceleration, whereas the other one is mediated by waves.

Note: In the definition (43) of the steady state "charge" by $\eta = \frac{r - \mu}{r}$, the metric angle density η depends on r. Thus, according to equation (2): $\frac{d\eta}{dr} = -\frac{dw}{dt}$, there should be a change of the flow velocity w with time. Why doesn't it occur in our scenario?

In the outline (S4) in section 1.4 can be seen that the angle change is different on both sides of r; only then follows an acceleration normal to r. However at the metric alteration, which is caused by a central charge, this is not the case (see (S15) and the attached comment). The metric changes are identical at *all* planes through O, and the flow is equally large in all tangential directions.

5.7. The Purpose of the subsequent Considerations

I shortly interrupt the train of thought just to point out what exactly the purpose of the whole action is.

It is neither about establishing a theory that is in competition with quantum mechanics, nor about deriving quantum mechanics once again. As with the interpretation of quantum theory in the First Part, also here it is intended to reconstruct the experiences, which gave rise to the theory, from a different point of view, in order to interpret them differently based on this reconstruction and, in this way, to *understand* them.

Due to the simplicity of the resources used, the results of the following sections correspond to those of the "old" quantum theory, which mainly Bohr and Sommerfeld contributed to. However for the intended target, this is not a disadvantage; on the contrary – precisely in this way we are returning to the original historic scene, so to speak exactly at the spot where the physics that had developed from experiences with objects hit the atomic facts and was not able to interpret them – or say: could only describe them by a mathematical scheme at the price of losing any possibility of understanding what is actually going on there.

If we now arrive at this very point on our way, the situation is completely different: We are not equipped with models, the concepts of which originate from mechanics and must necessarily fail here, but with the concepts flow and metric, and it will turn out that, on this basis, the atomic facts either follow almost by themselves or at least can be deduced in an altogether understandable way.

Think e.g. about the question of the "permitted paths" or states. In the historical development, Bohr decided this question at first so to speak "via enactment", before de Broglie explained it by assigning wave-attributes to the particles – where however the term "explanation" seems problematical, because this is again the step into absurdity: into dualism, uncertainty etc.

In the metric dynamic model, these "permitted paths" are a matter of course.

Moreover, it is evident that there are *actually* no "paths" – the particle does indeed not exist – and that, accordingly, in the case of states with angular momentum 0 nothing at all rotates. (Such states could not be represented in the Bohr-Sommerfeld model.)

Also the connection between angular momentum and number of node plains of the respective state, which is unexplainable within the frame of post-mechanical concepts, can easily be derived and understood on the basis of our assumptions. Basically, it is an analogy to the connection between

momentum and inverse wave-length that was cleared up in the First Part using the example of the Photoelectric Effect and the Compton Effect. In the same way as could be seen there why and how momentum is connected with propagating waves, it can be understood here why angular momentum must be assigned to spherical harmonics.

Also the quantization becomes evident, and at the same time the fact that it appears in the form of integer multiples of a fundamental unit.

The spin can be reconstructed and understood in the metric dynamic model, too, and the same applies to the three other quantum numbers.

As last point of this short preview, it should be mentioned that all these reconstructions can be carried out for any atomic number.

How will the reconstructions be performed? By using the metric-dynamic description of the field of a positive charge $\mu > 0$ in order to determine the possible stationary wave states within this field.

(From now on, only relativistic reference systems will be used. The system that rests relative to O – previously denoted S_R – will be called S', and the system that rotates with the flow still S_F.)

5.8. States of the Hydrogen Atom

Let S' be the system that rests with respect to a central positive charge $\mu > 0$. Let S_F be the system the points of which rotate with the velocity w(r) around O. (S_F is the flow system.)

To determine the possible stationary wave states within the field of a positive charge $\mu > 0$, the following prerequisites are needed:

a) $$r\,d\varphi' = r\,d\varphi\,(1 - \frac{\mu}{r})^{-\frac{1}{2}}, \quad dt' = dt\,(1 - \frac{\mu}{r})^{\frac{1}{2}}$$

b) $$r\,d\varphi_F = r\,d\varphi\,(1 - \frac{\mu}{r})^{-1}, \quad dt_F = dt$$

c) $w(r) = \pm c\sqrt{\frac{\mu}{r}}$

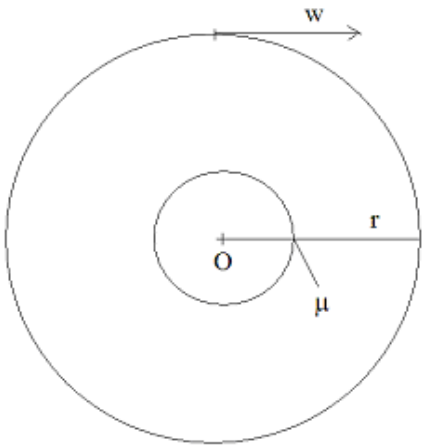
To the circumference U'(r) of a circle with radius r around O, measured in the system S', applies according to a)

$$U'(r) = 2\pi r \left(1 - \frac{\mu}{r}\right)^{\frac{1}{2}}$$

Seen from S_F, the same circle has, according to b), the circumference $U_F(r)$:

$$U_F(r) = 2\pi r \left(1 - \frac{\mu}{r}\right)$$

Here is an outline. It shows an arbitrary plane through O. (For w, one of the two possible directions is chosen.)



(S16)

So much to the prerequisites as regards the field.

(In the following, the factor k stands again for: $k = \sqrt{1-\frac{w^2}{c^2}} = \sqrt{1-\frac{\mu}{r}}$)

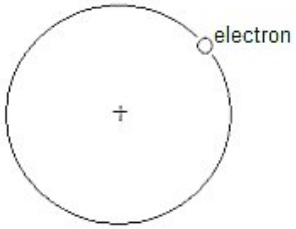
As a further prerequisite serves a metric dynamic fact derived in the previous chapter:

The existence of a particle is connected with the occurrence of an in-phase oscillation on the surface of a sphere, the frequency of which is equal to the frequency f of the particle.

(The frequency f is the one that, in standard-physics, is related to the energy of the particle by the equation E '= hf .)

Now we look at an electron. The geometric mass be m_e, the according frequency f_e. We imagine this electron placed into the field of a positive charge μ.

At first it must be cleared up what it means, seen from our viewpoint, "to place an electron into the field of a positive charge μ". Here, the electron is not a "particle" in the usual sense, because there are only metric alterations, flows and waves. Therefore it would be inappropriate to apply a mental image like in Bohr's atomic model:



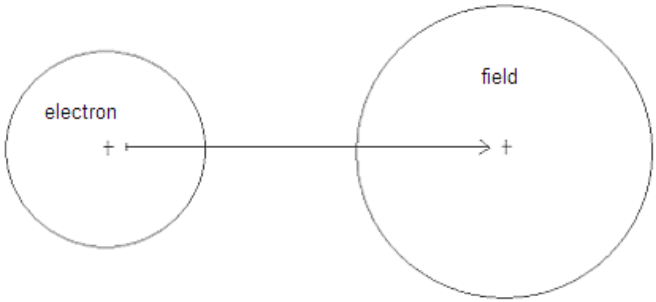
(S17)

– which means: to let the electron circle around the nucleus.

Instead we act – exactly as in the First Part – on the following assumption, – or say: working hypothesis:

The electron is an oscillation state of an area of the continuum.

Then placing the "electron" into the field of the "proton" means connecting the two states of the continuum, that is: to superimpose one on the other, as indicated in the next outline:



(S18)

So the question to be answered is:

What follows in regard to the in-phase oscillation on the spherical surface connected with the existence of the continuum state called "electron", if this state is superimposed upon an area of the continuum that is altered by a geometric charge $\mu > 0$?

The following sections will show whether our assumption regarding the electron is suitable.

In the first step, it will lead us to the ground state of the hydrogen atom.

The Ground State

Let us at first discuss the conditions of the field by looking at an arbitrary plane through O. The "electron" is in the field. This means: in this plane an in-phase oscillation exists on a circle around O.

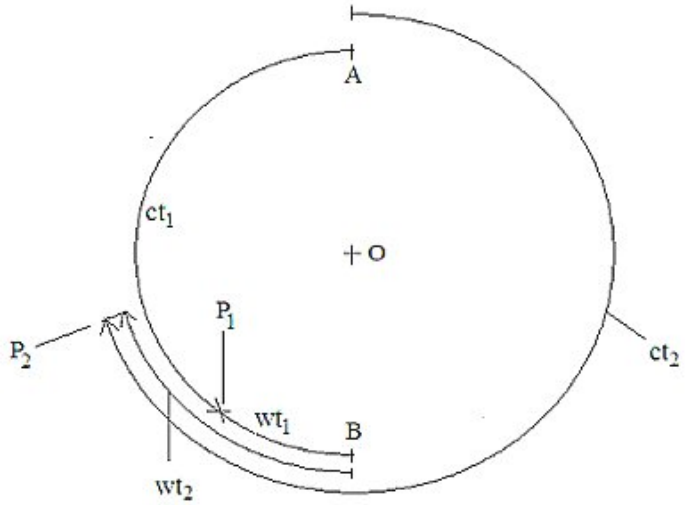
With respect to the rotating flow-system S_F, the phase coincidence of the oscillation is canceled, that is: with respect to S_F a *phase wave* exists. The wave-length of this phase wave provides for the condition, from which then ensues the radius r_1 of the simplest stationary oscillation state of the electron.

This condition reads as follows:

With respect to the flow system S_F, the wave length of the phase wave is equal to the circumference of the circle with radius r_1.

In S_F, the lengths are altered. Therefore, the connection between S_F and S' does not correspond to the connection between two reference systems of the special theory of relativity. So we cannot simply carry out a Lorentz transformation. Thus the simplest way to determine the phase differences with respect to S_F is to directly go back to the relativistic definition of time by light. (For an explanation see 2.8. from the First Part.)

The following outline illustrates the conditions by which the time shifts can be determined that apply to an observer in S_F compared with an observer in S':



(S19)

From A light signals are emitted into both tangential directions. If they propagate along the circle, they arrive simultaneously at an observer in S', who is resting at B. At an observer in S_F, who at the time of the emission of the signals is also at B and moves with velocity w along the circle, the one light signal arrives at point P_1 at the time t_1, the other one at P_2 at the time t_2. Therefore, the time points of the emission of the signals ***are*** different with respect to the moving observer by $\Delta t = t_2 - t_1$. Thus the time difference Δt corresponds to the phase shift per circumference with respect to the moving observer.

As can be seen in (S19), it holds that:

$$ct_1 + wt_1 = U_F/2 \qquad ct_2 - wt_2 = U_F/2$$

$$\Delta t = t_2 - t_1 = \frac{U_F/2}{c-w} - \frac{U_F/2}{c+w}$$

From this follows $\Delta t = U_F \frac{w}{c^2} (1 - \frac{w^2}{c^2}) = U_F \frac{w}{c^2} \frac{1}{k^2}$

Because of $U_F(r_1) = 2\pi r_1 (1 - \frac{\mu}{r_1}) = 2\pi r_1 k^2$

applies $\Delta t = 2\pi r_1 \frac{w}{c^2}$ (54)

This time difference must be set equal to one period of the oscillation. Since in S_F the time is identical with the time outside of the field, the frequency of the oscillation is f_e with respect to S_F, and accordingly the period is $1/ f_e$.

With this, the radius r_1 can be derived. We start at

$$\Delta t = 1/ f_e \quad (55)$$

$2\pi r_1 \frac{w}{c^2} = \lambda_{Ce} \frac{1}{c}$ (λ_{Ce} is the Compton wave-length of the electron: $f_e \lambda_{Ce} = c$)

$$2\pi r_1 = \lambda_{Ce} \frac{c}{w} \quad (56)$$

$$r_1 = \lambda\!\!\!^{-}_{Ce} \frac{c}{w} \quad (56')$$

With $\frac{c}{w} = \sqrt{\frac{r_1}{\mu}}$ follows

$$r_1 = \frac{\lambda\!\!\!^{-}_{Ce}{}^2}{\mu} \qquad (57)$$

Here, $\lambda\!\!\!^{-}_{Ce}$ is the geometric mean of r_1 and μ. (compare (41) und (41"))

If now the geometric charge μ is set equal to the classical electron radius r_e

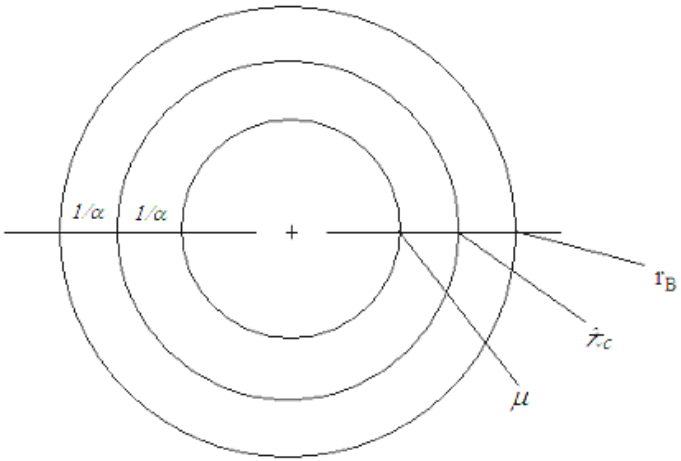
$$\mu = r_e \qquad (58)$$

– then r_1 is equal to the Bohr-radius, and (57) turns into the well-known equation:

$$r_B = \frac{\lambda\!\!\!^{-}_{Ce}{}^2}{r_e} = \lambda\!\!\!^{-}_{Ce}\,\frac{\lambda\!\!\!^{-}_{Ce}}{r_e} = \lambda\!\!\!^{-}_{Ce}\,\frac{1}{\alpha} \qquad (57')$$

Thus, because of (58), μ becomes the ***geometric elementary charge.***

Here is a (logarithmically scaled) outline of the conditions in the tangential flow w:



(S20)

In the metric dynamic model, the relationship between the three quantities classical electron radius (which here is the geometric elementary charge μ), the Compton wave-length of the electron and the Bohr radius is mediated by the rotating metric flow.

Up to now, the description was limited to the conditions on a plane. However anything hitherto derived applies to *any* plane through the center. This means that an in-phase oscillation with the frequency of the ground state of the hydrogen atom exists not only on a *circle* with radius r_B around O, but on a *spherical surface* with radius r_B.

If an electron is positioned into the field of a positive charge μ, then a state results, in which – on a spherical surface the radius of which is equal to the Bohr radius – an in-phase oscillation exists.

The question is: Does this state correspond to the ground state of hydrogen?

This depends on the extent to which the attributes of this state, which ensue from the metric dynamic field definition, correspond to the known attributes of the ground state.

So let us determine further attributes of this state.

The Frequency of the Ground State

From the metric dynamic point of view, the frequency f_e' of the (with respect to S' equiphase) oscillation at the distance r_B follows from the fact that, in S', the time at the distance r_B is retarded by the factor

$$k = \sqrt{1 - \frac{w^2}{c^2}} = \sqrt{1 - \frac{\mu}{r_B}}$$

Therefore applies:

$$f_e' = f_e\, k \qquad (59)$$

The standard value f_e' of the electron in the ground state of hydrogen is

$$f_e'/f_e = 1 - \frac{\alpha^2}{2} \qquad (60)$$

Let us compare $f_e'/f_e = k = \sqrt{1-\frac{\mu}{r_B}}$ with this value:

It holds that $\frac{\mu}{r_B} = \alpha^2$, and therefore

$$f_e'/f_e = \sqrt{1-\alpha^2} = 1 - \frac{\alpha^2}{2} + \frac{\alpha^4}{8} - ..... \approx 1 - \frac{\alpha^2}{2} \qquad (61)$$

Thus, the metric dynamic value of f_e'/f_e in (61) is slightly different from the standard value in (60) ($\alpha^4/8 = 3.54\ 10^{-10}$). Here, the standard value appears as a non-relativistic approximation.

The Spin in the metric dynamic System

To any point P on the spherical surface with radius r_B, where an in-phase oscillation with frequency $f_e' = f_e\, k$ exists, must be assigned the velocity $w(r_B)$ *at any direction* on the tangential plane defined by P.

On any planar section through the center of the sphere, there are exactly two possibilities in regard to the flow-quantity w(r) at the distance r_B:

$$w = \sqrt{\frac{\mu}{r_B}} \qquad \text{and} \qquad w = -\sqrt{\frac{\mu}{r_B}}$$

The fact of a rotation at any plane, the size of which is fixed and which has exactly two possibilities, corresponds to the definition of the spin.

Therefore, we will use the flow-quantity $w(r_B)$ for the definition of a quantity that represents the metric dynamic analogue to the spin of quantum mechanics.

The quantum mechanical spin has the dimension of a an angular momentum Θ, where

$$\Theta = M\, r\, w \quad \text{(M is the "normal" mass, w is the tangential velocity)}$$

In the metric dynamic system, there are only lengths and times and no other measures. Instead of introducing further unities, we define, analogously to the spin:

$$s_{md} = m_e\, r_B\, w_{r_B} \quad (m_e \text{ geometric mass of the electron, w means w/c})$$

$$w_{r_B} = \pm\sqrt{\frac{\mu}{r_B}}$$

$$s_{md} = \pm\, m_e\, r_B \sqrt{\frac{\mu}{r_B}} = \pm\, m_e \sqrt{\mu\, r_B}$$

According to (57): $\sqrt{\mu\, r_B} = \lambda\!\!\!^{-}_{Ce}$

Therefore: $s_{md} = \pm\, m_e\, \lambda\!\!\!^{-}_{Ce}$

According to (41"): $m_e\, \lambda\!\!\!^{-}_{Ce} = \lambda\!\!\!^{-}_{Pl}{}^2$, such that finally

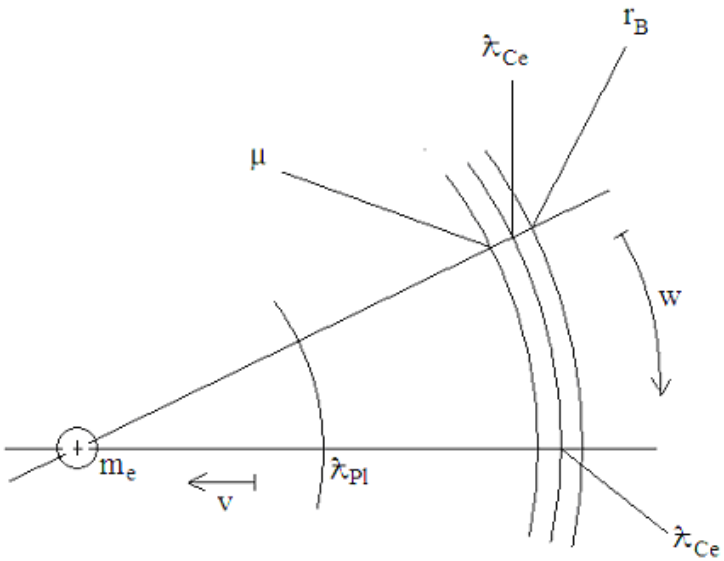
$$s_{md} = \pm\, \lambda\!\!\!^{-}_{Pl}{}^2 \qquad (62)$$

Thus the metric-dynamic spin is equal to the square of the fundamental length. (That this length appears squared is just a consequence of the definition of the metric dynamic spin.)

This corresponds to the quantum mechanical identity of spin and quantum of action – only the factor 1/2 has been lost. However it is somehow "not far away", if one thinks of the fact that, in the case of negative charge $\mu < 0$, the circumference of a circle with radius $r = |\mu|$ is equal to $4\pi|\mu|$, such that a full circle corresponds to an angle of 720° – which is exactly the condition which, in quantum mechanics, relates to the half-integer spin.

At the just performed derivation of the value of the spin, it can be seen how at first the relation between the three quantities [μ | $\lambda\!\!\!^{-}_{Ce}$ | r_B], which is mediated by the tangential flow w(r), and then the relation between the three quantities [m_e | $\lambda\!\!\!^{-}_{Pl}$ | $\lambda\!\!\!^{-}_{Ce}$], which is mediated by the radial flow v(r), together make it possible to trace back the spin to the fundamental length.

Here is an outline, again logarithmically scaled (but still not true to scale):



(S21)

As a reminder: According to (42') applies

$$m_e Z'_E = \lambda\!\!\!^{-}_{Pl} \quad \text{and} \quad \lambda\!\!\!^{-}_{Pl} Z'_E = \lambda\!\!\!^{-}_{Ce} \quad \text{with} \quad Z'_E = 2.390\ 10^{22}$$

– and, according to (57) and (57')

$$\mu \; 1/\alpha \;=\; \lambda\!\!\!^{-}_{Ce} \qquad \text{and} \qquad \lambda\!\!\!^{-}_{Ce} \; 1/\alpha \;=\; r_B \qquad \text{with} \quad 1/\alpha \;=\; 137.036$$

Interpretation of the Spin

Now we will investigate the meaning of the fact that there is a rotation *on any plane,* the value of which is fixed and for which there are exactly two possibilities.

Let us briefly return to the first law. It reads:

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

I said at this point: "This is the law, from which reality is woven."

Although this is expressed poetically, it is still meant to the point: *for us,* this law acts *in* space, but *in itself,* there is no such space – the continuum arises only through the action of this law, it is *actually woven from it.*

In the case of gravity, the development process is 1-dimensional: the continuum is composed of *flow lines*. Let us look, for the sake of simplicity, at the spherically symmetric case. Here, the continuum consists of radii – of rays that emanate from the center (or end in it). To these radii, certain metric attributes are assigned, and to the points located on them the according flow velocities. The condition, which is imposed on these one-dimensional regularities, is consistency: the 3-dimensional continuum, which is formed from these 1-dimensional laws, must not contain contradictions.

Since electromagnetism is assigned to the metric angle density, here the construction is 2-dimensional: the continuum is composed of *surfaces* that go through the center O – let us call them M-surfaces. Therein is nothing peculiar, it is just as natural as composing the continuum of lines.

In the spherically symmetric case, the surfaces are planes through the center. To these planes again metric attributes are assigned, and to the points located on them flow velocities. The condition is again that no inconsistencies must occur in the composition of the planes to a three-dimensional continuum.

If these M-surfaces through O are composed to a 3-dimensional continuum, then other surfaces emerge – say R-surfaces (in the spherically symmetric case, they are spherical surfaces) –, which are defined by the condition that to any point on the surface the same flow velocity is assigned, in fact *in any tangential direction* on the surface.

The point, which is decisive for understanding this statement, is the fact, that it is a *statement about the continuum.* As such, it is neither absurd nor contradictory: it is just about assigning velocities to points. Actually, *nothing* moves – a point of the continuum is not an abstraction of something existing.

However if one tries to interpret the velocity and the according rotation as *attribute of an object* – as is usually done in order to demonstrate the impossibility to understand quantum mechanical quantities other than mathematically – then the circumstances turn into absurdities, and, accordingly, it would indeed be proven that quantum mechanical objects are inaccessible to our thinking.

From the metric dynamic viewpoint, the following applies:

In the case of electromagnetism, the continuum consists of R-surfaces, to any point of which is assigned a flow velocity at any tangential direction. The surfaces are defined by the fact that the absolute value of this velocity is identical for all points of the surface.

These circumstances represent *attributes of the continuum.* They are *not* attributes of an object.

However the metric dynamic attributes of the continuum defined in this way now represent the necessary condition for the development of stationary wave states.

Only these wave states can be understood as "objects". Thus they contain the flow velocity not *as attribute,* but *as precondition.*

In the above section "The ground State", these facts can be seen clearly. There, an in-phase oscillation exists on the surface of a sphere. This oscillation state is the "object". The object has neither the attribute "flow velocity" nor does it rotate. Flow velocity and rotation are attributes of the continuum, and they are necessary conditions for the existence of the in-phase oscillation.

If one approaches the quantum mechanical objects coming from the side of the *things,* then the only possibility is to interpret the quantities, which are needed for the description, as attributes of things – and to fail with this attempt at interpretation.

But if, on the contrary, one starts the description of the world with the *preconditions of being,* then one is at first confronted with the necessity to reconstruct *things*. The quantities needed for that do not yet belong to the realm of objects. Thus, from this viewpoint, it is evident that they are prerequisites and not attributes of objects.

I close my remarks on the interpretation of the spin by quoting myself:

"That which is described by quantum mechanics lies on the border between the pre-objective and the objective realm. Only as seen in this way – by looking at it from both sides – a quantum object can be understood and interpreted realistically." (First Part, section 3.9, point 3.)

Excited States; Quantum Numbers

In order to keep the reconstruction of the first quantum mechanical state as simple as possible and to highlight the metric dynamic substantiations, I described the inner spherical surface, where a phase coincidence occurs, a bit more in detail and separately from the outer surfaces with in-phase oscillations. Actually, however, this separation is not justified, since the derivation of the radii of these surfaces is analogous to the derivation of the Bohr radius, which has just been performed in the section "The Ground State".

We are looking for the radius r_n of the n^{th} spherical surface, where an in-phase oscillation exists, and for the frequency $f_e(r_n)$ of this oscillation.

Again we begin with the fact that the in-phase condition at the spherical surface, which is caused by the geometric mass m_e of the electron, is canceled in the flow due to the rotation, which means that with respect to the rotating system S_F a phase wave exists.

The condition, which represents the basis of the calculation, is now that the circumference of the circle with radius r_n is, with respect to S_F, equal to n times the wave-length of this phase wave.

We start again with the phase difference Δt that occurs with respect to S_F. Analogously to (54) applies:

$$\Delta t = 2\pi r_n \frac{w}{c^2} \qquad (63)$$

However now instead of (55) $\Delta t = 1/f_e$,

for the n^{th} spherical surface applies:

$$\Delta t = n / f_e \qquad (64)$$

– because now the radius of the circle is to be determined, whose circumference is equal to n times the phase wave length, and therefore Δt must be equal to n periods of the oscillation. (Note that the phase wave exists only with respect to the rotating flow-system S_F; with respect to the non-rotating system S', there is no phase shift but again simply an in-phase oscillating spherical surface with radius r_n.)

With $\Delta t = 2\pi r_n \frac{w}{c^2}$ follows

$$2\pi r_n \frac{w}{c^2} = n \lambda_{Ce} \frac{1}{c} \quad (\lambda_{Ce} \text{ Compton wave-length of the electron, } f_e \lambda_{Ce} = c)$$

$$2\pi r_n = n \lambda_{Ce} \frac{c}{w} \qquad (65)$$

$$r_n = n \lambda\!\!\!^{-}_{Ce} \frac{c}{w} \qquad (65')$$

With $\frac{c}{w} = \sqrt{\frac{r_n}{\mu}}$ follows

$$r_n = n^2 \frac{\lambda\!\!\!^{-}_{Ce}{}^2}{\mu} \qquad (66)$$

$$r_n = n^2 \lambda\!\!\!^{-}_{Ce} \frac{1}{\alpha} = n^2 r_B \qquad (67)$$

The associated frequency $f_e(r_n)$ follows from

$$f_e(r_n) = f_e \sqrt{1 - \frac{\mu}{r_n}} = f_e \sqrt{1 - \frac{\mu}{n^2 r_B}} = f_e \sqrt{1 - \frac{\alpha^2}{n^2}}$$

$$f_e(r_n) / f_e = \sqrt{1 - \frac{\alpha^2}{n^2}} = 1 - \frac{\alpha^2}{2n^2} + \frac{1}{8}\frac{\alpha^4}{n^4} - .....$$

This is, except for the terms of higher order $\frac{1}{8}\frac{\alpha^4}{n^4} - .....$ identical with the usual value:

$$f_e(r_n) = f_e \left(1 - \frac{\alpha^2}{2n^2}\right) \qquad (68)$$

n is the principal quantum number.

The hitherto described states are phase coherent. There is no rotation – the "orbital angular momentum" is 0. However there are also states with angular momentum ≠ 0. Now we turn to these states.

At first we must define the metric dynamic analogue L_{md} of the orbital angular momentum |L|. Analogously to the procedure with the spin, we define:

$$L_{md} = m\, r\, v_t \qquad (69)$$

Here, m is again the geometric mass, r is the distance from the center of rotation, v_t is the tangential velocity (read v_t /c).

First, a preliminary consideration: The result of the previously performed derivation was that on a circle with radius $n^2 r_B$ an in-phase oscillation exists, i.e. an oscillation without node points.

On this circle, however, also states *with* node points are possible – but only if these nodes *rotate* with respect to S'.

Let us assume, the velocity at which the nodes – in other words: the oscillation state itself – propagate along the circle, is $w(r_n)$. If we multiply (65) by k, then the left side of the equation represents the length of the circumference of the circle with respect to S', and the right side represents the number of the waves times the phase wave length:

$$2\pi\, r_n\, k \;=\; n\; (\lambda_{Ce}\; \frac{c}{w_{(r_n)}}\; k\,)$$

This means: If the velocity of the node points is equal to the rotation speed of the flow $w(r_n)$, then follows that, with respect to S', a phase wave exists with n wave lengths per circumference. (With respect to S_F, the oscillation is in-phase.)

In general, the following applies: The wave-length of the phase wave in a resting system, which, due to the Lorentz-Transformation, emerges from an in-phase oscillation with frequency q in a system moving at velocity v, is equal to $(c/q)\,(c/v)\,k$. From this follows, that the wave-length is approximately inversely proportional to the velocity v. (Only approximately, because k depends on v.)

Therefore, if, at a rotation speed equal to the flow velocity $w(r_n)$, the number of waves per circumference is equal to n, then, for a phase wave with *one* wave per circumference, a rotation speed of $w(r_n)/n$ is needed.

And thus, finally, the precondition for the existence of a phase wave with *l* waves per circumference is, that the speed v_t at which the nodes rotate, must be equal to $l\,w(r_n)/n$.

Let us now substitute in (69):

$$L_{md} \;=\; m\, r\, v_t$$

For the geometric mass m must be set m_e, r is r_n, $v_t = l\,w(r_n)/n$.

This leads to: $\quad L_{md} \;=\; m_e\; r_n\; l\, w(r_n)/n$

Now $r_n = n^2 r_B, \quad w(r_n) = \sqrt{\frac{\mu}{n^2 r_B}}$

From this follows:

$$L_{md} = m_e \, n^2 r_B \, l \sqrt{\frac{\mu}{n^2 r_B}} \, \frac{1}{n}$$

$$L_{md} = l \, m_e \sqrt{\mu \, r_B} \qquad \mu \, r_B = \lambda\!\!\!^{-}_{Ce}{}^2 \qquad (57)$$

$$L_{md} = l \, m_e \, \lambda\!\!\!^{-}_{Ce} \qquad m_e \, \lambda\!\!\!^{-}_{Ce} = \lambda\!\!\!^{-}_{Pl}{}^2 \qquad (41'')$$

And therefore, finally

$$L_{md} = l \, \lambda\!\!\!^{-}_{Pl}{}^2 \qquad (70)$$

l is the orbital angular momentum quantum number.

For comparison: The quantum mechanical value of the orbital angular momentum is

$$|L| = (l\,(l+1))^{1/2} \, \hbar$$

There is a fundamental difference between spin and orbital angular momentum. The spin is an *attribute of the continuum* and, therefore, a *precondition* of the object "oscillation state".

In contrast, the orbital angular momentum follows from the assumption, that *the oscillation state itself rotates,* which means: it is an *attribute of the object.*

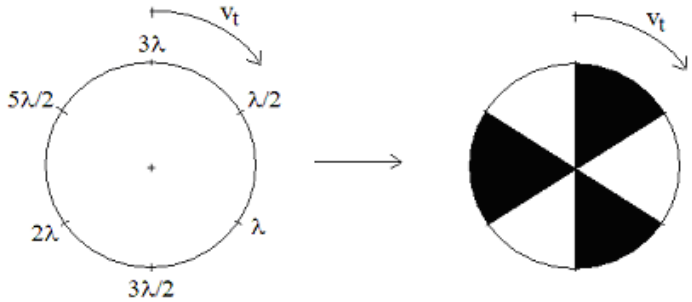
In the case of a state *without* orbital angular momentum, it is possible to assemble the in-phase oscillations along the circles with radius r_n at all planes through O to a total in-phase oscillating spherical surface.

However in the case of a state *with* an orbital angular momentum ≠ 0, there are node points, which move along the circumference with the velocity $v_t(l)$. If one now assumed the same rotation at all planes through O, it would be impossible to assemble the circles on all planes to an oscillating spherical surface.

This means: In the case of a state with orbital angular momentum ≠ 0, at the transition from the circle-oscillation to the spherical surface-oscillation, the spherical symmetry of the continuum-state is broken. Other than the spin, which is an attribute of the spherical symmetric continuum-state and has therefore the same value with respect to *any* plane or of any rotation axis, the orbital angular momentum is an object attribute and exists therefore always only with respect to a given direction.

Based on the hitherto performed conclusions, we have arrived at the idea of a spherical surface on which there is a wave with l nodal lines, and which, at the same time, rotates in a definite direction.

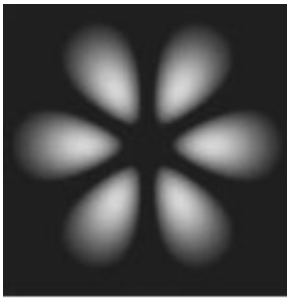
As an example, here is an illustration of the state with n = 4 and $l = 3$:



(S22)

Here, if one proceeds from the view at a plane (to the left) to a spatial view (to the right). then the oscillation state of the circle turns into the oscillation state of a spherical surface, which rotates with the tangential velocity $v_t(l)$. The 6 node points along the circle turn into 3 node lines on the spherical surface. The areas of positive amplitude values are displayed in black, the areas of negative values in white.

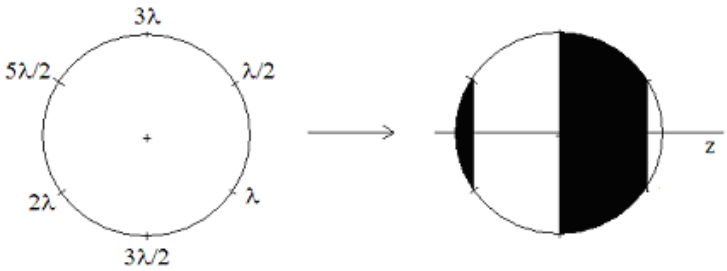
The angular momentum of the state on the right side of the outline corresponds to the angular momentum of the quantum mechanical 4f-state depicted in the following outline:



(S23)

(In (S23), all oscillation areas appear white, because here the squares of the amplitudes of the wave function are depicted.)

The transition from the oscillating circular line to the oscillating spherical surface can also be carried out in another way as in the outline (s22); e.g. like in this outline:

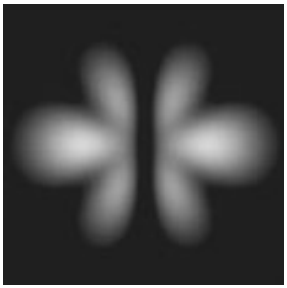


(S24)

Here, all planes defined by node lines are parallel to each other and normal to a given direction. In the outline, this is the direction parallel to the arrow. Let us call this direction z, as usual. From the derivation of (70) follows, that the rotation speed is proportional to the number of the nodes, which occur on the plane through O and normal to the rotation axis. Since in (S24), the number of the nodes on the plane through O and normal to z is equal to 0, there is no rotation with respect to z.

This leads us to the *fourth quantum number m:*

m denotes the number of the planes which are defined by node lines and which are *not* normal to z. Thus, in (S24), $m = 0$, and the state on the right side of the outline (S24) can be identified with the 4f (m=0) state in the following outline:



(S25)

(Also here all oscillation areas appear white, because the outline shows the squares of the amplitudes of the wave function.)

At any given number of nodes l, the number of possible m-states must be equal to $2l + 1$; it follows directly from the number of the possibilities, to arrange – in the case of l node lines in total – m of the planes defined by them in parallel to each other and normal to z, and from the fact that, for $m \neq 0$, there are always two rotation directions with respect to z.

The speed at which the spherical surface rotates around the z-axis – and the according angular momentum – depend on the number of the planes defined by node lines, which are not normal to z. Thus the angular momentum with respect to z depends on m.

This corresponds to the quantum mechanical precepts.

The general scheme is evident: the total number of nodes is determined. At the transition from the view at a plane to a spatial interpretation, the symmetry of the continuum state is broken, and the possible oscillation states of a spherical surface with l node lines must be determined.

In this way, the orbital angular momentums of all quantum mechanical states of the hydrogen atom can be constructed.

Up to now, we have only investigated the phase conditions on planes with radii $n^2 r_B$, which are characterized by the fact that the phase wave interferes *constructively.* However it is evident that the phenomenon "electron in the field of a positive charge μ" is a *three-dimensional* oscillation state. So, let us at last take a look at the "inside" of a state A, which is characterized by the quantum numbers n_A, l_A.

The surfaces with radii $n^2 r_B$ ($1 \le n \le n_A$) must be understood as those surfaces where the amplitude of the three-dimensional oscillation state has its maximum. In the case of the state A, the surface with radius $n_A^2 r_B$ is obviously the outermost of these surfaces.

How many such surfaces with maximum amplitude are there within the state A? At first it appears as if the answer were simply $n_A - 1$. However the following consideration shows that, for $l_A > 0$, not all spherical surfaces with radius $n^2 r_B$ are permitted. As follows:

The (metric-dynamic) angular momentum of A is $l_A \lambda\!\!\!^{-}_{Pl}{}^2$. Thus it depends only on l_A. We derived it from the phase conditions on the outermost spherical surface. It must be assumed, however, that the same value of the angular momentum applies also to all other spherical surfaces with maximum amplitude.

As was shown at the derivation of (70), $l_A w(r_n)/n$ represents the rotation velocity of the spherical surface with radius r_n. With $l_A = n$, this velocity would be equal to $w(r_n)$, and it can easily be shown that the frequency on this plane would then be equal to f_e, i.e. to the frequency of a free electron, which is not permitted.

Therefore, the condition must be met: $l_A < n$ $(1 \le n \le n_A)$.

From this follows that only $n_A - l_A$ surfaces of the n surfaces with $n^2 r_B$ can have a rotation velocity, which leads to the required angular momentum.

In other words: in the state A, which is characterized by the quantum numbers n_A, l_A, there are $n_A - l_A$ spherical surfaces, where the amplitude is maximal.

Between these spherical surfaces with maximum amplitude, there must be *node surfaces.* Thus, the number of the inner spherical node surfaces is $n_A - l_A - 1$.

Since we determined the number of the node surfaces that are planes through the state $A(n_A, l_A)$ as l_A, we come to the result that $A(n_A, l_A)$ is a spatial oscillation state with $n_A - 1$ node surfaces in total, of which $n_A - l_A - 1$ are spherical surfaces that lie inside.

This corresponds to the quantum mechanical definition of the *orbital*. However, at the orbital, rotation and oscillation are so to speak "frozen"; this is a consequence of the time-independence of the underlying Schrödinger equation.

(In order to determine the radii of the inner node surfaces as well as the distribution of the amplitudes in general, it would be necessary, besides the condition of the spherical harmonics also to take into account the r-dependence of the amplitudes. But this will not be carried out here.)

5.9. Atoms with Nuclear Charge Number Z > 1

Finally, here are some remarks about the generalization of the previous results to the case of a positive charge $Z\mu$ ($Z \in \mathbb{N}$, $Z > 1$), i.e. to atoms with a nuclear charge greater than 1. I will be brief, because the construction scheme remains essentially the same.

In all derivations, which were performed for $Z = 1$, μ must be replaced by $Z\mu$.

Thus instead of $w = \sqrt{\frac{\mu}{r}}$ must be set: $w = \sqrt{\frac{Z\mu}{r}}$

At the derivation of the radius of the n^{th} in-phase oscillating spherical surface, in the general case applies, exactly as in the case of hydrogen (see equation (65')):

$$r_n = n \, \lambda\!\!\!^{-}_{Ce} \, \frac{c}{w}$$

With $\frac{c}{w} = \sqrt{\frac{r_n}{Z\mu}}$ follows then

$$r_n = n^2 \, \frac{\lambda\!\!\!^{-}_{Ce}{}^2}{\mu} \, \frac{1}{Z} \qquad (71)$$

$$r_n = n^2 \lambda\!\!\!^{-}_{Ce} \frac{1}{\alpha} \frac{1}{Z} = n^2 r_B \frac{1}{Z} \qquad (72)$$

In the case of states with angular momentum ≠ 0 applies, as before:

$$L_{md} = m r v_t$$

$$m = m_e, \quad r = r_n = n^2 r_B \frac{1}{Z}, \quad v_t = l w(r_n)/n = l \sqrt{\frac{Z\mu}{n^2 r_B \frac{1}{Z}}} \frac{1}{n} = l Z \sqrt{\frac{\mu}{r_B}} \frac{1}{n^2}$$

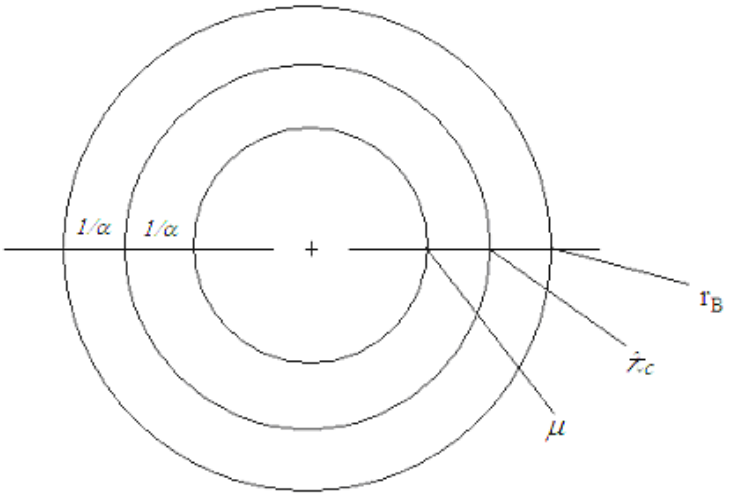
The factors Z cancel each other, and the result is again identical with (70)

$$L_{md} = l \lambda\!\!\!^{-}_{Pl}{}^2$$

Note:

It deserves to be mentioned that in the metric dynamic model can easily be demonstrated that nuclear charge numbers Z > 137 are probably not possible.

We look again at the logarithmically scaled outline (S20):



(S26)

Here, $\lambda\!\!\!^{-}_{Ce} / \mu = r_B / \lambda\!\!\!^{-}_{Ce} = 1/\alpha$

$\lambda\!\!\!^{-}_{Ce}$ is the geometric mean of μ and r_B, i.e. of the geometric charge and the radius of the innermost shell.

However this applies evidently to any geometric charge Zμ and any according radius r_B / Z of the innermost shell: with increasing Z, the geometric charge approaches the Compton wave-length of the electron from the inside, and the radius of the inner shell approaches the Compton wave-length from the outside; the Compton wave-length, however, remains always the geometric mean of the two quantities.

$1/\alpha = 137.036$, and therefore, with $Z > 137$, the geometric charge Zμ becomes greater than $\lambda\!\!\!^{-}_{Ce}$. The innermost radius lies then within $\lambda\!\!\!^{-}_{Ce}$ and therefore also within Zμ.

However within Zμ, i.e. for $r < Z\mu$, the velocity of the rotating metric flow

$$w = c\sqrt{\frac{Z\mu}{r}}$$

is greater than c, and, consequently, there is no longer a static real metric – exactly as is the case with gravity in the area $r < 2m$.

Though this is not a completely compelling reason that a limit of the possible nuclear charge numbers is reached, it can still be asserted that with $Z > 137$ something essential changes. It seems therefore unlikely that the regularities that apply to the cases with $Z \leq 137$ hold true in the realm outside of this limit.

Note: The Compton wave-length of the proton $\lambda\!\!\!^{-}_{Cp}$ is smaller than the geometric charge μ by the factor 13.399.

From this follows that the positively charged nucleus lies *always* inside the area of the complex metric.

5.10. Interpretation: What is an Electron Shell?

What is the "electron shell" of an atom?

The metric-dynamic answer has been given already in the First Part. In the Second Part, it has been completed and specified. It reads as follows:

The electron shell of a nucleus with charge number Z is a stationary oscillation state of a spatial area, in the center O of which a positive geometric charge Zμ is located. This charge creates a field, which is defined by a rotating metric flow and a metric change of the circumferences of circles around O. The field represents the necessary condition for the stationary oscillation state "electron shell".

The shell is complete, if its negative geometric charge amounts to −Zμ. Then the squares of the imaginary metric flow, which is connected with the negative charge of the shell, and of the real metric flow, which is connected with the positive charge of the nucleus, cancel each other out, and so do the metric alterations of the circumferences. The atom is then neutral

The interpretation of the electron shell as stationary oscillation state of a spatial area served in the First Part as basis for the explanation of the *reduction of the wave function* and for its description as an ordinary physical process. (See I, 3.6.)

This hypothesis, whose strength was at first that it enabled a consistent and objective interpretation of quantum mechanics, has now twice proven true:

On the one hand because it was possible to reconstruct an important part of the basic physical reality exclusively by the quantities metric density and metric flow – from which evidently follows that locally confined physical phenomena ("particles") are to be interpreted as stationary states of changes of these two quantities, and on the other hand because we succeeded in deriving many known atomic facts partly accurate, partly at least approximately under the assumption that electron shells are *in fact* wave states *and nothing else.*

This brings us to the next question: *What kind of waves are electron shells?*

Here, we constructed them as *phase-waves of the Planck-waves,* determined by the condition that they form standing waves. This condition appears two times: first it must be met in the longitudinal, radial metric flow, which is generated by the geometric mass m_e, and second in the transversal, rotating metric flow generated by the geometric charge $Z\mu$. Only due to the cooperation of both conditions the spatial wave structure can develop that presents itself as electron shell.

Are the material objects indeed phase-wave structures? This would mean that every physical process is *ultimately* a consequence of alterations of the Planck-waves. Is it possible that this is an artifact of a too much simplified description? I think no. The relations that followed from our approach are so specific and fundamental that it seems improbable that they could be explained also by completely different assumptions.

The next question is: *What is actually oscillating?*

This has already been answered. The amplitude of the waves represents the velocity of the longitudinal or the transversal metric flow or, alternatively, the metric density of the length or the angle. [24]

The appearance of an "electron" is always connected with a local increase of the angle density. In the case of a "bound electron", the area of increased angle density is spherically symmetric, in the case of a "free electron", the greater angle density must be transported through space by the electron-wave. Presumably this means that the amplitude of the angle density does not oscillate about the value 1 but

[24] According to our construction, the phase wave structure *electron shell* contains actually both kinds of waves: those which belong to gravity as well as those of electromagnetism. In the orbital, they are matched to one another. This suggests that in the oscillation states of the electron shells the information is hidden about the relationship between the strengths of the interactions.

about a value greater than 1 – as opposed to light waves, where no altered angle density must be transported and where the mean value of the amplitude is therefore 1.

The hypothesis that the electron shell is a stationary state of "normal" waves has some important consequences. They have already been mentioned in the First Part. However I will recapitulate them briefly and formulate them more precisely on the basis of the recently derived facts.

"Electrons", just as "photons", are transitions between different possible spatial oscillation states in the field of the charge $Z\mu$. The difference between both is that at the transition called "electron" the geometric charge changes, but not at the transition called "photon".

The transitions themselves – as always with standing waves – are indeed discontinuous, however only in the trivial sense, that the values of the quantities, by which the possible states are characterized, are not continuous but appear in discrete sequences. But the processes that cause the transitions are continuous – and this is exactly the same with electrons as with waves of any other kind.

In this regard, an electron can indeed be compared with an acoustic interval, which occurs at the transition between two states of a standing air wave in a tube and which therefore represents the difference between two tones.

Completely unsuitable, however, is the idea of an indefinable entity called "particle" that is "located" somewhere. (***What*** should be located somewhere?) [25]

Thus, from the metric dynamic viewpoint, it does not make sense to speak of the "number of electrons" in the shell, which is limited by the fact that no electron must match another electron in regard to all quantum numbers. There are not $2n^2$ electrons per shell but $2n^2$ possible oscillation states.

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[25] Once again the acoustic analogy: electrons are in just the same sense "particles" or *not* particles as a standing wave in a tube consists of a number of particles or does not, or as the transition between one overtone to another overtone is a particle or not.

So if anyone wants to contend that an electron shell consists of a certain number of electron-particles, he/she can of course continue to use this designation – however consequently he/she should then also say that the oscillation state of the air in the tube that corresponds to the 5^{th} overtone, consists of five particles, and that the transition from one overtone to another overtone is caused by a particle. And, above all, he/she should know that all these "particles" are by no means indivisible substantial entities but *gestalt phenomena,* which, under identical conditions, develop always anew in identical form.

With this, also the usual interpretation of the amplitude square of the wave function as "probability of the presence" of an electron becomes obsolete. However, this is by no means a loss: indeed, it is completely impossible to answer the question of *which physical entity* the probability actually refers to. The only possible answer would be: "To exactly *that* entity that is located there with this probability."

All that can be said beyond this nonsensical tautology is, that the probability distributions of events which are caused by the interaction with an electron, can be traced back to the distribution of the amplitude squares of the wave function of the electron.

However this connection is also substantiated by the pure wave interpretation, without going through the absurd detour over an entity "particle".

Let us assume e.g. that light is scattered on an electron-*particle*. Then the average scattering angle will be large where the amplitude square is large, because, in the usual interpretation, this means that the electron will be there with high probability.

But this is of course also true if the electron is interpreted as the whole *spatial oscillation state* and the amplitude is interpreted as angle density: where the periodic change of the square of the angle density is large, there also the average deviation of the light wave must be large.

And further: in the usual interpretation, the scattered photon causes, with a certain probability – that is again the square of a wave-amplitude – a transition, which can be measured.

In the wave-interpretation, the squares of the amplitudes add up, until somewhere a transition occurs The result is in both interpretations identical.

I can only repeat what I have already stated in the First Part:

Understanding the electron as particle leads to irreparable conceptual difficulties. The absurdities connected with it result ultimately in the loss of *any* interpretation – which, at present, is only masked by the fact that the currently prevailing combination of total conceptual void and formal and experimental know-how is called *interpretation,* though it surely does not deserve this denomination.

This state of affairs appears all the more unpleasant, as clinging to the notion of "particle" in the form of a substantial indivisible entity is actually completely superfluous.

5.11. Closing

I close the chapter on electromagnetism and forgo a summary: everything important has already been said many times.

On the one hand, it seems inappropriate and arbitrary to stop at this point – there are too many unanswered questions.

Above all, the description of the *actual* electromagnetic interaction is missing. However the metric-dynamic prerequisites of the interaction have been established, and it would therefore be easy to define the acceleration of an object in the electromagnetic field as follows: proportional to the central charge $Z_1 \mu$, to the charge of the test-object $Z_2 \mu$, to $1/r^2$ and to 1/m of the object. ($\mu > 0$, $Z_1 \in \mathbb{Z}$, $Z_2 \in \mathbb{Z}$; m is the geometric mass. I have noted the according equation at the end of 6.2.)

But such a description would be purely formal and therefore unsatisfactory. In electromagnetism, by contrast to gravitation, there is no accelerated flow and thus also no direct acceleration. Everything needed must follow either from the frequencies, lengths and phases of the waves,[26] or – and this would be the more attractive variant – the electric and magnetic field can be derived directly from the rotating metric flow-field. In both cases, I have not succeeded.

On the other hand, it is completely justified to stop here. The main objective of this Second Part of my work is, to derive known hypotheses by using only the quantities metric density and metric flow and to prove in this way, that it is possible to start the project *philosophy of nature* not from the observable phenomena but from the other side – from the metaphysical preconditions of being, and for this purpose also in this chapter more than enough evidence has been achieved.

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[26] If the interaction is to be described by waves, then there are two possibilities:

The first one is to describe it simply as *superposition* of the waves. The velocity that results from the superposition represents the outcome of the interaction. Two examples of such a description by wave superpositions were performed in the First Part in sections 3.4 and 3.5 on the Photoelectric and the Compton Effect.

The second possibility is to reduce the acceleration of an object in the field to the phase shifts of the waves in the field.

Notes

1. The considerations of this chapter confirmed the hypothesis which has been established in the First Part: quantum mechanics is the theory that describes stationary wave states and their transition probabilities.

These stationary states are to be understood as attractors of the local dynamics, which means: they are the simplest local oscillation states. Therefore, quantum mechanics is simple too. However for the same reason it is also not fundamental: the fundamental processes of development, transition and decay of such states are not contained in it but presupposed.

To describe what happens in atomic orders of magnitude, however, quantum mechanics is well suited, and it might be possible that we will never succeed in formalizing the actual, causal wave-layer.

Here, the state of affairs is indeed comparable with that of standing air waves in wind instruments: the description of the frequencies of the harmonics is simple, and it is perfectly suited for describing what can be heard (observed). However the transition processes that occur between the different sound events are extremely complex, never identical and perhaps in principle but probably never in detail formalizable.

However in order to *understand,* what actually is going on while playing a trumpet and why it happens, it is required to look at the whole dynamics – and the same applies to the molecular and atomic events.

2. From the metric dynamic viewpoint, it can easily be explained why in the usual description the electromagnetic interaction (as well as all other interactions) is mediated by particles (bosons). The explanation works at first in the same way as the explanation of the (ostensibly) discontinuous transitions between the states of electron shells, which are interpreted as "photons".

Then, in addition to the assumption that photons are just these transitions themselves (and not particles), here the assumption is needed that a change of velocity is tantamount to a change of frequency – which, in the wave model, is a matter of course.

So if two objects interact with each other, then this interaction must result in a change of frequency. This change is – as always – continuous, but observable are – as always – only the discontinuous transitions to another oscillation state, which are then, according to the usual scheme, again interpreted as particles.

3. The difficulties of the unification of gravity and electromagnetism are to be seen as a consequence of the fact that the theory of gravity (GR) is *fundamental* and the theory of EM is *phenomenal.* As follows:

What is the reason that the frequencies of identical particles located at different distances from a mass are different? There are two reasons for that: the different propagation of time, and the energy difference.

Ontologically, however, an elementary fact can have only one single reason. From our point of view, it is the different time. From this follows the difference of the frequencies, and only through the *definition* of the energy as proportional to the frequency follows then the energy difference.

And now, what is the reason, why the frequencies of two electrons located at different distances from the nucleus are different from one another?

In the usual view, it must be the different energies, because EM acts within the flat space-time, such that no change of time takes place. However if one takes this position, then one has accepted the fundamental ontological difference between EM and GR as a fact, and then the two interactions can not at all – or only by using absurd detours – be united.

In our approach, this difficulty disappears. In the metric dynamic model, also the different frequencies of the two electrons are caused by the different times. Here, both interactions are understood as alterations of space-time.

Reality is woven by *one single law* – by the one described by equation (1). This law has two interpretations: in the first one, the longitudinal metric flow is related to the metric density of the length, in the second one, the transversal metric flow is related to the metric density of the angle; the first one leads to gravity, the second one leads to electromagnetism.

The phenomena that are currently grouped under the names "gravitation" and "electromagnetism" are, therefore, states and processes, into which reality organizes itself due to the fundamental law.

In this concept, gravity and electromagnetism are unified. They emerge from the same law. Both are dynamics of space-time itself. At the same time, however, also their difference is cleared up: gravity is a phenomenon of the longitudinal flow and acts through the accelerated flow itself, electromagnetism is a phenomenon of the transversal or rotating flow and acts through waves.

Two Types of Mental Confusion

I. The Duck-Spaceship Dualism

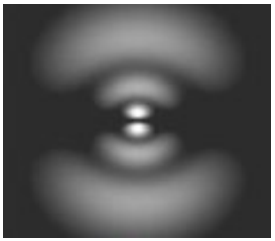
What is that?

A duck.

But if a person sees this picture, whose mind is clouded by the fact that he thinks he knows, for reasons which he believes to be absolutely certain and irrefutable, that the image represents a spaceship? – Then he will not deny the evident form, he will claim that it is a spaceship in the form of a duck. If the object then waddles and quacks, too, he has no problem. He simply asserts that the spaceship has all the features of a duck.

II. The Wave-Particle Dualism

What is that?



The distribution of the amplitude squares of the oscillation state of a sphere with three nodal surfaces: one of them in the form of a plane through the center and two in the form of spherical surfaces.

But if a person sees this picture, whose mind is clouded by the fact that he thinks he knows, for reasons which he believes to be absolutely certain and irrefutable, that the image represents a particle? – Then he will not deny the evident form. He will claim it is a particle whose probability is distributed just as the square of the amplitude of the oscillation state of a sphere. If the object then has frequency and wavelength and interferes, too, he has no problem. He simply asserts that the particle has all the features of a wave.

6. A Universe without Mass

6.1. Preliminary Note

In the First Part has been demonstrated that essential interpretation problems like dualism and non-locality disappear, if the coexistence of particles and waves is replaced by a hierarchical structure, where the concept "wave" is *fundamental* and the concept "particle" is *derivative*.

A necessary condition for this change of interpretation is that the respective measurement results can be derived from wave attributes – particularly such results for which the concept *particle* at first seemed indispensable.

For the Photoelectric Effect and the Compton Effect, this has been proven directly: the experimental facts that result from the interaction between electron and photon have been derived from the wave attributes alone – without drawing on the particle concept ore any particle attributes. This means that in the case of the Photoelectric and the Compton Effect the quantities *wave-length* and *frequency* are indeed fundamental and the quantities *momentum* and *energy* are derivative.

In the Second Part, the description of nature, using exclusively the quantities *metric density* and *metric flow,* was performed to such an extent, that it is now generally possible to define the quantities energy, mass, momentum, angular momentum, action etc. on the basis of metric-dynamic concepts and relations.

How can these definitions be carried out? To answer this question, let us briefly return to the First Part – to the section on the Photoelectric Effect.

Here, the equation for the velocity v of the emerging electrons

$$\nu_L = \nu_{e_0} \frac{v^2}{2c^2}$$

has been derived solely from the assumption that electron and photon are waves and that the interaction must therefore be understood as wave-superposition. The multiplication with h results in:

$$h\nu_L = h\nu_{e0}\,\frac{v^2}{2c^2} = m_e c^2\,\frac{v^2}{2c^2} = \frac{m_e v^2}{2}$$

Thus, the concept *energy* is unnecessary for determining the velocity v. Here, the only reason to define a quantity called energy by

$$E = h\nu$$

is, to enable the transition to the usual (post-mechanical) view.

So much to the considerations of the section about the Photoelectric Effect. They were, however, incomplete in two respects: *First* the identity

$$h\nu = mc^2$$

had to be *presupposed*. This incompleteness was eliminated in the Second Part by the metric-dynamic substantiation of equation (41') in Chapter 4

$$m\,c = \lambda_{Pl}{}^2\,\nu_m$$

The fundamental length λ_{Pl} takes the place of the quantum of action.

Second, the definition $E = h\nu$ itself contains an undefined quantity, namely the *unity of mass,* since the quantum of action h has the dimension [kilogram meter^2 second^{-1}].

We will now turn to the elimination of this elementary incompleteness.

6.2. The Relation between metric-dynamic Physics and Standard-Physics

At first it appears as if we had arrived at an unsolvable problem, because the concept of *mass, measured in kilogram,* is not just undefined but, within the metric dynamic universe, seems indeed to be *indefinable.* In actual fact, however, there is a surprising and simple solution – so obvious that it could remain hidden to the eye that is wandering into abstract expanses:

In all physical definitions and equations, the mass M, measured in kilogram, must be replaced by the geometric mass m, measured in meter.

At first, this act may seem strange, but it is actually evident: gravitation and electromagnetism are geometriciced – both are defined as *metric defects.* Mass corresponds to a change of lengths, and charge corresponds to a change of angles.

Therefore, the concept of a mass, which requires *a measurement unit independent of length and time,* is unnecessary. (Here, I will only refer to changes in the area of mechanics that follow from the elimination of mass.)

Under this condition, the entire formal system of physics remains the same in one respect: all equations are transformed into formally identical equations; but in another respect, it changes completely: in all equations, which contain the quantity mass, the dimension changes, because [kilogram] is replaced by [meter]. With this, *the set of basic measurement units is reduced.*

I will only briefly demonstrate how this works: (In the following, all metric-dynamic quantities are labeled by *.)

Let us start with Newton's equation force = mass times acceleration:

$$F = Ma \quad \text{or, in differential notation:} \quad F = d(Mv)/dt$$

This turns into $F^* = M^*a$ or $F^* = d(M^*v)/dt$ (here, the geometric mass is denoted by M^* instead of m. Thus, M^* has the dimension length.)

Here are some examples of the changing of physical quantities:

	Dimension of the *mechanical* quantity:		Dimension of the *metric-dynamic* quantity:		
force:	dim F:	$kg\ m\ s^{-2}$,	dim F^*:	$m^2\ s^{-2}$	
energy:	dim E:	$kg\ m^2\ s^{-2}$	dim E^*:	$m^3\ s^{-2}$	
action:	dim W:	$kg\ m^2\ s^{-1}$	dim W^*:	$m^3\ s^{-1}$	etc.

We have $M^* = M \frac{G}{c^2}$

From this follows that the relation between the metric-dynamic quantum of action h^* and the usual quantum of action h reads as follows:

$$h^* = h \frac{G}{c^2} \qquad (\dim h^*: \ m^3 s^{-1}) \tag{73}$$

Then from $E = h \nu$

follows $E^* = h \frac{G}{c^2} \nu$

$$E^* = h^* \nu \tag{74}$$

To the elementary length λ_{Pl} applies:

$$\lambda_{Pl}^{\ 2} = \frac{hG}{c^3} = h \frac{G}{c^2} \frac{1}{c} = h^* \frac{1}{c} \tag{75}$$

Thus, the metric-dynamic quantum of action h^* is equal to the square of the elementary length times light-speed:

$$h^* = \lambda_{Pl}^{\ 2} c \tag{75'}$$

With this, some of the equations derived in the Second Part assume the known form. E.g. equation (70) for the metric-dynamic analogue of the quantum mechanical angular momentum

$$L_{md} = l \, \lambda\!\!\!^{-}_{Pl}{}^2$$

turns into $L_{md} = L^* = l \, h^*$

(Here it must be taken into account that, in the derivation of (70), c is set to 1.)

Equation (41'): $M^* c = \lambda_{Pl}^2 \nu$

turns into $M^* c = h^* \frac{1}{c} \nu$

Therefore $M^* c^2 = h^* \nu$

With this, also this important relation – which has been derived in a metric-dynamic way in chapter 4 – appears in its well-known form.

At last, a note about the gravitation constant G. It holds that

$$G = G^* \frac{G}{c^2}$$

Therefore $G^* = c^2$ (76)

This means: *the gravitation constant G loses its status as independent natural constant.*

The Newtonian approximation

$$F = G \frac{M_1 M_2}{r^2}$$

transforms into $F^* = c^2 \frac{m_1 m_2}{r^2}$ (77)

(Analogously, Coulomb's law

$$F_E = \frac{Q_1 Q_2}{4\pi\varepsilon_0 r^2}$$

which describes the force between two charges Q_1 und Q_2 at a distance r, is transformed into

$$F_E^* = \beta\, c^2\, \frac{Z_1 \mu\, Z_2 \mu}{r^2} \qquad (\mu > 0,\ Z_1, Z_2 \in \mathbb{Z},\ \beta \in \mathbb{R},\ \beta \text{ is a constant } [27])$$

With this simple formal act – the replacement of the mass M measured in kilogram by the mass M^* (or m) measured in meter –, the transition to a metric-dynamic description system is completed.

Now it is justified to assert that the concepts *metric density* and *metric flow* are fundamental and *all other physical concepts* are derivative.

In this way, the whole system of physics remains formally unchanged. All equations, all principles – as e.g. the principle of minimal action – remain true. (Indeed it would be completely absurd if this were not the case.)

Nonetheless, the understanding of nature has changed fundamentally.

(According to our definition of the electric elementary charge μ, the dimension of the electric charge Q changes in the following way:

$$\dim Q = kg^{1/2}\, m^{3/2}\, s^{-1} \quad \rightarrow \quad \dim Q^* = \dim \mu = m$$

Assigning dimension length to the electric charge is a consequence of the metric-dynamic view of the interaction, and the analogy to gravitation becomes apparent. The other electromagnetic quantities must be adjusted.)

6.3. On the Comprehensibility of physical Concepts and Relations

"It is important to realize that in physics today, we have no knowledge of what energy is."[28]

Why is it that physical concepts cannot be understood beyond their mathematical definition? To answer this question, it is first necessary to distinguish between *basic concepts* and *derived concepts*.

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[27] Presumably applies $\beta = m_e/\mu$ (m_e geometric mass of the electron). I didn't pursue this question any further.

[28] Feynman, Leighton, Sands, *"Lectures on Physics"* Vol. 1, 4–1, Addison-Wesley 1965.

In no description system – be it mathematical, physical or verbal – could be postulated that derivative concepts, which appear in statements that are the result of chains of conclusions, are immediately comprehensible. To understand such concepts, it is always necessary to track the logical path back to the basic concepts.

Therefore, it can only be demanded that the basic concepts are conceivable or evident.

The same applies to the relations between the concepts or variables of a description system. Again, there are elementary and derivative relations, and again only the understanding of the fundamental relations can be postulated – and of course the evidence of the inferences that lead to the derived relations.

So what are the basic concepts of a physical description system?

Within standard-physics, there are *length, time* and *mass*. What can be said about these concepts?

About length: There is no doubt that the notion length is evident.

About time: The notion time is not obvious. However, as already mentioned in the First Part, this problem can be solved by replacing *time* with *motion* as basic concept. Accordingly, *time* is then a derivative concept, which follows from *motion* and *length.* This replacement is possible, if there is a fundamental motion which any movement can be related to. Evidently, light meets this condition.

Formally, nothing changes due to the replacement of time by motion, however an epistemological uncertainty is eliminated.

Therefore, *length* is evident, and *time* can be understood by tracing it back to *motion* and *length.* If there were only these two basic concepts, then all basic concepts would be understandable.

With this, it is clear that it is the concept *mass,* which causes the incomprehensibility of physical concepts and relations.

In fact, a critical examination shows at once that the apparent clearness of this concept, though it is based on facts from the area of our everyday experience, vanishes into thin air if one tries to understand it as an *object attribute.* The question what the mass of an object *actually* is, cannot be answered beyond measurement regularities.

There is a close connection with the problem of the notion *object,* if this notion is applied to anything which is thought to be elementary. It is then impossible to answer what this object *is* and *what it consists of*. However the notion *mass* relates to this questions, and therefore the inconsistency of the notion of an elementary substantial object is transferred to the (putatively irreducible) attribute *mass* of such an object (elementary means: not reducible to anything else).

In contrast, the geometric mass is free of such inconsistencies. It is not an attribute of an object that is assigned to this object just *by definition,* but – as metric defect – a constituting element of the object, i.e. an attribute that belongs to its metric-dynamic conditions and from which the effects emanating from it can be derived and understood.

Like the concept *object,* the concept *geometric mass* is derivative and not fundamental.

Now we proceed to the physical relations or laws. In the same way as with concepts, also here we must differentiate, as mentioned above, between fundamental and derivative laws. And again it can only be expected that the fundamental, which means: the elementary laws are immediately evident or comprehensible .

Standard-physics begins with Newton's equation:

$$\mathbf{F} = \mathrm{M}\,\mathbf{a}$$

After what has been said, it is clear that already this first step leads out of the realm of the understandable: this equation contains the inaccessible and ontologically inconsistent fundamental concept *mass* and the derivative concept *force,* which in turn contains the dimension kilogram, such that the questionability of the concept *mass* is transferred to the concept *force.* The same applies of course to all other equations where a concept occurs which contains the dimension kilogram.

Metric-dynamic physics begins with the equation

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

It contains the variables *metric density* σ and *flow velocity* v. Both are intuitively understandable. The relation between the two variables expressed by the equation follows directly from the analysis of the *origin of everything.*

This equation is the basis of metric-dynamic physics. It represents *the only one* fundamental metric-dynamic relation.

Therefore, as a summary, it can be stated:

Standard-physics contains the mechanical mass measured in kilogram. As fundamental, irreducible concept, it is inappropriate and, moreover, unnecessary. Its inaccessibility and ontological inconsistency is carried over to the whole system of standard-physics.

This concept of mass is connected with the concept of *material substance* and, with it, also with the idea of *elementary objects (particles)* which are always *substantially identical* with themselves; – an idea that – as has been shown in the First Part – leads ultimately to absurd concept formations like *non-locality* or *reduction of the wave function.* The consequence is a total loss of reality.

Metric-dynamic physics avoids these difficulties. The only basic concepts are *length* and *motion.* The only measurement units are meter and second.

Mass is a derivative concept. As such, as geometric mass, it is comprehensible, and the same applies to all other derivative concepts.

However, only if all concepts and relations are explained in a metric-dynamic way, we can speak of a fully comprehensible physical reality. We are still far away from this goal.

But at least we have covered a considerable part of the way.

7. Notes, Questions

Except for a brief note on cosmology, which will be the conclusion of the Second Part, now – as far as it concerns issues of physics – essentially everything is said what I have to say.

This chapter is therefore only an addition, a loose collection of notes, which seem to me worthy of mention for several reasons.

The four Interactions

Gravitation was determined as the field of laws that arise from the fact that, in the fundamental law, σ is interpreted as metric density of the length, electromagnetism as the field of laws that arise if σ is interpreted as metric density of the angle. However since there is nothing other than lengths and angles, the problem seems to appear that there is no room for other interactions. But this is not true for two reasons:

1. At the reconstruction of the atomic structure, not all possibilities have been exhausted. The condition of standing waves was only used for determining structures in the outer space. However this condition can also be applied *inwards*. The shell-model of the nucleus can be reconstructed analogously to the shell-model of the electrons, if the metric-dynamic procedure that was applied to the quantities geometric charge $Z\mu$ and Compton wave-length λ_{Ce}, simply is transferred to the quantities $Z\mu$ and Compton wave-length of the proton λ_{Cp}. This leads to a structure *within* the nucleus.

This fact as well as the close affinity of electromagnetism and weak interaction in the standard model suggest that the weak interaction can be derived from the flow rotation in a similar way as the electromagnetism.

2. Here, only the simplest linear regularities were taken into account. If, however, the waves of quantum theory are seen as actually existing waves – as is the case in the metric dynamic model –, then somewhere, which means: at a certain order of magnitude, the limit of linearity must be reached. It is reasonable to assume that this applies to the order of magnitude of the atomic nuclei. If this is true, then the strong interaction is presumably a non-linear phenomenon of the transversal (rotating) flow.

If there are also non-linear phenomena of the longitudinal flow remains open.

Regarding the strong interaction, also the following must be noted:

In the metric-dynamic model, the current description of the strong interaction cannot claim the same rank as the description of gravity. Rather it is an approximation, to be compared with the description of the planetary orbits by an epicycle system.

To substantiate this assertion, I remind you of the comments about the strong interaction at the end of the First Part:

On the one hand, quarks – the carriers of the color-charges – cannot be separated from one another, because the strong interaction does not diminish with the distance.

On the other hand, in a neutron interferometer, single neutrons are partitioned.

In the standard interpretation, this is "no problem", since the two rays which the neutron is split into are not seen as anything existing, but only as a mathematical tool: the wave-equations do not relate to real waves – their amplitude squares represent just probabilities of events.

From the point of view adopted here, however, denying the *existence* of a phenomenon which does not just correspond to a wave-equation but *actually interferes,* is not a possible interpretation but nonsense. From the fact of interference follows necessarily, that the neutron beams are not just mathematical tools but actually existing waves. Thus, the phenomenon called "neutron" is *actually* split.

But this fact contradicts the description of the strong interaction, according to which the neutron consists of three quarks which cannot be separated.

This means that the usual description of the strong interaction is an approximation, which – though it reflects the real circumstances quantitatively – does not correspond to that which *actually exists*; – similarly to the case of an epicycle system, which can represent the planetary orbits with arbitrary precision, though its parameters do not relate to existing quantities, or in the same way as Newton's description of gravity, which is a sufficient approximation for most cases, though its basic concepts completely miss reality.

What about the predictive power of the currently accepted description of the "strong interaction"? This is undoubtedly an argument that speaks for its current interpretation – albeit not a very meaningful one: probably almost every description, which contains general parameters by which some phenomena can be approximated, is capable of further approximately correct predictions.

From both Sides

If one starts the description of nature from *this side* – that is: the side of things –, then the initial concepts seem self-evident (particle, force etc.).This self-evidence, however, eventually turns out to be a deception, and the original content of the notions disappears. If then, ultimately, quantum objects are encountered, the failure of interpretation is inevitable. The initial ideas do no longer offer any possibility of understanding. Absurd concept formations are the result.

The objects of quantum mechanics cannot be interpreted as "real" in the usual sense. The consequence is that in the 20th century the interpretation of the real circumstances has been replaced by the interpretation of our failure to understand the real circumstances. The paradigms do no longer explain what happens, but instead demonstrate the impossibility of understanding what happens. The actual interpretation disappears or degenerates to the level of a mere manual for a *black box*.

This is problematic because science works only as interplay of interpretation and mathematics. In fundamental physics, the creative acts that contribute to the development originate in many cases in changes of interpretation. Only in the second step, when the creative act leads to a formal description, mathematics takes again the leadership. Fundamental Physics without interpretation is – as the experience of the recent decades teaches – incomplete and barren. Without interpretive guidance, the physical research takes wrong turns.

In contrast, if the description of nature starts from *the other side* – that is: from the side of the most abstract – then a totally different picture appears.

Following the principle of necessity, one is led to objects that exhibit exactly the differences to "normal" objects as prescribed by quantum theory. Yet it is these very objects – and only these objects – which we actually can understand, in the sense that they are derived from conditions, which are recognized as necessary conditions of existence, and that they are of metric-dynamic nature.

Exactly those elements of physical experience, which seemed to rule out a realistic interpretation for ever – imaginary dimensions, quantization, rotations at any direction etc. – prove to be necessary and geometrically understandable consequences of the build-up of physics upon the metaphysical conditions of existence.

It may contribute to clarity, to imagine the following classification:

There are two areas. The one is the area of physical objects. In the attempt, to substantiate the existence of these objects by concepts and methods which originate from this area itself, one arrives at its border – the "object-ness" of the objects dissolves.

The other is the area of abstract principles. Here, there are no objects. Objects must first be constructed – as patterns of the motion of AGENT.

In this image, quantum theory is to be regarded as interface between the two areas: at this interface, the objects derived from pure metaphysical necessity prove to be identical with those that represent the final step on the path of progressive abstraction of experiences in the world of things. Seen as such abstractions, they cannot be understood, however seen from the other side they are geometrically evident and necessary.

What are Material Objects?

Our investigations suggest the following hypothesis:

Material structures are interference phenomena, localized patterns of phase-waves of the Planck-waves, quantized through the condition that they form standing waves in the radial and in the tangential flow. The causal connections which these patterns are based upon and which determine their interactions do not lie in themselves but in the background of Planck-waves and flows.

The localized patterns can dissolve into the waves which they consist of. They will eventually emerge again at another position as identical patterns over identical background. However they are then not *identical* patterns in the sense which is suggested by the particle concept: the percentage of waves, which actually stem from the original, dissolved pattern can be negligibly small compared with the percentage that stems from other patterns of the same kind, which means: from *formally* identical patterns.

A basic Principle of Physical Reasoning

I use the thematic freedom of this chapter to sketch out a thought about physical reasoning, which, though I consider it important, as yet I did not mention, because its distance from the current style of thinking seems even greater then that of the hitherto presented thought trains.

I consider *conceptual and notional consistency* the fundamental principle of physical cognition. (Subsequently, I will illustrate what I mean by that.)

My confidence in this principle goes so far that I even think that this principle alone is sufficient to get to the true description of reality – and I think that the hitherto performed thought trains and results achieved through them justify this confidence to a certain extent.

If this is true, then follows that the proper strategy of physical reasoning is searching for such inconsistencies and eliminating them.

An example; Newton's theory of gravity contains a fundamental conceptual contradiction: a force exerted by a mass that acts through empty space upon another mass without any kind of mediation. This is evidently impossible. Thus, also the great success of Newton's theory cannot obscure the fact that it is only a *phenomenal* approximation, simply because of the conceptual contradiction contained in it.

With this, it is clearly specified what a "better" theory must accomplish: it must replace the action at a distance by a differential action that propagates "from point to point". This is exactly what Einstein's theory of gravity does, and in this way it eliminates the conceptual contradiction.

Now, however, appears yet another contradiction, which occurs also already in the Newtonian theory and which is not resolved by Einstein's theory. It manifests itself in the form of the unanswerability of the "why" question:

Mass curves space-time. Why? This question is unanswerable. The connection between mass and space-time exists only *by definition,* not other than the connection between mass and attracting force in Newton's concept. The *actual* problem, however, is not the unanswerability in the area of the description but the impossibility of the relation linked to it in the area of existence: space-time is another kind of entity as mass, it is *essentially* different from mass, and has therefore nothing to do with it.

In general the following applies: only entities of the same kind can influence one another, and the mediating element must also be of the same kind. Thus, an alteration of space-time can only be caused by space-time and be mediated by space-time. Therefore, the concept *mass* must be traced back to space-time-alteration.

From this follows already, that everything that exists is of the same kind, or, to put it more exactly: that everything that exists originates from one and the same metaphysical primal ground, and further

follows, that all entities and their interactions are of metric-dynamic nature, because only if this is the case – that is: if everything is *space-time alteration* – then the introduction of irreducible entities like *mass* or *charge* or *particle,* which are in no ontological relation with each other and are therefore *impossible*, can be dispensed with.

What is meant by that becomes clearer, if the notion "particle" is investigated, because it contains a contradiction that is closely related to the above contradiction:

In the case of a particle, there are two possibilities:

a) The particle is point-like. Then it does not exist and can therefore not be carrier of any attributes (charges).

b) The particle is spatially extended. Then the following applies: If it is elementary, then it is structureless. Then a spatial area "exists", which *by definition* falls out of time. Structurelessness means: nothing changes with time. Therefore, in the area without structure, there is no time. Time exists only outside of this area; it reaches up to its border, then it disappears, and only when we step out of the structureless area, time is again in effect.

This is obviously nonsensical in itself, and even more so due to the fact, that something, which is outside of time or without time, cannot influence something that is within time. (For this reason I've set the term "exists" in quotes: a structureless spatial area – which means: an elementary particle – can simply not exist.)

Therefore, there are no "structureless" elementary particles. Their existence is contradictory and thus impossible. Everything that exists must have inner structure and, therefore, be part of space-time. The differential causal chains described by the fundamental law (1) cannot just end at a certain point; they must lead everywhere. In other words: everything that exists is a pattern of alterations of space-time.

Thus, there is also a very short path to the fundamental knowledge about existence that is the basis of the physical description of the world presented here.

8. Cosmology

The metric-dynamic view of the universe leads to a cosmology that differs significantly from the standard cosmology. It will be outlined in this chapter.

What currently is told about the history of the universe and presented as secure knowledge is well known. So I can spare to go into it. Instead I want to ask you something:

Imagine, you measure the length of your dining table *today*. It is one meter. *Tomorrow* you measure again, and indeed with the same scale. This time the length is two meter.

What do you conclude? Either that the size of your dining table has doubled since yesterday, or that your scale has shrunk to half (– or that the size of both has changed, but we will ignore this variant).

Obviously, the two results alone do not permit any conclusion about which of these alternatives is correct. The decision is only possible if *further information* is available.

However exactly the same applies to the measured distance-dependent redshift:

Suppose we measure the wavelengths of two light rays that have been emitted from a certain element, say: Hydrogen, from two different cosmic distances – i.e. at two different points in time. The measurement is performed through a comparison with the wave-length by which the length unit is defined.

Evidently, there are two possibilities to interpret the distance-dependent redshift:

1. The universe expands.

2. The universe does *not* expand – instead our yardsticks shrink, which means: all wave-lengths, which may serve to define the unit of length, decrease with time. (Of course this applies also to the waves emitted by Hydrogen; however, from the instant of their emission, they remain unchanged.)

Also here applies that it cannot be deduced directly from the measurement whether 1 or 2 is true. For that, additional information is needed. The "rest of the circumstances" will motivate us to opt for one of the two variants.

This openness of the interpretation of the redshift is so obvious that the question arises whence the certainty comes with which has been assumed – indeed from the very beginning – that the universe expands, and why the alternative has never been seriously considered – all the more, as the assumption that the size of the universe is changeless and the redshift a consequence of the time-dependent decrease of the wavelengths that relate to material phenomena, would simply have made the absurd postulate of the so-called *big bang* superfluous.

It attracts attention that, in the historical development, there has never been any kind of doubt. The decision was clear from the outset, simply because the alternative did not lie within the horizon of the thinkable. This means that here deep unconscious prejudices are in effect – such ones, which exist prior to any act of thought and which represent therefore presuppositions of thinking.

It is also immediately clear *which* prejudice the view to the alternative option obscures: the notion of substantial, unchanging existence, which in physics survives in the form of the assumption of elementary particles and natural constants.

In order to avoid nonsensical concept formations and to get to a consistent local and objective interpretation, it has already proven necessary – in the explanation of the theory of relativity as well as in that of quantum theory – to replace the idea – no: the *prejudice* of substantial existence by the idea of change (which, in the Second Part, has developed into pure, i.e. *subject-less* change).

Now, as regards the question of the history of the universe, the same applies. Again it is necessary to reject the idea, which originates from the depths of a priori prejudices, that there is something given as non-contingent unchanging existent.

Exactly this idea is the source of the presently prevailing conviction that there was *an absolute scale,* with which even the size of the universe in total could be measured, and from whose existence would have to be concluded that the universe expands.

The two alternative hypotheses shall now be discussed briefly. First, we formulate them more precisely:

Hypothesis 1: The wave-length, by which the length unit is defined, is *absolute,* which means: time-invariant. The distance-dependent redshift of cosmic objects is a consequence of the increasing size of the universe.

Hypothesis 2: *All* wave-lengths – those emitted by cosmic objects as well as those by which a length unit can be defined – are *variable with time.* The distance-dependent redshift follows from the fact that

all these wave-lengths decrease at the same rate over time. To put it simply: the size of the material structures decreases; the assumption of a variable size of the universe is superfluous.

The two hypotheses can be assessed in three ways:

1. Regarding the observations.

2. By the theories that play a role here.

3. On the basis of principal philosophical considerations.

Since by now you are somewhat familiar with my style of thinking, you know that I consider the third way the most important. Still, I begin with point one because it was of crucial importance in the historic development.

The observation which led to the assumption of an expanding universe was of course the distance-dependent redshift. But this observation does not only represent the beginning of this strange hypothesis but continues to be its fundament. However as such it is inappropriate, because – as was just demonstrated – it doesn't only support the assumption of an expanding universe but also the assumption of decreasing wave-lengths.

The second observation, which has led to the "conversion" of most physicists, was the cosmic background radiation, which had been predicted before and could be considered as echo of the "Big Bang".

How can the background radiation be explained within the frame of the alternative hypothesis?

Just in the same way as in the standard hypothesis. What is in general – apart from the question of variable or fixed size of the universe – the difference between the two hypotheses? As follows:

In the standard hypothesis, there are fixed ratios between certain quantities (natural constants), and, *additionally,* the quantities themselves are also fixed, that is: they have time-invariant, absolute values. In the alternative hypothesis, there are also fixed ratios between certain quantities (wave-lengths), but the additional postulate of fixed values of the quantities themselves is missing.

This is a strong argument in favor of the alternative hypothesis, because if there are two hypotheses that explain the same, the one with fewer presuppositions must be chosen.

Except that, in the alternative variant, everything which exists and which happens shrinks with time, physical processes are basically identical in both variants. From this follows that the observable phenomena do not permit to distinguish between the two variants.

An example: the so called cosmic time-dilatation. Suppose a far away event A causes another far away event B. In standard cosmology, the mediating process appears retarded, because event B occurs at a greater distance, such that the information about the event B reaches us later and, therefore, from our point of view the process seems to require a longer time.

In the alternative cosmology, the reason for the retardation is seen in the fact that the events are *actually* located at a greater distance from one another.

Does this mean that the alternative cosmology is just a spatial and temporal transformation of the standard cosmology? Not at all! Within the framework of the alternative hypothesis, the cosmos is *a closed metric structure,* and this is a fundamental change against standard cosmology. E.g. from this assumption follows directly a self-organization in the form of standing waves.

But we will get to that later. First, it should be noted that the alternative hypothesis based on the metric-dynamic physics is more than a mere transformation of cosmology, because it leads to a radical reinterpretation of the history of the cosmos, and because the "rest of the circumstances" – which, as elucidated previously, is indispensable for the decision which hypothesis to choose – is completely changed by it. The universe is then no more a building set, in which ever identical entities and their ever identical attributes form the reality, but a self-organizing structure, in which everything has *originated.*

Here, there is no room for the idea of *absolute existence,* which is the prerequisite for the assumption of an absolute scale. There are only waves which form patterns and whose lengths change with time. Only one thing remains constant: the ratio of the wave-lengths, because they relate to each other within the self-organization and are therefore bound to one another by natural laws.

However a stationary universe, as Einstein imagined originally, would be impossible for various reasons. One of these reasons is the fact that the equations of the general theory of relativity do not permit a time-invariant size of the universe. As is known, Einstein's attempt to make a steady universe possible by introducing the *cosmological constant,* does not work. The universe that corresponds to the adapted equations is not stable.

However the alternative hypothesis, according to which not the universe is expanding but all wave-lengths that relate to material phenomena change, does indeed not describe a stationary universe: the

dynamics which is necessary to avoid contradictions is simply transferred from the size of the universe to the size of the material structures.

Now I change over to the argumentation area that I consider decisive for the question, which of the two hypotheses must be chosen: the philosophical area. Here, the situation is perfectly clear. To say it in advance:

A variable size of the universe can be excluded on metaphysical grounds.

The basis of the argumentation is that the concept *size* is only applicable in the realm of the *existing.* It is a *relation* between existing objects or between quantities connected with these objects.

Right at the beginning of the Second Part, we have already encountered an entity which the concept of size cannot be applied to. The *origin of everything* – that, which neither is nor is not and which cannot be thought as it is *in itself* – has no size. Everything that is relational originates from it, but it itself is *not* relational.

Let us briefly return to the initial equation (1)

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

The fact that the *origin of everything* has no size manifests itself in three ways:

1. There are only *differential quotients*, i.e. *alterations* of quantities. The quantities themselves do not appear.

2. The equation is *linear.* Linearity means size (scale) invariance. If an equation of the form $x = y$ is transformed by

$$x \Rightarrow q\,x \qquad y \Rightarrow q\,y$$

then it remains identical.

3. A necessary condition for the simple form of equation (1) was to determine σ as *metric* density.

The metric density σ differs from the "normal" (one-dimensional) density ρ by the fact that there is no absolute value which the respective value of σ relates to; instead only *one* single differential time step is factored in. In other words: the normal density has a memory, the metric density has no memory.

However the absence of an absolute value means – at this level of reality and of its description – that there is no size. If σ were understood as normal density, then in equation (1) and (1a) the factor $1/\sigma$ would be necessary, and the size invariance mentioned at point 2 would disappear.

The difference between both kinds of density can be illustrated by the following thought experiment:

If one enlarges or reduces the size of a sphere, which is made of an elastic material and which, before the change, is in a (force-free) stable state, then a force will originate that acts against the change.

In the case of a *metric* sphere, however, in which only the metric density exists, enlargement and reduction are operations by which actually *nothing* is changed. The sphere is simply transformed into an identical sphere. *The idea of an absolute size loses its meaning and becomes empty.*

(But caution is required. From the scale invariance of (1) does *not* follow that a theory which is based on this equation is also scale invariant.)

Thus, at the beginning of the construction of physics from metaphysics stands the fact that there is no absolute size.

However the same applies to the universe *as a whole*. In the same way in which the *origin of everything* is not just a *thing with attributes,* also the universe as a whole is not a thing with attributes. *It is not relational.*

This fact reveals itself indeed immediately if the question is asked *against what* the universe actually expands. This question has already been posed many times, but hitherto nobody has drawn the correct consequence from the fact that an answer is impossible *on principle* – the consequence, that is, that it *cannot* expand, because here the concept "size" is not applicable.

The reason for this omission is that we *must* always think what we think as *substance and accident.*

At the beginning of our considerations, it was necessary to *objectify* the *origin of everything.* Though it does not divide into substance and accident, we had to assign to it *change* as attribute*,* in order to make it thinkable. And in the same way, as it was unavoidable to treat that which neither is nor is not *as if it*

were a thing, it is also completely unavoidable to objectify the universe as a whole. And *one* way of objectification – indeed the most common one – is to assign a size to it.

However isn't this justified simply for the reason that we can put any chosen length unity into relation to the size of the universe?

Not at all! From the metric-dynamic point of view, the possibility to speak and think of the size of the universe is nothing but an artifact of the *a priori* necessity to objectify (treat as a thing) everything which is thought.

So what should be done if the size of the universe appears as function of time in an equation?

Plain and simple: since it is not permitted to apply the concept "size", which belongs to the world of things, to the universe as a whole, the size of the universe must remain untouched. And from that follows that the time-dependent alteration must always be interpreted as a change of the scale.

Proposition:

There is no absolute size, only size relations.

Not the universe expands, but all wave-lengths that relate to material phenomena decrease – and this applies to the wave-lengths which we receive from the cosmos as well as to those which we use for defining lengths scales. (After the instant of the emission, they remain constant.)

This hypothesis is another important element of a universe that corresponds to the principles of reason. In this way, the assumption of the big bang becomes superfluous, by which the most important one of these principles is violated: the principle of the completeness of reality, which says that there is nothing but reality and that nothing – no model, no theory – can lead out of reality. Thus, if the big bang is understood as an event where *everything* originated – also, as is told, space and time – then, in light of this principle, that is simply nonsense.

In recent years, however, an increasing number of speculations has developed, that beyond the big bang might be another universe. Though these variants are to be preferred compared with the absurd idea of a beginning of everything, they still proof what had to be expected: just as in the context of the "reduction of the wave function", where now already for decades the strangest ideas have been roaming, also the Big Bang scenario turns more and more into a playground for the most absurd

fantasies, such as the idea of "space-time bubbles" that arise constantly anew and evolve into universes. Here, science turns into science fiction and eventually into pure fantasy.

It is the fate of such erroneous assumptions to beget just more and more nonsense. So the respective scenarios are not at all *explanations,* i.e. they do not enable a reduction to something simpler, but on the contrary they represent *openings,* transitions to other, more complex scenarios with unknown elements, where always chance plays a central role. The apparent palatability of such fantastic amplifications merely obscures the fact that a real explanation is missing.

Dark Energy

The hypothesis that not the universe expands but the wave-lengths shorten permits not only to dispense with the absurd idea of a beginning of space and time, from it ensues also that the so-called *dark energy* vanishes into thin air. As follows:

In the standard cosmology before 1998, there were only two factors from which the velocity of the ostensibly expanding universe could depend: the *initial velocity* (after the end of the so-called inflation – a phase of exponentially accelerated drifting apart), and from then on only a gradual reduction of the velocity through the effect of gravity.

Thus, when at the end of the last millennium observations led to the conclusion that the speed of the expansion is increasing, this fact had no place in the existing model. Therefore it was necessary to introduce an *additional element* into the model – the so-called *dark energy.*

Such *ad hoc* introduced elements, which serve only for the purpose of eliminating a contradiction that occurs in an otherwise well-functioning model, are sometimes appropriate when problems of minor importance appear. However *dark energy* is by no means an unimportant element of the physical reality: it is supposed to account for 70% of the universe. So this is certainly the most enormous *ad hoc* conceptualization of all times!

That its invention, in accordance with the current presentation style in most branches of business, is celebrated by some physicists as the "dawn of a new physics", can hardly compensate for the fact that it is hitherto impossible either to integrate dark energy into the existing physics or to present just the slightest idea what a new kind of physics it should lead to.

How do the observational facts present themselves in the alternative cosmology?

The circumstances are straightforward:

Dark energy is the reason for the accelerated expansion of the universe. Thus, *if there is no expansion, then there is no dark energy.*

With this, everything of importance is already said. The unpleasant introduction of an unknown form of energy is superfluous.

Nevertheless, we will dwell a little on the subject, to discuss which observations are to be expected under the assumption that not the universe is expanding, but the wave-lengths are decreasing.

First it is to be noticed that a constant velocity of shortening of wave-lengths in the alternative model corresponds already to an increasing expansion velocity of the universe in the standard model.

A simple example for illustration:

Be t_0, t_1, t_2 three cosmic time points, $t_2 - t_1 = t_1 - t_0$.

At the time t_0 the wave-length that serves as length unit be equal to 1. If it decreases between t_0 and t_1 by 0.1 to 0.9, then in the standard cosmology this fact is interpreted as increase of the size of the universe by 1/9 of its size at t_0.

An equally large decrease of the wave-length from 0.9 to 0.8 between t_1 and t_2 corresponds to an increase in size of the universe by 1/8 of its size at t_1. Thus, the increase between t_1 and t_2 is $(1/8 * 10/9) = 1/7.2$ of the size at the time t_0.

Therefore, the increase of the size between t_1 and t_2 is greater than that between t_0 und t_1; the speed of the expansion has increased.

This would be the case if the shortening of all material wave-lengths would have a constant velocity. However this is not a plausible assumption. More probable seems a periodic change of the wave lengths. (With a period of at least some ten billion years.)

To realize this, it might be useful to draw an outline of the self-organizing universe.

What comes to mind immediately if one thinks of a closed self-organizing metric structure? Of course standing waves. Comparable with a vessel driven by a strike into a vibration state that manifests itself as sound, the cosmos organizes itself, based on the laws (1) and (1a), in the form of standing waves.

(I've been asked at this point: Who strikes the universe? – Well, nobody. The *origin of everything* does not divide into substance and accident, it is not *something which* changes. That, which neither is nor is not, *is* change. Without change, it disappears. Thus, it need not be struck – no, it *cannot* be struck, because it is only there as "struck", i.e. as everywhere and permanently changing.)

Cosmic observations on the one hand and our considerations on the other hand lead to the following assumption:

The cosmos organizes itself in the form of standing waves in two orders of magnitude:

1. In waves of the magnitude of some hundred million light-years. Their oscillation areas are the cosmic voids, around which galaxies are arranged in the form of clusters and filaments. In this model, they represent the node "surfaces", i.e. the areas of lesser extent that lie between the honeycomb-like voids.

2. In waves, the wave-length of which is equal to the (here time-dependent) Planck-length. They are the basis of the material structures. Upon them, as outlined in chapters 4 and 5, the material world is built up in the form of phase-waves, whose wavelengths are in constant ratios to one another and to the Planck length.

If the basic law (1) were based on the normal density, then the universe would be comparable to an ideal elastic medium, and it would have to be assumed that it approaches a stationary state, an attractor, which is of a similar kind as the sound of a struck vessel. As mentioned above, such a state is not permitted.

Can the fact, that (1) does not contain the normal density but the metric density, prevent the existence of an attractor of this type?

I believe yes, and I think the reason is that, in the case of a law which contains the normal density, any attractor relates to the absolute value of the length, where the density is equal to 1 and no accelerations occur. In the case of the metric density, such an absolute value does not exist. Therefore, in the case of normal density, the accelerations depend on the *absolute value* of the length, whereas in the case of metric density, they depend only on the *temporal change of the length*.

Basically, there are two variants: either the material wave-lengths are shortened *ad infinitum,* or they change periodically. I prefer the assumption of a periodic change. A change that occurs permanently into the same direction would appear strange to me. I consider it probable that, in the context of the self-organization of a closed metric structure, most of the quantities are subject to periodical changes.

Back to the question: is the decrease of the material wave-lengths constant or variable with time? Here, the decision is easy:

Within the framework of standard cosmology, the assumption of an (approximately) constant velocity of the expansion follows simply from the fact that the velocity of moving masses is always constant if no force is acting upon them. This justification disappears in the alternative cosmology, because here the masses do not at all move away from each other. There is then absolutely no reason for the assumption, the change of the wavelengths would occur in such a way that it could be interpreted as constant expansion velocity.

Also the assumption of a constant decrease of wavelengths is improbable. The wavelengths would then eventually become zero – however not asymptotically but instantly. This is not plausible, and therefore it must be assumed that the decrease of the wavelengths varies over time.

However these considerations have no relevance for the question of *dark energy.* The only fact to note here is the following:

Observations, which in the standard cosmology must be understood as proof for the accelerated expansion of the universe and enforce *ad hoc* assumptions, are, in the metric-dynamic cosmology, compatible with the simplest model assumptions. In order to explain them, no additional assumptions are required – and this applies to *any* variant, regardless of whether it is assumed that the alteration of the wave-lengths has only one direction or that it changes periodically.

Actually, in the alternative cosmology the circumstances are exactly the reverse of the ones in the standard cosmology: In the standard cosmology, in order to explain the *change* of the velocity of the expansion, an *ad hoc* assumption is required, whereas, in the alternative cosmology, the assumption that the change of the wavelengths occurred exactly in such a way that – seen as expansion of the universe – it would correspond to a *constant* expansion velocity, would require an *ad hoc* explanation.

An alternative Story of the Cosmos

Let us in short complete our history of the self-organizing universe.

There is no beginning. The universe is a closed metric structure, which organizes itself in the form of standing waves in two orders of magnitude.

The first kind of waves is cosmic waves: longitudinal metric waves with a length of some hundred million light years. They form *cosmic voids,* which represent the oscillating areas of these cosmic waves. Where the voids adjoin one another, there are areas of lesser extent that represent the node areas of the cosmic waves. The pattern formation, which takes place here, corresponds to the formation of structures that is assumed in the standard cosmology. First, the simplest forms of matter develop. However – as elucidated in the previous chapters – their interpretation changes: the particles and fields that emerge are seen as *phase wave structures.*

Precondition of this kind of pattern formation is the existence of a second kind of standing waves, the lengths of which decreases in the course of the cosmic evolution. (Currently, they are by 57 orders of magnitude shorter than the standing waves of the first kind.) They are waves with Planck-length. They exist in the longitudinal flows, whose simplest forms were identified in chapter 2 with the phenomena called *gravitation* in standard physics.

The dynamics of the phase wave structures – in standard physics called "the four interactions" – leads to further pattern formation over many orders of magnitude, from atoms up to super clusters of galaxies. Since all structures within the node areas of the cosmic waves are based on the Planck-waves and remain connected with them, the size of these structures changes always at the same rate as the length of the Planck-waves.

Why do the wave-lengths change? Since, if the universe were an ideal elastic medium, a stationary state in the form of a basic frequency and harmonics would take place, the reason for the change must be sought in the difference between the universe of the alternative cosmology and a universe that organizes itself like an ideal elastic medium.

This difference consists, as mentioned above, in the fact that an ideally-elastic medium would have a normal density, while in the alternative universe everything depends on the metric density, in other words: exclusively on the temporal course of the metric length- and angle-densities. The absolute point of reference, which determines the behavior of a medium, is missing here.

Let us then assume the material wave-lengths decrease over time. What is the temporal development of this decrease? Presumably periodical, and the duration of one period should be substantially greater than the time which, in the standard cosmology, is currently considered the age of the universe since the big bang.

Perhaps after a certain number of periods dissolution of the material structure takes place, and then a new phase of self-organization begins.

However perhaps there is only one single period. The material structures originate, develop, shrink at the same time until a minimum is reached, then the material wave-lengths increase again – up to the point where all patterns dissolve again.

Then the game can begin anew.[29]

Dark Matter

The outer areas of galaxies rotate faster than they are supposed to as regards the observed masses.

In the standard model, this means that there must be additional, not visible mass. It is called *dark matter.*

(The other possibility is to change the law of gravitation on large scales. Of course Newton's law – the $1/r^2$ dependence of gravitation – can easily be changed. However in fact the change is about *Einstein's* gravitation law, and this law provides much more resistance against the necessary correction. And this applies even more to the law of gravitation presented here: according to its nature it cannot be changed at all.) [30]

[29] Since the directionality of time is a necessity only through self-organization and is thus bound to structure formation, the time has no direction in a phase of structural disintegration or absence of structures. This means that, if a cosmos disintegrates and another cosmos evolves, it is not possible to see the one as the "previous" and the other one as the "later" cosmos. So it cannot be claimed that the time can be extended without a limit "into the past" or "into the future".

[30] However, there is the possibility to understand the altered formula not as new law of gravitation but just as an algorithm by which precisely that modification is expressed which the (Newtonian) gravitational dynamics of galaxies is subject to due to the metric dynamic self-organization of the universe.

Also here, the metric dynamic model of the cosmos offers the possibility to dispense with ad hoc assumptions.

Let us first ask: What is actually the difference between Einstein's view of gravitation and the metric-dynamic view?

Einstein describes gravitation as distortion of the space-time-continuum, whereas in the metric-dynamic model gravitation is seen as metric densification of space, i.e. as alteration of the length unit, from which in turn follows a *metric flow.* In this way, space turns into a dynamic entity, it becomes an accelerated flow itself.

In this view, at first time remains unaltered, and only at the transition to local observer systems, the valid local time can be derived from the velocity of the metric flow. As was demonstrated in the Second Part, in some simple cases (perihelion precession, light deviation, circular orbit of light), the results agree with those of General Relativity. However, if great masses are moving, the results of the two theories diverge, for the following reason:

The flow lines are accelerated by the masses. So they are *directed to* the masses, they *follow* them. This means: if – as in the case of galaxies – a great amount of mass rotates around a center, then *also space itself rotates.* The motion of the stars that results from their mutual gravitation plus the gravitation of the black hole in the center, must therefore be seen in relation to *that* space that is already rotating – contrary to Einstein's or Newton's theory, where of course it has to be understood as relative to *resting* space.

This means: *The rotation of space, that has to be expected in our view of gravitation, must be added to the rotation that follows from the usual view.*

Actually, Einstein's version of gravity and the metric-dynamic version agree exactly only in the case of gravity of one single object. However, in any real scenario, there is more than one object, and since the flow lines follow the movements of the objects which cause the flow, the motion of space must always be factored in. In many cases, however, as e.g. in solar systems, the adjustment would be minimal, because the main part of the metric densification and therefore also of the acceleration of the metric flow is caused by a central object. In the case of galaxies, however, this is not true. Here, the rotation of space contributes significantly to the observed rotation speed.

Admittedly, this explanation is just an outline. But at least it shows very clearly the mechanism that lies behind the observed increased rotation speed. And, moreover, it demonstrates that the idea of a cosmos that organizes itself in the form of metric flows and waves offers much more dynamical

possibilities than the standard version – possibilities which provide more attractive explanations for the observed gravitational phenomena than the assumption of exotic kinds of matter.

In the standard model of cosmology, dark matter has a further important task: without it, no agglomeration of material objects could occur, which means: there would be no stars, galaxies, galaxy-clusters etc. Only dark matter allows the generation of these material structures. For this purpose, however, it is necessary to adjust *ad hoc* the amount of dark matter as well as the time of its decoupling from radiation in the early universe.

In the metric dynamic model, the initial structure-building is self-evident: space organizes itself into a shape of standing waves, which in turn form the large-scale background for the generation of material structures.

Comparison

Finally, we compare the two cosmological narratives:

What can be said with respect to the observational data?

As mentioned already at the beginning, the observations do not permit a decision which variant must be chosen. Since the structure formation, as far as material structures are involved, in the alternative cosmology is analogous to that in the standard cosmology, and since the hitherto applied physics is not suspended but only reinterpreted, the observational data confirm both models – except for two facts: some redshifts measured since 1998 and the dynamics of galaxies.

In the standard cosmology, these facts force two *ad hoc* assumptions: the existence of *dark energy* and of *dark matter*.

To say it very clearly: both facts *contradict* the hitherto prevailing concept of the cosmos and of its history. Therefore it seems entirely appropriate to interpret this as a refutation of the previous assumptions – as far as a refutation is possible at all. As is well known, any existing model can be immunized against emerging contradictions by *ad hoc* assumptions.

(Since its invention, however, dark matter proves to be very useful in computer simulations of the structure formation in the cosmos – to such an extent that now nothing works without it. But this is not, as some physicists believe, an argument for the existence of dark matter. It goes without saying

that an entity, whose distribution and properties can be determined completely free and unhindered by theoretical requirements, facilitates modeling.)

In the alternative cosmology, however, no additional assumptions are needed. The assumption of *dark energy* is superfluous, because here a non-linear redshift-law corresponds to the simplest model assumptions. (If it would actually be approximately linear in the long term, then exactly this fact would require an *ad hoc* explanation in the alternative model.)

In the alternative model, also the observed galaxy dynamics, which, in the usual interpretation, can only be explained by the assumption of additional non-luminous mass, does not require exotic *ad hoc* additions.

As regards the question of structure formation in general, the alternative model differs from the standard model in that it contains a top-down structure formation, which does not exist in the standard version: the large scale patterning in the form of standing waves. The structure formation in all orders of magnitude, which in the standard model still causes considerable difficulties, is thereby facilitated.

Summary

No beginning, no expansion, no absolute quantities, *self-organization* through metric flows and waves.

These are in short the main characteristics, by which the alternative model of the cosmos differs from the standard model.

No beginning: this corresponds to the principle of *completeness of reality.* The idea of a beginning of everything leads beyond reality and must therefore be rejected.

No expansion: this is a metaphysical certainty. The universe as a whole is not a *thing.* It is *not relational.* It would be nonsensical to assign a variable size to it.

No absolute quantities: this follows from the basic principles of this work, which have been introduced in the First and Second Part. In short: there are no absolute entities. Everything which exists is originated. Everything changes over time. In the context of self-organization, only the ratios of wave-lengths remain constant.

Self-organization by metric flows and waves: this follows from the build-up of physics from metaphysics.

These statements represent what, at the beginning of this chapter, was called *additional information,* which is necessary for the decision, which cosmological model must be chosen.

The hitherto acquired observational facts confirm both models in the same way – with two exceptions: gravity that cannot be traced back to the luminous matter known in current physics, and "accelerated expansion".

These two phenomena contradict the standard model and enforce the introduction of exotic entities.

In the alternative model, there is no expansion, such that the explanation of its acceleration is obsolete, and the just mentioned gravitational phenomena (e.g. the high rotation speed of the outer areas of galaxies) can be understood as part of the self-organization of the universe by metric flows and waves.

Note:

Seen historically, the question of whether the universe is expanding or the material wavelengths become smaller is of a similar kind as the question of whether the sun revolves around the earth or the earth around the sun. In both cases, the observable consequences of the competing hypotheses are (initially) identical, and the first-mentioned hypothesis is the one that fits perfectly into the just prevailing world view, whereas the alternative seems impossible in an almost ridiculous way.

Yet this belief is – in both cases – no more than a prejudice that occurs as a result of a series of other prejudices and vanishes together with those.

9. Propositions

P 1: *The origin of everything itself is no being. It does not divide into substance and accident. It does neither exist nor not-exist.*

P 2: *Thus the answer to the question: "Why is there anything and not nothing?" reads as follows: Since the origin of everything neither is nor is not, it is* **necessary***, and with it that which originates from it – that is: everything which exists. (If nothing existed, then also the origin of everything would not exist – in contradiction to P 1.)*

P 3: *Existence is activity. What does not change does not exist. The notion of something pure existing without changing is an artifact of the a-priori-necessity to think everything that exists as substance and accident – as combination of a thing that just is (inactivity) and an attribute (activity).*

P 4: *To make the origin of everything thinkable, change must be assigned to it as attribute.*

P 5: *If the change ended, nothing would be. Thus the chain of changes must be perpetual.*

P 6: *Therefore the fundamental law reads: one alteration is equal to another alteration.*

P 7: *The necessary conditions of existence are space and motion.*

P 8: *Therefore, the fundamental law must express the simplest relation between spatial change and change of motion. Spatial change is change of the metric density, change of motion is the acceleration of the metric flow.*

P 9: *Everything that exists is a pattern of changes of the metric flow.*

P 10: *As a consequence of the fundamental law, in the metric flow waves occur which propagate at the speed of light.*

P 11: *Gravitation is the dynamics of accelerated longitudinal metric flows caused by metric changes of lengths. In the case of central matter or antimatter, these changes lead to spherically symmetric stationary states of the longitudinal metric flow.*

P 12: *In the case of matter, the metric flow is real, in the case of antimatter, it is imaginary. The passing of time is retarded by matter, accelerated by antimatter.*

P 13: *Electromagnetism is the dynamics of the transversal metric flow caused by metric changes of angles. In the case of central positive or negative charge, these changes lead to spherically symmetric stationary states of the transversal metric flow.*

P 14: *At positive charge, the flow is real. Time passes slower. At negative charge, the flow is imaginary. Time passes faster. Positive and negative charge cancel each other out. Positive and negative charge relate to each other with respect to the tangential flow in the same way as matter and anti-matter with respect to the longitudinal flow.*

P 15: *Longitudinal and transversal flows and waves follow from the fundamental law. Therefore, also gravitation and electromagnetism follow from this law. This is the metric-dynamic form of their unification.*

P 16: *Within the longitudinal flows there are standing waves of Planck-length. They represent the basis of the material structures.*

P 17: *Due to the radial flow caused by a geometric mass m exists, with respect to a system that rests relative to m, a phase wave of the Planck-waves. Therefore, on a spherical surface at the distance of one Compton-wave-length from the center, there is an in-phase oscillation with a frequency equal to the frequency of a particle with this mass.*

P 18: *Due to the tangential, rotating flow caused by a geometric charge Zμ, the phase coincidence of this oscillating spherical surface is canceled. Thus tangential metric phase waves arise. The local metric oscillation states – i.e. the electron orbitals – are determined by the condition that the phase waves in the rotating flow system form standing waves.*

P 19: *Quantum Theory represents the interface between the abstract pre-stage of being and the world of things. The objects described by QT do not appear from either side as thing-like objects – as seen from the side of the world of things no longer, as seen from the abstract side not yet.*

P 20: *Material structures are interference phenomena, localized patterns of phase-waves of Planck-waves, quantized by the condition that they form standing waves within the radial and tangential flow. The causal relations which these patterns are based upon do not lie in themselves but in the background of Planck-waves and flows.*

P 21: *There is no "big bang" – the size of the universe does not change, because there is no absolute size, only size relations. Thus, that which changes is the wave-lengths by which our length unit can be defined.*

P 22: *The universe is a closed metric structure which organizes itself by metric flows and waves.*

P 23: *The pattern formation at the largest scale is the formation of standing waves of a magnitude of approximately 10^8 light years. They form the cosmic voids.*

P 24: *The formation of material structures takes place in the interstices of this honeycomb-like structure, i.e. in the nodal areas of the cosmic standing waves. It begins with standing waves of Planck-length, whose length diminishes with time. First, "particles" develop – metric densifications, which represent the necessary and sufficient condition for the formation of stationary phase wave states –, then "interactions" – flows and waves, which are caused by these metric densifications and which in turn determine the dynamics of the stationary phase-wave states. The material structure formation is analogue to that in standard cosmology. Due to gravitation, it reaches up to the order of magnitude of galaxy clusters.*

P 25: *Since there is no expansion, there is also no dark energy.*

P 26: *Gravitational flows are metric shifts. In their stationary form, they are identical with gravitation in the usual form. In their non-stationary form, they act like additional gravitation upon the dynamics of galaxies. The assumption of dark matter can be dispensed with.*

Zeitgeist-Musical

A semi-dark factory shop. Machinery noise in the background.

Dramatis personae: PHYSICISTS, ENGINEERS, PHILOSOPHERS, the WORLD, the COSMOLOGICAL CONSTANT, the HOLY GHOSTS of physics, I MYSELF, an EXTRA-TERRESTRIAL GNOME.

Distributed over the entire stage are groups of PHYSICISTS and ENGINEERS, who are busy with work on strange machines. The PHILOSOPHERS form a separate group.

Downstage to the right several PHYSICISTS attempt to cram the WORLD into a bed bearing, in golden letters, the legend SO(10). The bed is too small. The WORLD puts up a desperate resistance.

The PHYSICISTS sing:

> *We love the groups! The groups are in, the world is out!*

Then they proceed to cut off all extremities of the WORLD. It now fits into the bed. It is dead.

The PHYSICISTS sing:

> *We've done it! We've done it! We knew it could be done!*

The PHILOSOPHERS sing:

> *The being of being is the nihilation of nihil.*

Noise from the background. The COSMOLOGICAL CONSTANT refuses to appear on the stage. Some PHYSICISTS drag it onto the stage and do violence to it. It runs away and tries to escape. Once more a group of PHYSICISTS assaults it. Again it is raped.

The HOLY GHOSTS of physics move to the forestage and turn to the audience.

They sing in chorus:

> *In the name of the Holy Secret of Quantum Theory! Don't depart from the straight and narrow path of Uncertainty, of the reduction of the wave function and of the action at a distance!*

But I say:

> *In the name of the Holy Enlightenment! Do you long for the secret or for clarity? Do you long for absurdity and unreality or would you rather have the solution to the puzzle?*

The PHILOSOPHERS sing:

> *The nihilation of being is the beingness of nihil.*

The COSMOLOGICAL CONSTANT is raped again.

Some ENGINEERS have taken the dead world from its bed and, after it, fashion a jointed doll.

They exult:

> *How much more beautiful it is than the ugly old one!*

The HOLY GHOSTS sing in chorus:

> *In the name of Holy Mathematics! Don't permit yourselves to be dazzled by the brightness of understanding! Safety is to be found only in mathematical figures! Though the heavens fall and the world perishes, figures will be our salvation!*

But I say:

> *In the name of Holy Reason! Do you want to be confused, figure-muttering observers of the unfathomable or cognizants of the real world?*

The HOLY GHOSTS clamour:

> *Think about our successes! Where would you be without us? Without us you would still be squatting in some cave and picking off lice!*

But I say:

Success is not tantamount to truth!

The HOLY GHOSTS by now are in a state of great excitement. They are all shouting at once:

Nonsense! We are going to win out! We are quite close to our goal!

But I say:

The curse of destruction rests upon you! In rational frenzy you are going to destroy everything!

A terrific uproar breaks forth. The HOLY GHOSTS chase ME across the stage. Some PHYSICISTS wave their instruments about in an agitated manner. Most of the ENGINEERS carry on with their work impassively.

The PHILOSOPHERS sing:

The negation of the negation is the pure negativity of the self-comprehending comprehension.

A gusty wind rises. It turns into a gale, then into a full-fledged hurricane. The entire scenery is swept from the stage.

Change of scene. A tranquil, but strangely unfamiliar landscape. I sit together with the EXTRATERRESTRIAL GNOME on the shore of a yellow gleaming lake.

The EXTRATERRESTRIAL GNOME asks:

Do you think there are extraterrestrial beings?

I say:

No, I don't believe so. Let's go for a swim.